Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 6793
Program Title: Spectroscopic Verification of Robust z>15 Galaxy Candidates Selected with Multiple Medium-Band Datasets

Principal Investigator: Harikane, Yuichi

PI Institution: University of Tokyo, Institute of Cosmic Ray Research

JWST was designed to study the first galaxies, which are theoretically thought to have emerged at z~20-30. Since its first operation, the JWST has discovered a surprisingly large number of galaxies at z > 10, and its NIRSpec spectroscopy has successfully confirmed some of these galaxies up to z~14. Because z~14 is the upper limit for galaxies selected as F150W-dropouts, the next logical step is to target even higher redshift candidates, F200W-dropout galaxies at z~15-20. However, efforts to spectroscopically confirm F200W-dropouts have faced challenges. For example, NIRSpec observations showed that a previously claimed z~16 galaxy candidate was actually a foreground object at z=4.9 whose strong emission lines boosted fluxes in broad and medium-bands, making a SED similar to that of a z~16 galaxy. In this program, we will conduct NIRSpec/PRISM spectroscopy targeting 10 carefully selected F200W-dropout galaxies at z~15-20. These galaxies are chosen based on extensive datasets that include multiple medium-band data crucial for removing interlopers with strong lines identified in the previous F200W-dropout selection, and multi-epoch broad-band data useful to exclude transient contamination, ensuring that our targets are robust z>15 candidates. Successful confirmation of their redshifts would not only set a new redshift record but also provide a unique opportunity to study the star formation activity and the physical properties of galaxies at z>15. Alternatively, if all of our candidates are revealed to be interlopers, this would indicate a sharp decline of the cosmic SFR density from z~12 to z>15, suggesting a rapid buildup of the first galaxies ~200 Myrs after the Big Bang.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Gas, Dust and the ISM
ID: 6796
Program Title: Resolving Multi-phase Outflow/Inflow via Gas Dynamics and Chemical Abundance Distribution in a Sub-L* Dwarf Galaxy at z=6.1

Principal Investigator: Fujimoto, Seiji

PI Institution: University of Toronto

We propose deep high-resolution spectroscopy across ~0.7-5.3um with NIRSpec MSA, targeting remarkably bright (F150W=23.4mag), highly magnified (30-160x) multiple images of a sub-L* galaxy at z=6.072, RXCJ0600z6-ID3 and ID1,2 (~6"-long arc). Recent ALMA and MUSE observations have revealed significantly extended (~3"-6") and redshifted (~200-400 km/s) [CII]158um and Lya line structures around ID3, indicative of the presence of ongoing outflow/inflow. These two multiple images and associated extended nebular regions will be efficiently covered by stepped-MSA observations, providing the first spatially resolved views of a low-mass early galaxy, from the CGM, ISM, and individual star-cluster scales down to ~1-10pc. Our proposed deep spectroscopy across the rest-frame UV-optical range will enable the detection of key emission (e.g., HeII, CIII], NIII], [OII], [OIII], Ha) and absorption lines (e.g., O I, Si II, Si IV, CII, CIV) to achieve the following four major goals: -Spatially resolve the multi-phase (ionized states/densities) gas outflow and inflow, -Map out C/O, N/O, O/H distributions across the galaxy and study their connections with the stellar feedback and potential dilution of recent pristine gas inflow -Search for uniquely high N/O regions inside the galaxy and investigate where and how the proto globular clusters are formed -Verify metal-free ionization in the extended Lya-emitting regions These are achieved only by the unprecedented spatial and spectral capabilities enabled by JWST and strongly lensed brightest objects like our targets at z>6, which guarantees giant leaps in our understanding of the feedback mechanisms and baryon cycles in early galaxies.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 6821
Program Title: Dust, gas, and ice formed before and after stellar mergers

Principal Investigator: Kaminski, Tomasz

PI Institution: Nicolaus Copernicus Astronomical Center

Some noncompact binary stars end their lives in a cataclysmic merger, giving rise to transients known as red novae. Six Galactic and over a dozen extragalactic objects of this type are known. Red novae expose the elusive physical mechanisms that lead to stellar mergers (incl. the common envelope phase), providing crucial input for modern theoretical models of binary evolution, directly affecting stellar population studies. A red nova outburst can also be considered a birth of a new star with peculiar properties and surrounded by a complex circumstellar medium which is bright in the IR. We propose to use MIRI and NIRSpec spectral mode to characterize better the complex vicinity in three red nova remnants whose mergers involved giants: V1309 Sco (Nova 2008), V4332 Sgr (Nova 1994) and BLG360 (outburst 2002). We request spectra within a combined range 2.9-28 um which will give us access to multiple tracers of different phases within the remnants. Silicate and alumina dust features will be used to study dusty disks and dusty ejecta surrounding the coalesced star. Ice mantles, mainly of H2O, will be analyzed to investigate whether they might originated from mass loss preceding the merger. Multiple atomic and ro-vibrational lines (e.g. of CO, H2, OH, FeII, and H2O) will be used to probe shocks in the remnants, which either are a signature of material falling back on the star or manifest interaction of merger ejecta with an older outflow. These JWST observations will provide the most comprehensive view on remnants of stars which merged 1-3 decades ago, providing a benchmark for the study of extragalactic red nova analogs which are expected to be abundant in the Rubin-LSST survey.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 6827
Program Title: From Dawn till Noon: Chronicling the Cosmic History of Black Hole Growth

Principal Investigator: Eilers, Anna-Christina

PI Institution: Massachusetts Institute of Technology

The formation and growth of supermassive black holes (SMBHs) in the early universe represents one of the major unsolved mysteries of modern astronomy. While in the latter half of cosmic history a self-consistent narrative of SMBH growth has emerged, the presence of luminous quasars powered by billion solar mass black holes at Cosmic Dawn poses significant challenges to our understanding. To grow the observed masses of SMBHs within short amounts of cosmic time, it is necessary to modify our standard picture and invoke either very rapid “super-Eddington” accretion, or alternatively, highly dust-obscured black hole growth phases. With this proposal we aim to trace the formation and growth of SMBHs across billions of years of cosmic history and connect the yet-to-be-understood mysteries at Cosmic Dawn to the decade-old and seemingly well-understood results at Cosmic Noon. JWST’s unique new observing capabilities allow us to address some of the major open questions in astronomy and motivate our proposal to study both luminous, unobscured AGN, as well as heavily dust-enshrouded, obscured objects and their respective environments. Using NIRCam in wide-field slitless mode as well as deep MIRI imaging in five quasar fields we propose to observe >80 (>200) unobscured (obscured) AGN and quasars across a wide range of halo mass, black hole mass, stellar mass, luminosity and redshift, in order to determine (#1) their dark matter halo masses and duty cycles, (#2) their obscuration fraction, (#3) the initial seed black hole masses, (#4) the merger rate, and (#5) their accretion rates to paint the first coherent picture of SMBH growth across cosmic time - from Cosmic Dawn to Cosmic Noon.

Proposal Category: AR
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 6829
Program Title: Understanding the rich molecular spectra observed with NIRspec and MIRI/MRS toward protostellar outflows

Principal Investigator: Neufeld, David

PI Institution: The Johns Hopkins University

Spectroscopic observations of protstellar outflows and jets with JWST reveal an extraordinary wealth of molecular lines. Carefully interpreted with the use of detailed molecular excitation models, they will provide unique physical and chemical information about the local environment, such as the gas temperature, gas density, composition and ambient UV field. The AR theory proposal proposed here has two key elements: (1) We will model the excitation of H2, CO, H2O, CH4, CO2, and C2H2 bands that have already been observed by JWST, focusing primarily but not exclusively on five sources targeted in the "Investigating Protostellar Accretion" (IPA) program (PID 1802). The expected outcome of the analysis will be more reliable estimates of the molecular abundances, gas temperature and density (and how they vary spatially). These parameters are key for understanding the nature of protostellar outflows; and (2) we will create a set of tools of general applicability to the target molecules in dense astrophysical environments. These will be made available to the community and will prove useful for the interpretation of molecular emissions from a wide range of astrophysical sources that have been/will be targeted in previous/future JWST observations.

Proposal Category: GO (GO-Archival)
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 6840
Program Title: Jupiter's Oval BA: Trends in Space and Time

Principal Investigator: Wong, Michael

PI Institution: University of California - Berkeley

We propose a comprehensive study of Oval BA, a major anticyclonic vortex on Jupiter that has not been observed by JWST. NIRCam images separated by 10 hours (one Jupiter rotation) will utilize JWST's newfound ability to measure high-precision velocity fields in hazy areas (such as Oval BA) at altitudes some 35 km above the level probed by visible-wavelength imaging used in the past. This first-ever direct measurement of vertical wind shear in Oval BA---a fundamentally different class of vortex than the Great Red Spot---will advance the velocity field data from a 2D to a 3D paradigm in the JWST era. We will interpret the results using numerical simulations with vertically variable stratification, another 3D step that has profound effects on modeled vortex physics. NIRSpec IFU observations will quantitatively determine the altitude of wind tracers, and a MIRI IFU spectrum will measure the 3D thermal structure in the vortex and its surroundings. Over 15 years of archival visible-wavelength data will be used to quantify dynamical and photometric trends. The program will advance our understanding of vortex dynamics in shear flows with variable stratification, a class of phenomena covering protoplanetary disks, terrestrial ocean vortices, and vortices on other giant planets. We will use dynamical models to extend shallow observational results into the surrounding deep atmosphere, providing a reference for future microwave retrievals. The combination of our thermal, compositional, and wind shear measurements with new numerical simulations will place constraints on the meridional and vertical flows, part of the climate circulation that cannot be directly measured.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 6852
Program Title: Calibrating Stellar Evolutionary Models using M31 Clusters

Principal Investigator: Goldman, Steven

PI Institution: Space Telescope Science Institute

Accurate stellar evolutionary models are critical for estimating properties in high-redshift galaxies like mass, metallicity, and star formation history. These models have been calibrated using cluster AGB stars within the Magellanic Clouds; however, it is now known that using these clusters as benchmarks introduces systematic errors in modelling, due to these clusters' unique star formation histories. To finally obtain a robust sample of AGB stars with measured ages and metallicities, we will target the clusters within M31 with the MRS on MIRI. M31 avoids the biases in the Magellanic Clouds, while also probing new metallicity regimes, more typical of massive galaxies. AGB candidates have already been identified in these clusters which have measured ages and metallicities. However, their chemical and dust composition and mass-loss rate are unknown. These are critical for constraining the two leading uncertainties in models, the mass loss and third dredge up. In addition to constraining the derived properties of high-redshift galaxies, these results will allow us to study the effect of metallicity and age (main sequence turn off mass) on AGB dust properties, their lifetimes and evolution, and their still unexplained wind-driving and mass-loss mechanisms. Each of these constraints have large implications for stellar and chemical evolutionary models, dust budget calculations, and cosmological simulations.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 6865
Program Title: Jupiter's Stripes: Testing the Canonical View of Banded Circulation Patterns on Giant Planets

Principal Investigator: Fletcher, Leigh

PI Institution: University of Leicester

Jupiter's banded structure has long been associated with atmospheric circulation patterns on the scale of the zonal wind jets, with a canonical picture of rising motions in cool, cloudy zones; and sinking in warm, cloud-free belts. However, direct evidence of vertical motions within these bands is scarce, particularly away from the equatorial region. Neither temperatures, nor clouds, are robust observables for vertical motions. The spatial distribution of gases, such as ammonia, phosphine, arsine, water and hydrocarbons, can serve as excellent tracers provided the sources and sinks are known. These are only accessible via mid-infrared spectroscopy with MIRI/MRS. Space-based mapping by the Cassini and Galileo missions lacked the spectral and spatial resolution to map these species on the scale of the bands. Juno microwave observations probe the correct scales, but a degeneracy between temperature and ammonia thwarts attempts to understand the vertical motions without a unambiguous measurement of temperature, which can be provided by MIRI/MRS. We will also characterize the present state of Jupiter's stratospheric circulation, from the equatorial oscillation to the cold polar vortices, to provide contemporary temperature context at all latitudes for radio occultation experiments on the Juno spacecraft, scheduled during Cycle 4. Both our tropospheric and stratospheric objectives require a central-meridian scan of Jupiter, using 13 separate pointings with MRS from pole to pole, to determine whether there is truly evidence of upwelling/downwelling on the scale of Jupiter's bands to set the paradigm for banded circulation on rapidly-rotating giant planets.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 6866
Program Title: Sakurai's Object - mineralogy and morphology

Principal Investigator: Evans, Aneurin

PI Institution: University of Keele

Intermediate mass (0.8-8 Msun) stars, after evolving away from the Asymptotic Giant Branch, become planetary nebulae and eventually hot young white dwarfs. During this evolution, they undergo a series of Helium shell flashes (thermal pulses). In some cases, a very late Helium shell flash (a very late thermal pulse - VLTP) may occur that raises the star from the embers of a cooling white dwarf back to the original luminous giant stage. The evolution is reversed, and the star - Phoenix-like - rises from the ashes and is born-again. The known cases of this dramatic regeneration are extremely few , Sakurai's object (SO) being the prime example. Further, how a star evolves after being born-again is completely uncharted territory. There is therefore a compelling need to document it. SO's present evolution is dominated by its dust shell, and so its study is centered around the mid-IR. JWST observations are critical to address our goals, which are to (i) determine the early morphology of the material ejected following the VLTP, (ii) determine the mineralogy of the ejecta, and (iii) test and constrain models of VLTP evolution using JWST 3d spectral-spatial cubes.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Stars and Stellar Populations
ID: 6876
Program Title: An Stellar (JAGB/Carbon star) Distance to the Coma Cluster: Establishing Four New Determinations of the Hubble Constant

Principal Investigator: Freedman, Wendy

PI Institution: University of Chicago

The Coma cluster, one of the richest nearby clusters of galaxies known, provides us with the unique opportunity to resolve the debate over the much-disputed value of the Hubble constant. And JWST is uniquely positioned to rapidly determine a precise and accurate value for the distance to the Coma using JAGB/carbon stars as standard candles. Knowing Coma's true distance immediately allows us to calculate four new measurements the Hubble constant, totally independent of the current Cepheid distance scale: (1) The recessional velocity of Coma simply divided by its distance gives a one-step value of Ho at a distance that is on the threshold of the pure Hubble flow. (2) A distance to Coma will allow us to calibrate the absolute magnitudes of 12 historical Type Ia SNe in Coma which will, on their own, allow us to determine Ho in the far field flow mapped by over 300 distant SNe Ia. (3) Combining the 12 supernovae in Coma with the 8 JAGB calibrated SNe in nearby galaxies will more than double the number of JAGB-based calibrators giving an even more robust estimate of Ho. (4) A Coma distance will give the first stellar-based, zero-point calibration of the Fundamental Plane method which has over 4000 tracers of Ho in the Hubble flow out to a redshift of 20,000 km/s. Using ultra-wide filters (F150W2 & F322W2) on NIRCam it will be possible to complete this determination of Ho with 2 (four-hour) exposures containing 5 Coma galaxies, a factor of 1.7 faster than standard wide filters. An absolute zero-point calibration (requiring less than 300 sec) will be made using N4258, which has a geometric distance. For a very modest amount of time the results will be of very high impact.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 6882
Program Title: Vast Exploration for Nascent, Unexplored Sources (VENUS)

Principal Investigator: Fujimoto, Seiji

PI Institution: University of Toronto

Recent discoveries of luminous galaxies to z=14.3 and numerous faint AGNs to z~10 are remarkable, prompting the next step of addressing their earlier phases to explore the first galaxies, black holes (BHs), and their evolution. However, their intrinsic faintness remains a challenge in general field surveys. To overcome this, we propose a multi-epoch Treasury program that immediately releases uniform NIRCam 10-filter imaging (0.16deg2; 5sigma~28mag) in 60 well-studied massive clusters (epoch1) and NIRSpec/MSA follow-up spectroscopy + NIRCam 2filter imaging in the 10 best-selected clusters (epoch2). This program significantly widens JWST-observed highly-magnified areas and identifies apparently bright (thus spectroscopically feasible), but intrinsically faint distant objects >10-100x more than previous lensing cluster surveys. Naturally, this enables unique discoveries in Image/Spec/Time dimensions and initial spec census of 1) Onset of star-formation at z>14 and UV luminosity functions at z~6-20 down to Muv=-12 2) Spatially resolved characterizations and evolution histories in early galaxies down to star cluster scales 3) Low-mass BHs down to ~10^5Msun in normal galaxies and their over/under-massive relations 4) Lensed stars and supernovae at z>5-6 and test the top-heavy initial mass function The target clusters/numbers are carefully determined to secure the key discoveries beyond the cosmic variance. A wide lensing survey must now be done to find where the community invests more time (e.g, long monitoring). We commit to immediate data release (maps, catalogs, multiple lens models) for all 60 lensing clusters, unlocking unprecedented legacy fields for the community.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 6886
Program Title: Reconstructing the history of FUor outbursts by tracing jet knot proper motions

Principal Investigator: Kraus, Stefan

PI Institution: University of Exeter

V346 Nor is the first member of the FUor class that has been observed to switch to a very low-accretion phase, followed by the onset of a new accretion outburst. VLT/SINFONI imaging reveals a complex system of H2 jet knots, whose spacing provides a record of at least 3 eruption events that took place during the past centuries. The orientation of the jet axis seems to change systematically, which suggests that the jet-launching disk is precessing. Our goals are (a) to obtain deep images of the bow-shock morphology in order to validate the precessing jet interpretation, (b) to associate, for the first time, a jet knot to a specific accretion outburst event, (c) to reconstruct, for the first time, the past outburst history of an FUor, (d) to search for the putative companion that could be responsible for triggering the outburst and the observed jet precession, and (e) to search for bodies that might have been ejected as part of the outburst-triggering event. This will provide much-needed insights on the outburst-triggering mechanism in FUors. Also, we will search for ejecta that might have been launched during the new high accretion phase event that started in 2011.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 6905
Program Title: The Bleeding Wedge: Constraining Metal Enrichment of Close-in Companions to Trace Formation

Principal Investigator: Balmer, William

PI Institution: Space Telescope Science Institute

Early JWST data on the multi-planet system HR 8799 suggests that a simple JWST NIRCam diagnostic, based on photometric signatures of CO2 and CO abundances, might empirically capture the link between formation processes and composition for directly imaged giant planets. We propose a small program that repeats this early experiment on four other amenable directly imaged systems in order to establish, or rule out, the significance of this tantalizing result, and to sort these companions into the metal-rich or solar-metallicity populations. We will use the wedge-shaped LWBAR coronagraph's "narrow" offset position to image four closely separated companions in the L-T transition. The high throughput of this underutilized mode make this an efficient program that will result in information-rich images of each system at previously invisible wavelengths.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 6915
Program Title: Direct Detection and Characterization of a Nearby Temperate Giant Planet

Principal Investigator: Balmer, William

PI Institution: Space Telescope Science Institute

We propose to image HD 222237 b, a nearby, temperate, eccentric giant planet prime for characterization by JWST. HD 222237 b, observable only with JWST, is the next rung on the "effective temperature ladder" that will connect known directly imaged planets (like eps Indi b) and Y-type brown dwarfs (like W0359 or W0855) to Jupiter and Saturn. It provides a rare opportunity to study the atmospheric state of giant planets in the asymptotic phase of their evolution and benchmark evolutionary models, and will be a critical point of comparison between directly imaged planets and mature, temperate transiting exoplanets. This program will target the potentially coldest-imaged planet with the NIRCam and MIRI coronagraphs. These observations will constrain key atmospheric model uncertainties, like the strength of water-ice cloud opacity, the abundance of ammonia, and the strength of disequilibrium chemistry in the planet's atmosphere. This program is designed to efficiently detect the planet at high confidence, photometrically characterize the atmosphere, and refine the planet's sky-projected orbit ahead of Cycle 5; doing so will allow the community to estimate the feasibility of follow-up spectroscopy on the fastest timescale.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 6927
Program Title: Groundbreaking Constraints on the Galactic Dust Extinction Law in the High-Opacity Regime

Principal Investigator: Ashby, Matthew

PI Institution: Smithsonian Institution Astrophysical Observatory

Given its fundamental importance for so many areas of astrophysics, the Galactic dust extinction curve has attracted a great deal of attention, and is already well-characterized in environments where the extinction is relatively low (of order Av<5 mag). ?Unfortunately, the extinction curve remains poorly constrained in the high-opacity regime critical for understanding grain growth, the ice content of dense molecular clouds, molecular cloud structure, the 3D structure of the Galaxy, and many other phenomena. To help remedy this situation, we seek NIRSpec MSA spectra prioritizing highly obscured stars in a well-known infrared dark cloud, the Brick. Cycle 1 NIRCam imaging of the Brick has revealed thousands of highly obscured stars in and around this extremely dense object at Av's up to 50 mag, ideal for characterizing the high-opacity dust extinction curve with groundbreaking precision. As our fits to hundreds of simulated attenuated stellar spectra demonstrate, our proposed MSA spectra of over 200 stars will successfully constrain the 1 to 5 micron spectral dust extinction curve over a wide range of dust extinctions. With an abundance of targets, our proposed observations will provide transformative constraints on the spectroscopic extinction curve as a function of Av, an outcome with wide applications, and one not possible from any other facility. NIRSpec's high spectral sensitivity and resolving power are needed for this work: it cannot be done with broadband photometry.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 6932
Program Title: Bridging the generation gap with TOI-1801 b, a 700 Myr-old temperate sub-Neptune

Principal Investigator: Luque, Rafael

PI Institution: University of Chicago

Exoplanets with sizes between Earth and Neptune (sub-Neptunes) are extremely common in the Milky Way, yet do not exist in the solar system. Little is known about their most fundamental properties, including their origin and nature. Mass and radius measurements are insufficient to uniquely ascertain their composition, making atmospheric observations necessary to advance their characterization. However, featureless transmission spectra of sub-Neptunes obtained in the past decade have shown the ubiquity of aerosols and metal-rich, high mean molecular weight atmospheres among the tested population. To overcome these observational challenges, we request 6 JWST visits of the young sub-Neptune TOI-1801 b with NIRISS/SOSS and NIRSpec/G395H. Its age (700 Myr) and temperate equilibrium temperature (500 K) are ideal for mitigating the impact of aerosols and metal-enrichment processes that make these observations challenging for other planets. The planet is the coldest and smallest among the young sub-Neptune population (< 1 Gyr), and one of the few with a robust dynamical mass measurement. The observing strategy is designed to measure the abundances of C-, N-, and O-bearing species with high statistical confidence if present in the planet's atmosphere. With these observations, we will 1) bridge the gap between the young and mature sub-Neptune populations being currently probed by JWST and 2) determine the planet's status as a water world or gas dwarf, thus gaining insight into its bulk composition, formation, and evolution history. The unique properties of this object make it the perfect missing piece in the puzzle to understand the evolutionary processes at play in sub-Neptunes.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 6940
Program Title: Determining the Origin of Water Ice in the Beta Pictoris Debris Disk

Principal Investigator: Betti, Sarah

PI Institution: Space Telescope Science Institute

We propose to obtain deep 1.88-5.2 micron NIRSpec IFU medium resolution spectroscopy to map and spectrally resolve the 3 micron water and 4 micron CO2 ices in the beta Pictoris debris disk. Recent PRISM observations revealed the presence of submicron ices across the whole disk for the first time in a debris disk, including a hint of a significant ice population at the outer edge of beta Pic dust clump. This discovery changed our understanding of debris disk chemisty as these grains were not expected to survive, and opened up new questions on the role of giant collisions in producing the observed ice grains. Therefore, characterizing their origin and composition is of vital importance to our understanding of late stage planet formation and the transport of ices in disks. Medium resolution (R~1000) IFU spectroscopy provides the only means to a) spectrally map down to 20 au separation, where PRISM mode saturates, but also where a giant collision could have produced the observed dust clump, and b) spectrally resolve the CO2 ice features, allowing us to model the molecular components of the ice, a key means to determine the collisional bodies required to produce the ice. By mapping the whole dust clump, we can uncover the origin, chemical composition, and thermal history of the ices in this disk.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 6954
Program Title: Spectroscopic confirmation of the most robust z=15 galaxy candidate

Principal Investigator: Donnan, Callum

PI Institution: University of Edinburgh, Institute for Astronomy

We propose an efficient NIRSpec PRISM observation of the single most robust and luminous z=15 galaxy candidate selected from all available JWST NIRCam imaging - PANORAMIC-z15. Given that this is the only robust z=15 galaxy candidate detected in all of the current NIRCam imaging, spectroscopic verification of the redshift is vital for our understanding of the nature of star formation at cosmic dawn. This efficient 6-hour program will not only definitively confirm the redshift of this object via (at least) the spectroscopic detection of the Lyman break, but, crucially, it will also detect rest-frame UV emission lines. Specifically, our exposure time of 4 hours should enable the detection of CIII] 1908 given the typical minimum equivalent widths in similar sources at extreme redshifts but may also allow the detection of NIV 1488, CIV 1549, HeII 1640, NIII 1750 and potentially even Lyman-alpha. This will place crucial constraints on the nature of star formation and/or AGN activity only 270 Myr after the Big Bang. By spectroscopically confirming a galaxy at z=15, we will not only set a new redshift record but also reveal the nature of star formation earlier than ever measured before.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 6958
Program Title: Past, present, and future of a dynamically cold disk in an extreme environment

Principal Investigator: Valentino, Francesco

PI Institution: European Southern Observatory - Germany

We propose a small NIRCam+MIRI pilot program to image an orderly rotating, dynamically cold disk, harbored by an extreme hyper-luminous IR galaxy in an overdensity at z=2.41. The existence of disks in such strongly starbursting galaxies, revealed by deep high-resolution ALMA observations of the cold molecular gas, is hard to reconcile with the standard formation via gas-rich mergers, which should leave behind highly chaotic disk structures. With the requested JWST images, we will accurately reconstruct stellar mass and SFR maps, modeling the effects of dust, emission lines, and AGN contamination. This will allow us to test the past and present stability of the disk with a three-pronged novel strategy. (i) We will search for a stellar bar, a long-lived structure that would automatically imply long-term past stability on timescales of >1 Gyr. The gas distribution and kinematics already support this possibility; (ii) We will assess the present stability in 3D (in the disk plane and vertically), superseeding simplified approaches based on the Toomre Q-parameter. This will reveal unstable regions prone to fragmentation and clump formation, potentially forming a bulge and contributing to the suppression of the star formation; (iii) We will test this last hypothesis by correlating maps of clumpy star formation with the 3D disk stability maps. As a bonus, we will map the stellar mass and SFR in 4 confirmed Hy- and ULIRGs in the surrounding overdensity and detect tens of reliable photometric candidate members. This pilot will test the soundness of our strategy, which could be successfully applied to large statistical samples covered by JWST and ultradeep ALMA observations.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 6978
Program Title: The dayside of the coolest ultra-hot Jupiter, KELT-20b, resolved with eclipse mapping

Principal Investigator: Wardenier, Joost

PI Institution: Universite de Montreal

With the advent of JWST, one-dimensional atmospheric models of hot gas giants are no longer sufficient to capture the complexity of their spectra. 3D models are now required to correctly interpret the atmospheric signals of these planets. However, these models need a new kind of observable to be properly benchmarked: the planet's 3D temperature structure. Eclipse mapping is the only technique that can directly resolve the dayside temperature structure of hot gas giants, both in latitude and longitude. We propose to create the most precise 3D temperature map of an exoplanet to date. Our selected target, the ultra-hot Jupiter (UHJ) KELT-20b, offers the highest expected signal-to-noise ratio for eclipse mapping and exhibits prominent water and CO emission features, owing to a strong dayside thermal inversion. Thanks to its sensitivity to these two molecules, NIRSpec-BOTS/G395H will allow us to probe different pressures and measure the temperature structure horizontally and vertically. Eclipse mapping provides crucial measurements to understand how the energy from the host star is redistributed globally across the atmosphere of UHJs. Moreover, simulations predict a large range of temperatures on KELT-20b’s dayside (1000-3500K), including the limit where molecules such as water and H2 will dissociate (around 2200K). This will cause important temperature heterogeneities on the dayside that will be measured by our eclipse map, allowing us to put constraints on these phenomena. From the disk integrated emission spectrum, we will be able to constrain the C/O ratio and improve the refractory-to-volatiles ratios, which are tracers of giant planet formation/migration mechanisms.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 6987
Program Title: Unveiling Eta Carinae's Eruptive Mass-Loss History with JWST Spectroscopy

Principal Investigator: Morris, Patrick

PI Institution: California Institute of Technology

The Luminous Blue Variable Eta Carinae is a colliding-wind binary, the most massive stellar multiple within 3 kpc, and a strong candidate for a merger in a born-triple system. Its spectacular bipolar 10" x 20" Homunculus Nebula, formed in the "Great Eruption" in the 1840s, is postulated to have been ejected in a super-Eddington wind during the spiral-in phase of two merging stars. The nitrogen-rich nebula contains at least 0.4 Msun of dust, with a diverse chemistry reflecting the CNO-processed abundance pattern of the erupting star's surface. However, the mass and chemical distribution of the dust between the polar lobes and a warm wind-carved equatorial torus -- tracers of the system's mass-loss history -- are highly uncertain since the only spectrum revealing the unique dust bands is spatially unresolved. We propose to decisively fill this crucial gap in our knowledge with JWST spectral maps of the nebula and two positions in the nearby debris field containing N-rich material ejected centuries before the Great Eruption, possibly during an unstable triple orbit phase involving mass-stripping encounters. The dust bands and nebular lines provide essential diagnostics of the distribution of dust species, grain properties, and associated excitation conditions, and will constrain the dynamical models of the system with the mass budget over the its eruptive history, and provide a detailed understanding of the photon- and shock-driven gas excitation. The science unique to JWST's capabilities will offer insights into key processes like common-envelope evolution, a critical yet poorly-understood phase in the formation of gravitational wave sources.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Gas, Dust and the ISM
ID: 6991
Program Title: Testing planet-disk interaction theory by imaging a unique spiral-arm-driving and gap-opening protoplanet

Principal Investigator: Ren, Bin

PI Institution: Observatoire de la Cote d'Azur

At the early stages of planet formation, giant planets interact with and shape their surrounding protoplanetary disks. While we have identified nearly two dozen spiral arm systems in protoplanetary disks, none of the planets that shape these spiral structures are confirmed. To locate these hidden planets, ground-based high-contrast imagers are observing these spiral systems at two distinct epochs over 5 or more years. With these observations, we constrain spiral motion, identify spiral formation mechanism, and pinpoint the orbits for these spiral-arm-driving giant planets. With the recent validation of the theory using the co-motion between a spiral and a stellar companion, we can now start hunting these spiral arm drivers in the planetary regime. A two-epoch observational study of the V1247 Ori spiral motion prescribed a hidden giant planet at 118 au or 0.29". The orbit aligns with an ALMA dust continuum gap, and there is a near-infrared high-contrast imaging candidate from Keck/NIRC2 almost exactly matching hydrodynamical simulation location. These four pieces of evidence complementarily support the theory that a giant planet is driving the scattered-light spirals and creating a millimeter gap. Situated at 0.29" ± 0.05", this hidden giant planet is the best target for NIRCam high-contrast imaging, thanks to unprecedented NIRCam sensitivity and contrast that are otherwise unachievable from the ground. Once confirmed, this joint-evidence approach will establish a new way of planet imaging, and deepen our understanding of planet formation. If not, this poses serious challenges to planet-disk interaction theories and protoplanet evolutionary models for further refinement.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7014
Program Title: Searching for Population III stars around massive interacting galaxies in the reionization epoch

Principal Investigator: Calabro', Antonello

PI Institution: INAF - Osservatorio Astronomico di Roma

Recently, the efforts to uncover traces of the elusive Population III stars have intensified, with several studies hinting at their detection in early galaxies. Yet, definitive observational evidence of this stellar population is still lacking. We propose a new, physically motivated approach, complementary to existing surveys, to search for Pop III stars by observing with NIRSpec-IFU (at medium resolution) the environment of 9 massive and interacting galaxies between redshift 7 and 9.5, which recent simulations suggest may host rich Pop III-forming environments in their surroundigs with high probability. Pop III stars will be clearly identified by the presence of bright HeII 1640 line and Balmer lines, and faint or absent metal lines, supported by robust photoionization model predictions. Additionally, these observations will provide new insights into the star formation and interstellar medium properties of merging galaxies at $z > 7$, improving our understanding of galactic interactions during this early epoch.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 7024
Program Title: From Accretion to Dispersal: Understanding Disk Evolution Around the Most Common Stars

Principal Investigator: Pascucci, Ilaria

PI Institution: University of Arizona

Recent theoretical studies propose that protoplanetary disk evolution is determined by magnetically-driven (MHD) disk winds, which enable accretion, and photoevaporative (PE) disk winds, which contribute to the dispersal once accretion weakens. NIRSpec/IFU's superior angular resolution and spectral coverage recently achieved a breakthrough with spatially resolved line maps, identifying clear signatures of MHD winds in 3 edge-on, high accretion rate systems that have dissipated their natal envelopes. Here we propose to expand on these initial findings by mapping 14 spectroscopically-identified winds from well-characterized disks around the most common ~0.1-0.4 Msun stars, which are also the most frequent exoplanet hosts. By spanning a range of accretion rates, we will determine whether the character of the disk wind changes with mass accretion rate and find if and when winds transition from predominantly MHD to PE, which is critical to constrain disk lifetimes, hence planet formation and migration. By measuring wind mass loss rates, we will test a key prediction of MHD-driven winds, that mass ejection rates in the wind are comparable to the mass accretion rate onto the star. In addition to mapping radially extended disk winds, NIRSpec/IFU will spatially resolve jets, enabling a comparison in the mass ejection rate and opening angle in the jet with those of the wind, thus providing crucial constraints to models of jet-wind interactions. With JWST spectro-imaging already available for younger protostellar systems, our study will also enable a comparative analysis of outflow morphologies across key stages of star and disk evolution.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7033
Program Title: Mapping the Dust and Multiphase Gas in the Perseus Cluster of Galaxies

Principal Investigator: Hlavacek-Larrondo, Julie

PI Institution: Universite de Montreal

We propose multi-filter NIRCam imaging and NIRSpec/MOS observations of the Perseus cluster of galaxies. Perseus is the archetype for radio-mode feedback and has been considered the best laboratory for understanding the complex interactions between radio jets and the hot X-ray-emitting intracluster medium for decades. It contains a spectacular nebula of multiphase gas that spans the inner 100 kpc. The most important and unanswered question about this multiphase gas is its unknown origin. Here, we target the fine structures and subtleties in dust emission within this multiphase gas, aiming to achieve the first in-depth mapping of the dust in any cluster core. NIRSpec/MOS will also, for the first time, map the 1000–4000 K phase for the entire nebula, the last phase without spectroscopic data. By leveraging the JWST's unique capabilities and drawing on extensive multiwavelength observations from Chandra, Hitomi, ALMA, JVLA, HST, Herschel, Spitzer, CFHT, and others, we aim to deliver an unprecedented, in-depth analysis of all gas phases in Perseus and decipher the origin of the dust and multiphase gas in cluster cores. In just 12.4 hours, this study will therefore significantly enhance our understanding of how black hole radio jets shape and influence their surrounding gas environments.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Stars and Stellar Populations
ID: 7034
Program Title: Distance Scale Linkages between JWST Tip of the Red Giant Branch and JWST/HST Surface Brightness Fluctuations (and SNIa in E Hosts)

Principal Investigator: Tully, R.

PI Institution: University of Hawaii

The value of the Hubble constant remains contentious and there is a need for a completely different path to a determination from one using Cepheids or supernovae. A Population II path that is particularly suited to exploitation with JWST involves the bright stars on the red giant branch. In nearby galaxies those stars are resolved and distances can be determined from the magnitudes of those at the tip of the red giant branch (TRGB). In more distant galaxies those same kinds of stars are blended but distances can be inferred from the spatial power spectum of surface brightness fluctuations (SBF). HST SBF observations have been made with WFC3/IR of 220 galaxies. However, the absolute calibration of this outstanding sample depends on a transfer from dated Cepheid observations. The proposed observations will provide a proper calibration of the HST material tied to a Pop II JWST calibration by extending the overlap from 6 to 17 galaxies. That JWST calibration including establishment of the TRGB zero point and the transfer to SBF is a work in progress. This program will almost double the connections between TRGB and SBF in JWST passbands from 14 to 25 galaxies, all within 30 Mpc. As a secondary benefit, TRGB distances will be determined for 9 elliptical galaxy hosts of Type Ia supernovae. Immediate products will be a determination of H0 from 220 HST SBF observations within 100 Mpc with a Pop II calibration and a separate determination of H0 from the calibration of SN Ia in E/S0 hosts. The long term benefit is through the calibration of SBF with JWST which ultimately will give H0 with observations reaching 350 Mpc.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 7035
Program Title: Brown Dwarfs in NGC 602 in the SMC - An opportunity to characterize a substellar IMF at low metallicity

Principal Investigator: Zeidler, Peter

PI Institution: Space Telescope Science Institute - ESA - JWST

We propose to exploit the synergy of NIRCam and NIRSpec to characterize, for the first time, the initial mass function (IMF) down to 15 Jupiter masses in NGC 602, a low-metallicity (1/5 Solar) young star cluster in the Small Magellanic Cloud (SMC). NGC 602 formed in an isolated location in the “wing” of the SMC, still it hosts numerous OB stars. It is the only low-metallicity young (about 2 Myr) star cluster where, with JWST, planetary-mass Brown Dwarfs have been detected, thus offering an opportunity to study the impact of stellar feedback from OB stars across the cluster region. We will collect tens of NIRSpec spectra of young, low-metallicity Brown Dwarfs. By targeting a completely unexplored parameter space (young and low metallicity), we will assemble a unique dataset that will have long-lasting legacy value for all the studies of Brown Dwarf formation, especially at sub-Solar metallicity. Only combining deep NIRCam photometry and NIRSpec MOS it is possible to derive accurate spectral-type-based masses and measure ages better than 0.5 Myr using evolutionary models and spectral templates. This dataset will add an invaluable piece to the puzzle of the formation of sub stellar objects at conditions that are different than Solar, and will address the environmental condition impact on the young star cluster IMF.

Proposal Category: SNAP
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7040
Program Title: Filling the Gaps: a Census of Dust Production from Gap Transients

Principal Investigator: Lau, Ryan

PI Institution: NOIRLab - (AZ)

Dust grains are the seeds of star and planet formation and are direct tracers of the chemical enrichment of the Universe. Despite the importance of dust in tracing our own cosmic origins, the origins of dust are unclear. Although core-collapse supernovae (ccSNe) with their metal-rich ejecta are considered to be prolific dust factories, both observational and theoretical studies challenge this claim given the destructive nature of SN shocks and suggest they may even be net dust destroyers. Emerging classes of IR-luminous "gap" transients, which occupy the luminosity gap between novae and supernovae, indicate substantial dust formation and occur at a significant fraction of the SN rate. Gap transients may therefore prove to be the missing source of explosive dust production that could supplement or dominate the dust budget of galaxies. However, their dust production has been largely unexplored due to observational limitations on measuring their warm dusty ejecta at mid-IR wavelengths. With the capabilities of JWST, we are now able to directly address the role of gap transients as potential dust factories. We propose a JWST Cycle 4 Survey program with a target list of 45 gap transients to measure their dust production with four filters of the MIRI Imager. Given that gap transients are largely discovered in nearby galaxies, they are fairly evenly distributed over the sky and ideal for a Survey program. Our key science goal is to determine whether or not gap transients are significant sources of dust relative to core-collapse supernovae. Given the potential benefit of our proposed dataset to the community at large, we will make our data immediately available.

Proposal Category: GO (GO-Archival)
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 7041
Program Title: The CLASSYIR Treasury: Unveiling the Cosmic Engines Powering Galaxies with JWST/MIRI

Principal Investigator: Berg, Danielle

PI Institution: University of Texas at Austin

A key goal of JWST is to determine how galaxies evolved across cosmic time. Nebular emission lines provide our most detailed view of the properties/conditions of star-forming galaxies (SFGs). However, the robustness of these diagnostics hinges on our ability to understand the ionizing sources powering them. While the non-ionizing and low-energy ionizing continua of SFGs have been successfully mapped, the high-energy ionizing continuum (>54 eV) is completely unconstrained. This poses an alarming problem for the revolutionary high-z JWST observations that reveal inexplicably intense high-ionization emission. Progress requires constraining the high-energy ionizing continuum responsible for these lines, but, there is no feasible way to directly observe it. Fortunately, MIRI boasts 100x higher sensitivity than previous observatories, opening an unprecedented opportunity to detect rare emission lines that trace the unseen high-energy ionizing continuum. We propose the CLASSY+IR (CLASSYIR) Treasury: MIRI spectra of 31 local SFGs to complete the 1st comprehensive investigation to map the unseen ionizing continuum shape. CLASSYIR will leverage existing datasets to provide the community with high level science products, including benchmark integrated, aperture-matched UV+optical+MIR spectral templates. The CLASSYIR templates will sensitively probe, for the 1st time, the range of ionization states needed to map the shape of the full ionizing spectra of the sources powering nebular emission across cosmic time. In tandem with JWST observations of the 1st galaxies, these templates will reveal our 1st glimpse into the ionizing sources that dominated the early universe.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Stars and Stellar Populations
ID: 7049
Program Title: A Unique Opportunity to Probe Lensing-Magnified Star Clusters in a Low-Mass Galaxy at z_spec=8.3 with JWST

Principal Investigator: Mowla, Lamiya

PI Institution: Wellesley College

We propose for high signal-to-noise spatially resolved spectroscopic observations of the Firefly Sparkle (FS), a highly magnified galaxy at z$_{spec} = 8.3$, using NIRSpec/PRISM IFU to obtain spectra of the individual star clusters. These observations are only possible due to NIRSpec's unparalleled sensitivity, making it uniquely capable of resolving the spatially resolved ISM conditions within and around the star clusters in a lensing magnified low-mass galaxy at cosmic dawn. These timely observations coincide with JWST's groundbreaking ability to directly observe globular cluster (GC) formation, and provide a bridge between the old stellar populations that we see in GCs today and the young clusters they are thought to form from. Our key science goals are to: (i) characterize the extreme ISM conditions in the clusters, (ii) determine whether they form in a single burst or show extended star formation, (iii) investigate the potential evidence for an excess of massive stars expected in early star formation using Nitrogen abundances, and (iv) evaluate the possibility of a clumpy CGM by spatially resolving the Lyman-break. These observations will significantly advance our understanding of the birth of the first stellar systems in a low-mass galaxy at extreme redshifts, probe the connection between massive star clusters in young galaxies and future globular clusters, and provide synergies with upcoming ALMA measurements.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Stars and Stellar Populations
ID: 7068
Program Title: Surveying Stellar Shenanigans: Exploring M dwarf Flares for Exoplanetary Insights

Principal Investigator: Doshi, Dhvani

PI Institution: McGill University

This proposal presents a legacy campaign to observe stellar flares on M dwarf stars in the near-infrared (NIR) using the James Webb Space Telescope's Near Infrared Imager and Slitless Spectrograph instrument. Exoplanetary transits, eclipses, and phase curves all rely on the stability of the stellar spectrum over time. However, this stability is disrupted by stellar flares, which alter the star's spectrum in unpredictable ways. To date, there have only been a handful of published NIR spectra of M dwarf flares, despite their crucial role in understanding exoplanetary environments. Given that current models are insufficient for M dwarf stars, it is essential to directly study and model M dwarf stellar flares. By observing 5 active M dwarf stars for 5-10 hours each, our goal is to compile a comprehensive library of NIR stellar flares, totaling over 400 events with energies exceeding 10^{30} erg. This initiative will significantly advance our understanding of M dwarf stars, with implications for transit spectroscopy and stellar physics. Through detailed analysis of flare properties and behavior in the NIR regime, our proposal aims to address critical gaps in our understanding of stellar flare phenomena on M dwarfs, refining existing models and enhancing our ability to interpret exoplanetary spectra in the presence of stellar activity.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 7073
Program Title: Charting the Cosmic Shoreline

Principal Investigator: Lustig-Yaeger, Jacob

PI Institution: The Johns Hopkins University Applied Physics Laboratory

Measuring the prevalence and diversity of M-dwarf rocky exoplanet atmospheres stands to be one of JWST's lasting legacies. However, the detection of secondary atmospheres remains elusive. In hindsight, this should not come as a surprise, since none of the rocky planet transit observations to date are sensitive to Earth-like (i.e., N2-rich) atmospheres. Furthermore, the overwhelming majority of these planets are not expected to have atmospheres based on solar system trends. Coined the "cosmic shoreline," this hypothesized trend stems from an empirical division between bodies with and without atmospheres, yet early JWST measurements imply a strong stellar dependence to the cosmic shoreline when extended down to M-dwarf systems. Thus, we are at an inflection point where, despite past investments, many questions remain unanswered: (1) Do temperate M-dwarf rocky planets possess high mean molecular weight atmospheres? (2) Where is the cosmic shoreline located within a given multi-planet system? (3) How does the presence of atmospheres correlate with stellar type? This program will answer these questions by targeting six temperate exoplanets across three M-dwarf subtypes to enable comparisons between rocky planets with similar formation, migration, and stellar evolutionary histories. Our focused NIRISS and NIRSpec observations will yield 1-5 μm transmission spectra with sufficient precision to robustly detect N2-rich atmospheres, thus greatly outperforming past programs and complementing the Rocky Worlds DDT program. Ultimately, this study will constrain how stellar type sculpts the cosmic shoreline and provide transformative insights in comparative planetology.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 7075
Program Title: Kepler's Supernova Remnant: New fundamental Insights into Type Ia Supernova Explosions

Principal Investigator: Milisavljevic, Dan

PI Institution: Purdue University

Type Ia supernovae (SNe) have fundamental consequences in a broad range of astrophysical topics, and hence the identification of their unknown explosion mechanisms and progenitor systems is ranked among the most important problems of stellar astrophysics. Widely believed to be the result of the thermonuclear combustion of a carbon-oxygen white dwarf that is destabilized through the interaction with a companion star, whether or not that companion is degenerate and whether it survives are all critical unanswered questions despite numerous extragalactic SN Ia studies. JWST's resolution and sensitivity open new pathways to investigate the nature of SNe Ia via spatially resolved observations of young, nearby Galactic Ia SN remnants. One extraordinary SN Ia remnant, Kepler’s SNR (SN 1604), best highlights the issue about whether SNe Ia have single or double degenerate progenitors (SD vs DD): its circumstellar medium suggests a SD channel, whereas the lack of a surviving donor star is best explained by the DD scenario. We propose a JWST imaging and spectroscopy survey of Kepler's SNR that will: 1) greatly improve characterization of the SN ejecta, CSM, and dust over previous studies, 2) test the leading hypothesis that its dust properties require a 4-6 Msun AGB star that is no longer present, and 3) map the distribution of C+O material to distinguish between SNe Ia explosion models. Our results results will help interpret JWST observations of unresolved extragalactic SNe Ia, be synergistic with new XRISM observations, and provide tests of 3D simulations that evolve SNe Ia to the remnant phase.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 7076
Program Title: A comprehensive population study of Little Red Dots: Connecting early BH and galaxy growth

Principal Investigator: Akins, Hollis

PI Institution: University of Texas at Austin

JWST has revealed a previously unknown population of dust-reddened active galactic nuclei (AGN) in the early universe, raising questions about the abundance of supermassive black holes in the epoch of reionization and the typical growth mechanisms and seed populations. These "little red dots" may represent a transition phase from obscured, rapidly accreting BH seeds to unobscured, blue quasars, but the properties of the AGN and their host galaxies remain unclear. LRDs generally do not exhibit common AGN signatures, and some may be dominated by host galaxy emission. We propose an efficient and comprehensive NIRSpec follow-up program targeting LRDs, obtaining uniform PRISM+G395M spectroscopy for ~100 of the brightest and highest-redshift LRDs discovered by JWST, particularly those with MIRI coverage at >10 micron. With these data we will be able to disentangle the heterogeneous LRD population and: 1) Search for outflows and high-ionization lines to determine the nature of LRD obscuration 2) Measure black hole and stellar masses and examine implications for LCDM and BH seeding scenarios 3) Measure number densities of LRDs with secure redshifts, and bolometric luminosities over a large volume The proposed data will facilitate comprehensive analysis of the LRDs as a population, cross-correlating various observables to test key predictions from different interpretations, providing valuable insight into their role in early galaxy/SMBH growth.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 7078
Program Title: On the search for a primeval black hole in a spectroscopically-confirmed galaxy at z=12.3

Principal Investigator: Mitsuhashi, Ikki

PI Institution: University of Colorado at Boulder

JWST has discovered a surprisingly large number of bright galaxies at z>10, which challenges theoretical expectations. To account for their existence, we must consider different physical properties compared to lower-z systems, or the potential influence of early AGN activity. Recent observations on the bright galaxy GN-z11 at z=10.60 suggest the presence of an active black hole with a super-Eddington accretion rate, which accounts for its high luminosity. It is now imperative to study other bright galaxies at similar or even higher redshifts to test whether this early onset of AGN is a common feature among these unique systems. Here, we propose to conduct MIRI/MRS spectroscopy of GHZ2 at z=12.35, the highest redshift AGN candidate. Recent NIRSpec/PRISM and MIRI/LRS spectroscopy detected several emission lines that revealed extremely high ionization conditions, potentially due to AGN. Additionally, compact morphology and SED fitting results imply a significant AGN contribution. Nevertheless, their low spectral resolution hampers the identification of unique AGN signatures, such as broad emission lines. The proposed MRS spectroscopy, with R~3000, will allow us to measure the Ha line width and investigate whether GHZ2 has an AGN through one of the robust and well-calibrated methodologies. This is crucial to understand the physical origins responsible for the overabundance of bright galaxies at z>11. If the existence of an AGN is confirmed, this would be the most distant massive black hole to date, providing unparalleled information about the black hole seeding mechanisms and early black hole growth scenarios.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Gas, Dust and the ISM
ID: 7081
Program Title: A Race Against the Clock: Too Much Nitrogen, Too Early?

Principal Investigator: Berg, Danielle

PI Institution: University of Texas at Austin

Chemical abundances encode the integrated star formation over the lifetimes of galaxies. Since stars produce nitrogen and oxygen on different timescales, the relative abundance of N/O acts as a clock constraining the star formation history. Specifically, N/O describes the relative ratio of moderately old stars(>100 Myr) to very young stars (<10 Myr). Recently, JWST observations of extreme star-forming galaxies only a few 100 Myrs after the big bang have found extreme UV N IV] and N III] emission lines. These lines suggestsuper-solar N/O ratios, implying a contradiction: galaxies existing for < a few 100 Myr seem to have N enrichment from substantial older stellar populations. These galaxies have too much N too early in the universe. However, accurate relative abundances from rest-UV lines are extremely sensitive to the physical conditions assumed, such as the high densities (> 1e6 cm^-3) measured for some high-z galaxies. Thus, unearthing the conditions that produce the N lines is essential to constrain the chemical enrichment of the first galaxies. We propose 25.8 hours of high-resolution NIRSpec MSA observations of z>5 galaxies with existing detections of FUV NIV], NIII], OIII] and CIII] emission lines, providing the first sample of accurate measurements of high-ionization gas densities and N/O ratios derived under these conditions. This will allow us to test whether current models of rapid N enrichment are correct or if they are driven by extreme environments at high-z. The outcome will enable a blueprint to diagnose the properties of extreme N emission and reshape how we interpret metallicity and star formation in the earliest galaxies.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7084
Program Title: Measuring the Thickness of a J-Shock in Cep A West

Principal Investigator: Green, Joel

PI Institution: Space Telescope Science Institute

We will measure the thickness of a resolved interface between jet and cloud shock for the first time, using the high spatial resolution of JWST/MIRI. Only JWST can spatially resolve the working surface (bow shock) or other sources of potential confusion in this edge-on, emission line flow. We will map the high velocity HH 168 flow with the MIRI IFU, slicing the shock pixel by pixel in the dissociative zone, in search of a resolved magnetic precursor. The working surface size is hinted at the subpixel level by Spitzer mapping but only JWST/MIRI has the spatial resolution needed, which will provide critical constraints on interstellar shock models (pre-shock magnetic field, change in velocity, temperature, and density across the shock boundary). Resolving the working surface provides observational constraints on theoretical estimates for turbulence, mass density, and shock morphologies generated during periods of massive star formation used in models of interstellar shocks to justify star formation efficiency parameters. Observational constraints on these parameters are ultimately required to understand the role of clouds, shocks, and filaments in our galactic ecosystem.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7085
Program Title: Dust Evolution in Molecular Cores

Principal Investigator: Paladini, Roberta

PI Institution: California Institute of Technology

We propose to constrain the initial stages of grain growth in early sites of star formation. This objective will be achieved by obtaining NIRSpec MSA spectroscopic observations of background stars behind three dense molecular cores of different evolutionary stages. By employing background stars, we will avoid uncertainties arising when embedded sources, with uncertain IR excesses, are used. The proposed observations will provide unprecedented spectroscopic information on the systematic variation of the extinction curve with depth into the cloud, at levels of extinction that were not possible to probe before JWST.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7087
Program Title: A High Precision Disk Opacity Law from the Great Serpens Shadow

Principal Investigator: Green, Joel

PI Institution: Space Telescope Science Institute

In a disk system, starlight penetrates the disk surface layers subject to the dust opacity as a function of wavelength. The relative dust opacity law is critical input for protoplanetary disk formation and evolution models, but has not yet been measured empirically. An observational measurement of the opacity in a disk will influence planet formation models, settling, and interpretation of surface tracers accessible to JWST, including molecular gas. However, the precision needed to measure the opacity law via direct methods cannot be achieved with existing facilities. We propose to observe, for the first time, the relative disk opacity law in a young disk through the magnifying effect of shadowing. The Herbig Ae/Be-like star HBC672 (EC82), embedded in the Serpens molecular cloud, is associated with a giant (17000 AU scale) disk shadow revealed through HST/WFC3IR imaging. In this edge-on circumstellar disk system, starlight is occulted by disk surface structures in the innermost few AU, creating a sharp conical shadow against the cloud background. The shadow is cast from the innermost AU region of the disk in this system, at least three orders of magnitude smaller than the shadow extent, magnifying the effect of disk opacity by at least three orders of magnitude against the Serpens cloud background. Using JWST/NIRCam and MIRI imaging we will measure the relative disk opacity law in 13 bands from 0.9-18 microns by determining the shadow opening angle, translated to disk scale height, as a function of wavelength. Using this special geometric setup, this would be the first empirical measurement of the dust opacity law in a planet-forming disk.

Proposal Category: GO (GO-Archival)
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Gas, Dust and the ISM
ID: 7099
Program Title: Unveiling the Changing C/O Chemistry in Young Planet-Forming Disks with JWST and ALMA

Principal Investigator: Cleeves, Ilse

PI Institution: The University of Virginia

Recent advances now allow us to statistically compare the compositions of planets with their planet-forming environments. Gas giant planets with masses within a factor of a few of Jupiter exhibit a wide range of atmospheric C/O ratios, including values greater than 1. A high C/O ratio has traditionally been interpreted as evidence that a planet formed beyond the water snowline and later migrated inward. However, recent JWST observations suggest that the C/O environment in protoplanetary disks is more complex and likely evolves over the first few million years (Myr) of the disk's lifetime. Specifically, recent JWST MIRI observations of young (< 1 Myr) Class II disks reveal chemistry consistent with high C/O ratios in the inner few astronomical units. This raises the possibility that such planets could form in situ, without significant migration. To better understand these environments, we propose a survey of 20 young Class II disks in the Rho Oph star-forming region, combining 7 archival datasets with 13 new JWST MIRI observations of star-disk systems. The sample is chosen based on having sensitive ALMA data enabling a comparison with the outer disk composition, including C/O. This expanded dataset will provide a more representative view of typical planet-forming environments around both M-dwarfs and solar-type stars, offering new insights into the evolution of C/O ratios in disks and their influence on the formation and composition of emerging planets.

Proposal Category: SNAP
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 7113
Program Title: Toward a 1% measurement of H0 with all-sky SBF distances at substantial redshifts

Principal Investigator: Tully, R.

PI Institution: University of Hawaii

A measurement of the Hubble constant giving H0=73 km/s/Mpc with apparent statistical accuracy of 1.4% is claimed for the Pop I ladder linking Cepheid variables with Type Ia supernovae (SNIa). Could the measurement be affected by systematic errors? An entirely Pop II ladder can be constructed linking Tip of the Red Giant Branch (TRGB) and Surface Brightness Fluctuation (SBF) measurements, with the potential of comparable 1.5% statistical accuracy. Any disagreements between the completely independent pathways will expose systematic problems. This proposal is a request to launch the crucial final step in the TRGB-SBF ladder. Step 1 (not JWST specific) involves the absolute calibration of the TRGB methodology; step 2 (a completed JWST c2 program) builds the link between TRGB and SBF in 14 nearby galaxies; step 3 (an active JWST c3 program) establishes the precision of SBF measurements with relative distance removed as a variable with observations of 40 galaxies in the Coma Cluster; and the proposed final step 4 establishes absolute distances to galaxies at redshifts where the fractional component of deviant velocities should be negligible. There have been hints of variations in H0 measurements in different directions and depths. Concern of systematics that arise with with SNIa are minimized with all-sky JWST SBF distance measurements. The Survey mode is an efficient way to proceed. Random sampling from among the abundance of target choices is acceptable. The proposal will be successful with observations of 60 galaxies selected from a target list of 300 that are well distributed across the sky, drawing appropriate E/S0 systems from 2MASS groups out to z=0.06.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 7119
Program Title: Does Reionization Quench All Ultra-faint Dwarf Galaxies? The Ancient Star Formation History of Pegasus W

Principal Investigator: Sand, David

PI Institution: University of Arizona

We request F090W+F150W NIRCam imaging of Pegasus W (M_V=-7.2; D=915 kpc), an isolated ultra-faint dwarf galaxy on the far side of the Local Group and beyond the virial radius of M31 itself. Pegasus W is a unique ultra-faint, as HST imaging indicates that it quenched 7.4 Gyr ago, far more recently than the ultra-faint satellites of the Milky Way, and, remarkably, that its star formation may have re-ignited briefly ~500 Myr ago. Reionization is expected to quench the smallest galaxies at early times (>10 Gyr), heating their gas reservoirs and stopping any subsequent star formation. However, the effects of reionization may vary based on the mass of the dwarf, and on the local ionizing field, neither of which has been explored. Pegasus W is the first isolated ultra-faint dwarf which may have been resistant to the effects of reionization, but resolved stellar population observations down to the oldest main sequence turnoff are necessary to robustly verify its ancient star formation history. Only JWST+NIRCam can perform these observations in a reasonable amount of time at the distance of Pegasus W, allowing us to probe reionization's role in the smallest dark matter halos in a new regime. We have designed our observations with future proper motion measurements in mind to further understand the dynamical history of this unique ultra-faint dwarf. We also waive proprietary rights so the full community can immediately utilize this potential touchstone data set.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7135
Program Title: Population Study of Chemistry in the First Million Years of Planet Formation: A MIRI Survey of Embedded Disks in Ophiuchus

Principal Investigator: Zhang, Ke

PI Institution: University of Wisconsin - Madison

We propose a comprehensive JWST-MIRI survey for 40 Class I/FS disks in the Ophiuchus region. This survey will provide the first population study of the chemical composition and pebble drift conditions during the crucial first Myr of planet formation. Recent research indicates that planet formation may begin much earlier and proceed faster than traditionally believed, with critical planet formation processes initiating during the embedded disk stage (less than 1Myr). Previous JWST/MIRI programs have mostly focused on very young Class 0 sources (<0.2 Myr, may not have a disk yet) or older Class II disks, leaving the bulk population of embedded disks —Class I (0.1–0.6 Myr) and Flat Spectrum (FS, 0.6–1 Myr) sources—largely unexplored. MIRI spectra of a preliminary small sample of Class I/FS sources reveal that molecules such as gas-phase H2O, CO, CO2, C2H2, HCN, and OH are readily detectable. Interestingly, these spectra suggest a distinctive chemistry compared to older Class II disks, aligning with a water-rich and CO2-poor phase in the first Myr predicted by pebble drift models. Ophiuchus is the closest star-forming region with a large population of embedded disks and the only region with most of embedded disks characterized with high-resolution ALMA observations (5-10 au). Leveraging existing ALMA observations, this program will provide crucial insight into the early disk composition in the terrestrial planet-forming region and key constraints to the pebble fluxes and volatile transport within the first Myr under a wide range of stellar and disk properties.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7140
Program Title: A JWST Survey of Compton Thick AGN

Principal Investigator: Armus, Lee

PI Institution: California Institute of Technology

An obscured phase in the accretion history of supermassive black holes (SMBHs) is widely thought to represent a key step in the co-evolution of Active Galactic Nuclei (AGN) and their host galaxies. While models of the Cosmic X-ray Background have shown that the most obscured, Compton-thick (CT) AGN (those with N(H) >1E24 cm^-2) are expected to comprise up to 50% of the AGN population, they are extremely hard to detect and identify. Most of the CT AGN we know at low redshift are located within 100 Mpc, and we still lack a clear understanding of the properties of their circumnuclear material, star formation, and the impact of AGN feedback on the host galaxy. We propose here to obtain JWST/MIRI observations of 13 nearby, hard X-ray selected CT AGN to obtain resolved mid-infrared spectra and images of their circumnuclear, multi-phase ISM. By studying this sample with MIRI and applying the suite of powerful mid-infrared diagnostics to these elusive galaxies, we can simultaneously measure the SMBH accretion rates, star formation rates, warm molecular gas masses and temperatures and map the excitation and dynamics of the ionized atomic gas on scales of < 100pc for the first time. These data will also allow us to measure the spatially resolved properties of the dust in absorption and emission, providing the first detailed infrared maps of the obscuring material around CT AGN. Our proposed survey will advance our understanding of this critical phase of SMBH growth, be invaluable for understanding high-redshift obscured AGN discovered with JWST, and set the stage for large area surveys to be done in the coming decade with the next generation of X-ray and Far-Infrared probes.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 7169
Program Title: Dissecting the Arches cluster: An ideal test bed to study the metal-rich Universe

Principal Investigator: Legault, Alexandre

PI Institution: Centro de Astrobiologia (CAB), CSIC-INTA

Located at the centre of the Milky Way, the Arches cluster is a metal-rich, young massive star cluster, pervaded by massive stars that populate the cluster mass-function up to the highest masses. Its proximity, compactness, and youth, combined with the unprecedented spectroscopic sensitivity of JWST NIRSpec, enables --for the first time-- a detailed census and characterization of its heavily reddened massive cohort. We propose NIRSpec IFU spectroscopic observations covering 1.66 to 5.27 μm of a significant fraction of the Arches, down to early B-dwarfs, at a modest observational cost. Our results will allow for the first comprehensive test of the validity of current models of radiation driven winds in a high-metallicity environment. We will also obtain a direct measurement of the extinction towards each star, breaking current degeneracies that plague ground-based and space photometric studies. Quantitative spectroscopic analysis of the rich suite of H-, He-, and metal-line diagnostics with state-of-the-art model atmosphere programs will return accurate fundamental stellar properties, including masses and mass-loss rates. This will provide a gauge of the mechanical energy, momentum and ionizing power provided by the cluster to its environment, as well as the cluster mass function and its potential top-heavy nature. Consequently, the Arches cluster will become the prototypical template for understanding clusters and their environments in more distant, metal-rich, massive star-forming galaxies.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7184
Program Title: Measuring H0 with Deep NIRcam imaging of the next generation of time-delay lenses

Principal Investigator: Millon, Martin

PI Institution: ETH Zurich

If confirmed, the Hubble tension, i.e. the 5-sigma discrepancy between direct measurements of H0 in the local Universe with supernovae and the CMB value extrapolated to present day, would imply that the LCDM paradigm needs to be revised. Given the high stakes for cosmology, independent measurements are needed to confirm (or not) this tension. Time delays in strongly lensed quasars is the only single-step method truly independent of any other cosmological probe. It requires precise time delays and deep sharp images of the lensed quasar host galaxy in each system, but for 10 systems that have new exquisite time delays, the lensed host galaxy is beyond the reach of HST imaging capabilities. The superior resolution, sensitivity, and redder wavelength coverage of JWST-NIRCam are necessary to transform these lenses into distance indicators. In practice, the NIRCam images will 1- constrain the radial slope of the lens mass models needed to turn time delays into H0 and 2- allow us to identify any deviation of the mass model from elliptical symmetry, ensuring that this do not contribute significantly to the total error budget on H0. The new images will double the number of systems with time delays and all ancillary data needed. It will also significantly increase the scientific impact of Cycle 1 and 2 JWST/NIRspec observations, leading to 2.3% precision on H0.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 7188
Program Title: All you need is Love numbers: simultaneous measurement of the oblateness and atmospheric composition of a warm gas giant

Principal Investigator: Acuna, Lorena

PI Institution: Max Planck Institute for Astronomy

A key open question for gas giant exoplanets is how heavy elements are distributed between the core and the envelope. With the combination of two observables uniquely accessible with JWST, the Love number and atmospheric metallicity, it is possible to break degeneracies in theoretical models and uniquely determine the interior structure. The Love number quantifies the deviation of the planet's shape from a perfect sphere due to rotational or tidal forces. For the same force, the deformation will be greater for planets with well-mixed regions between the core and the envelope (known as dilute cores) than for planets with well-differentiated cores. We will observe a long-period gas giant, TOI-199 b, and measure its rotation-induced oblateness from a precise transit light curve. We will also measure the atmospheric composition with transmission spectroscopy, determining the atmospheric metallicity and C/O ratio to a precision better than 0.28 and 0.04 dex, respectively. Taken together, these measurements will provide constraints on the mass and dilution of the core of a cold gas giant exoplanet. Jupiter and Saturn both have dilute cores. Thus, if we find the same is true for TOI-199 b, that would be a positive indication that dilute cores are a typical outcome of gas giant formation both in and out of the Solar System.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 7195
Program Title: Deciphering the torus and extended dust properties of local active galactic nuclei

Principal Investigator: Alonso-Herrero, Almudena

PI Institution: Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.

JWST observations of the early universe are revealing an excess of supermassive black holes (SMBH) and a commensurate large number of obscured high-z active galactic nuclei (AGN). The understanding and characterization of these dust-shrouded distant objects relies of local AGN templates, including emission from the dusty torus. Postulated several decades ago, and now with several competing models, it is only through the advent of JWST's near- and mid-infrared capabilities, fused with ALMA's (sub)mm wavelengths that observational constraints can be firmly placed on the torus and models that seek to explain its presence, maintenance, and relationship to the host galaxy. In this proposal we plan to obtain NIRSpec and MIRI spectroscopic and imaging observations for a complete sample of Seyfert galaxies at 14-27 Mpc that have ALMA resolved torus data. We will use the leading torus models to fit the JWST-ALMA data to determine the torus dust structure and geometry and compare and contrast the optimal torus model(s). Furthermore, we will explore the extended mid-infrared polar dust, including its temperature and morphology, and determine if the dust is shock heated, AGN heated, or is part of a nuclear outflow. Finally, the data will also probe other dust components, such as polycyclic aromatic hydrocarbons and water ice. We will investigate the role of the nuclear gas content in protecting them from the harsh AGN radiation fields. We stress the connection of our local AGN work with JWST high-z observations, leveraging our local knowledge to help understand the coevolution of the AGN and host galaxy.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7196
Program Title: How Extreme is Pegasus W? Testing Galaxy Evolution at the Lowest Stellar Masses

Principal Investigator: Escala, Ivanna

PI Institution: Space Telescope Science Institute

Ultrafaint dwarf galaxies (UFDs) are thought to be the fossils of galaxies that formed nearly all of their stars at early times, and were quenched by the bath of UV photons during the epoch of reionization. However, nearly all UFDs studied to date are satellites of the Milky Way or M31, where tidal and ram pressure stripping can significantly impact the history of a UFD. Recent high-resolution simulations suggest that in isolated UFDs, extended star formation will occur even in very low-mass halos, and reionization alone may not be responsible for quenching all UFDs. Pegasus W is a newly discovered UFD on the far side of the Local Group. Based on HST imaging of the resolved stars, the galaxy was quenched long after reionization, ~7 Gyr ago. With a stellar mass of only 6.5x10^4 solar masses, Peg W may prove to be the most extreme example of low-mass, star forming galaxies discovered to date. The combination of Peg W's low stellar mass, extended star formation, and relative isolation means that matching its observed properties will provide a stringent test of galaxy formation models. However, understanding the nature of Peg W and its evolutionary history depends on measuring its dark matter (DM) content, for which we have no constraints. We propose NIRSpec observations of the stars in Peg W to measure its DM halo mass to determine whether Peg W's total mass is large enough to have shielded itself from reionization. These observations will provide strong constraints on the efficacy of reionization in quenching the lowest mass galaxies, and more broadly test our understanding of the physics of galaxy formation and evolution in the lowest mass systems.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 7199
Program Title: Anomalous infrared fluxes of M dwarfs

Principal Investigator: Zackrisson, Erik

PI Institution: Uppsala Astronomical Observatory

We target three very-unusual “one-in-a-million” main-sequence M dwarfs that show extreme levels of mid-infrared excess flux. These objects were singled out from a sample of five million stars sampled by Gaia and WISE in a search motivated by the quest to detect technosignatures, or Dyson spheres. Regardless of the physical explanation for the mid-infrared excess, JWST’s unique combination of sensitivity, spectral range and spectral and spatial resolution will allow different explanations for the excess to be tested. Three possible explanations have been proposed for the remarkable mid-IR excess of these M dwarfs: 1) An extreme, late-forming debris disk due to collisions within their planetary systems; 2) Contamination by a rare very-luminous type of WISE-discovered obscured active galactic nucleus that only contributes significantly to the flux at wavelengths longer than 10 micron, and which happens to be projected within a few arcseconds of the M dwarf; 3) A bona-fide Dyson sphere absorbing starlight, and operating at ~100-200 K. We propose a combination of MRS spectroscopy at 5-25 micron, along with imaging in F560W, F1000W and F1500W of the surrounding field to uncover the true nature of these objects. This project has the potential to make: the first detection of extreme debris disks without signs of ongoing gas accretion around mature M dwarfs; a “black swan” detection of an alien civilization; or to reveal three fascinating distant galaxies masked by a foreground star, which will provide precious adaptive-optics-friendly targets for future ELT spectroscopy.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Gas, Dust and the ISM
ID: 7201
Program Title: A deep look into the physics of the interstellar medium 360 Myr after the Big Bang

Principal Investigator: Castellano, Marco

PI Institution: INAF - Osservatorio Astronomico di Roma

JWST observations have unexpectedly revealed a large number of distant luminous sources whose investigation is directing most observational and theoretical efforts. An outstanding example is provided by the MUV=-20.5 object GHZ2/GLASS-z12 at z=12.34, which has been observed with both NIRSpec PRISM and MIRI LRS, and with ALMA Band 6 and 8. The strength of its UV emission features is exceptional compared to the general high-redshift population and implies extreme ionization conditions. We will observe GHZ2/GLASS-z12 with the G235H/F170LP and G395H/F290LP configurations that cover all its key emission features, and whose resolving power enables to separate all density-sensitive line doublets (NIV, CIII, OII) and cleanly detect faint lines that are hardly measurable at low resolution. Coordinated ALMA Band 8 observations will reach ultra-deep limits on the [OIII]52μm transition which provides a powerful density diagnostics in combination with the available [OIII]88μm data. The proposed observations will provide firm constraints on the ISM of GHZ2/GLASS-z12 by measuring its electron density across 4 orders of magnitude and from low, to very high-ionization regions. The NIRSpec high-resolution observations will also robustly measure the HeII emission, confirm the highest-redshift detection of the Bowen fluorescence line OIII3133, and put tight constraints on very high-ionization features indicative of AGN emission. ALMA will reach deep limits on its dust continuum emission. This program will thus provide a thorough investigation of the ISM, ionization sources, abundances of an object that has the potential to become one of the best studied targets at very high-redshift.

Proposal Category: SNAP
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7208
Program Title: THRIFTY: The High-RedshIft FronTier surveY

Principal Investigator: Meyer, Romain

PI Institution: University of Geneva, Department of Astronomy

The abundance of luminous z>9 galaxies is one of the major discoveries of JWST. Their number density far exceeds that of most pre-JWST models, prompting a revision of our understanding of early galaxy formation. The solutions offered to explain the formation of such luminous systems less than 500 Myr after the Big Bang range from stochastic star-formation histories, higher star-formation efficiencies and a changing IMF at high-redshift, feedback-free starbursts, contamination by early AGN, and even modifications to LCDM cosmology. However, the observational evidence rests on photometric candidates without spectroscopic confirmations, and thus needs direct confirmation. Furthermore, a small number of spectra of z>9 ultra-luminous (Muv < -21) galaxies have revealed a plethora of rest-UV high-ionisation lines whose origin is still debated. This programme addresses the paucity of spectroscopic redshifts for the most luminous z>9 candidates in the most efficient manner, in Survey mode. THRIFTY will determine the true number density of ultra-luminous galaxies at z>9 by targeting a sample of 123 candidates selected from >1 million sources over a total 0.3 square degrees (out of the Galactic plane) from all existing prime and pure-parallel JWST imaging surveys. This Survey will triple (quadruple) the number of spectroscopically confirmed z>12(9) Muv<-20 galaxies. By design, it will characterise the rare contaminants impeding our search for the highest-redshift galaxies. This large sample will constrain field-to-field variance at the UVLF bright-end, reveal the diversity of ultra-luminous "GNz11-like" galaxies and provide unprecedented constraints on the onset of reionisation.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 7213
Program Title: Probing the disk evolution in an early stage massive protocluster

Principal Investigator: Cheng, Yu

PI Institution: National Astronomical Observatory of Japan (NAOJ)

Circumstellar disks are critical to the formation of stars and planets, yet most surveys of these disks focus on nearby, low-mass star-forming regions. This bias may limit our understanding of the more typical environments for planet formation, as most stars form in dense clusters. Extending these studies to distant, massive protoclusters has mainly been restricted by the lack of prior YSO identification and classification from infrared surveys. We propose to utilize the unprecedented sensitivity and resolution of JWST to conduct the first deep census of YSOs in the early-stage massive protocluster NGC6334I(N) and NGC6334I. Our goal is to identify YSOs down to 0.1Lsun for AK < 10 and classify the evolution classes of cluster members with near- to mid-infrared photometry. The survey will yield a sample of over 10^3 YSOs, achieving a depth comparable to infrared surveys in nearby regions. Combined with joint ALMA observation (15au resolution, 0.87~mm) in a pilot sample of over 200 disks, we will measure the distribution of dust masses and radii for disks at different evolutionary phases and search for disk substructures. This will provide new insights regarding how disk evolution unfolds in early-stage massive clusters, with potential implications for our understanding of star and planet formation on a broader scale.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 7230
Program Title: Shadows and Dust - MIREX Mapping of a Massive Molecular Filament

Principal Investigator: Tan, Jonathan

PI Institution: Chalmers University of Technology

We propose MIRI and NIRCam imaging of a well-studied Infrared Dark Cloud (IRDC) filament that is one of the best test cases for mid infrared extinction (MIREX) mapping. This project will produce MIREX maps at <0.3 arcsecond resolution, eight times finer than achieved with Spitzer and a unique and powerful probe of the structure of star-forming clouds that only JWST can deliver. The NIR images will detect background stars, whose sight lines will yield pinpoint extinction measurements that help calibrate the MIREX map. Combined analysis of NIR and MIR extinctions will test models of dust grain evolution in a wide range of conditions in molecular gas. The same NIR and MIR images will also be exceptionally sensitive to protostellar and young stellar object (YSO) populations in the cloud, enabling a full characterization of the initial mass function (IMF) in this early-stage massive molecular filament. Key questions that will be answered by this project include: - What are the structural properties of molecular gas at the onset of massive star and cluster formation? - What are the natures of the young and forming stellar populations in this filamentary IRDC? - What is the core mass function (CMF) in this region and how does it relate to the stellar initial mass function (IMF)? - How does the NIR to MIR extinction law vary as a function of density and temperature and what are the implications for dust grain growth and evolution?

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 7232
Program Title: Orphan Dwarfs: Benchmarking Low-Mass Galaxy Evolution in an Isolated Environment

Principal Investigator: Cohen, Roger

PI Institution: Rutgers the State University of New Jersey

Dwarf galaxies, because of their low masses and shallow potential wells, are ideal laboratories to study the processes driving galaxy formation and evolution. However, a detailed picture of dwarf galaxy evolution is currently limited to the Local Group, making it impossible to isolate environmentally-driven effects, which play a role far beyond the host galaxy virial radius (D>1 Mpc) based on both observations and simulations. We propose to isolate the role of environment using a carefully selected control sample of seven isolated "orphan" dwarf galaxies at D>~2 Mpc from the Local Group barycenter. By providing the first set of homogeneous lifetime star formation histories (SFHs) for isolated dwarfs, we will facilitate a direct, empirical comparison to their Local Group counterparts to address the following questions for the first time: 1) Are the SFHs of isolated dwarfs similar to each other, and/or to their less isolated counterparts? We will test the hypothesis that the diversity of dwarf SFHs near the edge of the Local Group is a result of diverse birth conditions, confirming or refuting predictions that isolated dwarfs assemble their mass both later and more uniformly than those in groups. 2) How far does the influence of a massive host extend? We will quantify predicted correlations between mass assembly timescales and isolation out to >3 Mpc. 3) Do isolated dwarfs show "gappy" SFHs, predicted by simulations due to cosmic web stripping by the intergalactic medium? Post-reionization SFH "pauses" are observed for some dwarfs near the edge of the Local Group, but an environmental origin for these features can only be ruled out with a more isolated sample.

Proposal Category: AR
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7238
Program Title: Constructing High-Dynamic Range PSFs for the MIRI detector for accurately calibrating extended source photometry

Principal Investigator: Gaspar, Andras

PI Institution: University of Arizona

While the photometric calibration of point sources with MIRI are accurate to within 1% (Gordon et al., 2024), the absolute calibration of *extended sources* - such as deep field extragalactic objects - may be off by up to 7%. This is all due to our lack of understanding of the full spatial extent of the MIRI PSF and the characteristics of its encircled energy curve at large radial distances. An unfortunate attribute of the Si:As detectors used in MIRI is their low absorption efficiency at shorter (<12 micron) wavelengths, which results in scattering of the photons within the detector. The now well known feature, the cross (or cruciform) artifact (Gaspar et al., 2021), is the easily recognized (but very difficult to model) diffraction pattern produced by the scattering. It is accompanied by a much more evenly dispersed but just as substatial halo. These patterns displace 21% of the stellar flux from the PSF core at 5.6 microns, based on theoretical models. Low SNR and small field of view PSFs do not include these extended features and calibrations determined on - and for - point sources are therefore not accurately applicable for extended objects. Here we propose to use archival data to produce high dynamic range PSFs for the MIRI imager at all wavelengths, which will enable accurate photometry of extended objects. The PSFs we will construct will also be used to refine WebbPSF models, thereby also helping to calibrate the LRS and MRS photometry.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 7240
Program Title: Gas cooling in the molecular CGM of the Spiderweb: in-situ galaxy growth at z=2

Principal Investigator: Emonts, Bjorn

PI Institution: Associated Universities, Inc.

The evolution of galaxies at Cosmic Noon is linked to complex physical processes that take place across the circum-galactic medium (CGM), such as gas outflows, accretion, and mixing. However, a direct link between the CGM and the stellar growth of galaxies critically depends on identifying cooling processes that trigger the formation of molecular clouds - and ultimately stars - on large scales. Deep HST and ALMA imaging showed that the massive Spiderweb Galaxy at z=2.2 is rapidly forming stars in-situ from cold molecular gas across the CGM. The goals of this JWST proposal are to understand how the CGM can cool down to form stars, and on what scale in the CGM this process happens. JWST/MIRI is uniquely suited to study this through line observations of warm H2, which unambiguously trace the dissipation of kinetic energy from the CGM. We will use this to test the hypothesis that H2 is the dominant coolant in the CGM. Using the MRS, we will image the distribution and kinematics of the pure rotational H2 0-0 lines to study the H2 excitation, energy budget, and cooling rates across the CGM. This will be compared with a suite of molecular lines imaged with ALMA, including new ALMA Band 1 data of CO(1-0), which traces the coldest H2 gas. Commensally, we will obtain deep MIRI wideband imaging, and complement this with existing deep (19 orbits) HST imaging, to derive masses, rates and time-scales of the in-situ star formation. By studying H2 as the main channel for widespread cooling, and comparing cooling and star-formation rates across the CGM, we will gain a comprehensive understanding of the critical role that the multi-phase CGM plays the early evolution of massive galaxies.

Proposal Category: SNAP
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 7248
Program Title: A spectrophotometric survey of the colors of trans-Neptunian objects: An efficient constraint on post-formation evolution in the outer Solar System

Principal Investigator: Trilling, David

PI Institution: Northern Arizona University

The primary result to date from the Cycle 1 "DiSCo" program is that all large trans-Neptunian objects (TNOs) fall clearly into one of three spectral groups in the NIRSpec IFU wavelength range, and there are no TNOs that show JWST spectra intermediate between these three groups. These clear spectral signatures appear to map directly to formation location in the early Solar System. Spectra of smaller TNOs, which may be more likely to undergo dynamical mixing and collisional resetting, can therefore be used to measure the importance of those processes over the history of the Solar System. To measure the degree of post-formation evolution of smaller TNOs, we propose an experiment to understand whether this clear mapping of spectral signature to dynamical class extends to much smaller TNOs. We propose here a Survey program to obtain spectrophotometry of small TNOs with well-known orbits to increase our understanding of the evolution in the outer Solar System over the past 4 billion years. This Survey program is a very efficient use of JWST time that leverages and enhances the science return of the Cycle 1 DiSCo program. Though we have no minimum number of targets to be observed, our goal is to observe a sample that is comparable in size to the DiSCo spectral survey.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7251
Program Title: Does Our Closest M-Dwarf Rocky Neighbor Have An Atmosphere? We Need to Find Out.

Principal Investigator: Bennett, Katherine

PI Institution: The Johns Hopkins University

Knowing which M-dwarf rocky planets have atmospheres and which do not is critical to our understanding of the prevalence of habitable conditions in the Galaxy. This question is at the forefront of the exoplanet community, yet so far the community has been riddled with inconclusive data and mere elusive hints of atmospheres. We propose a deep (eight transit) and broad (1-5 micron) dive into one of the M-dwarf rocky planets that is most likely to have an atmosphere: LTT 1445Ab. This planet, part of a triplet M-dwarf system 6.9 pc away, is our closest transiting M-dwarf rocky neighbor, and its size (1.3 Earth radii and 2.9 Earth masses) and equilibrium temperature (424 K) hold promise for the presence of an atmosphere. Importantly, recent HST observations reveal a non-flat near-IR spectrum that must be followed up on as soon as possible. Unfortunately, the planet's proximity also means that its bright host star saturates most JWST near-IR observing modes. Now, however, with the new implementation of the NIRCam Short-Wavelength Grism Time Series, we can for the first time observe LTT1445Ab in transmission without risk of saturation. We propose four transits with the F150W2+F322W2 filters and four with F150W2+F444W for complete 1-5 micron coverage of this promising target. We note that LTT1445Ab's hotter and smaller sibling, LTT 1445Ac, is being targeted by the STScI Rocky Worlds DDT Program. By coupling the DDT emission photometry study with our NIRCam transmission spectroscopy study, we can map the presence of atmospheres within a single system. What's more, if LTT 1445Ab does not have an atmosphere, this would have profound implications for M-dwarf habitability in general.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7255
Program Title: A Day In The Life of KELT-9b

Principal Investigator: Stevenson, Kevin

PI Institution: The Johns Hopkins University Applied Physics Laboratory

KELT-9b is, by far, the hottest known exoplanet. With a dayside temperature of ~4,500 K, most molecules have dissociated into their constituent atoms. Rather surprisingly, the dayside HST emission spectrum favors an anomalously high metallicity and excessive H-, TiO, VO, and/or FeH. While metal hydrides and H- are reasonable absorbers for KELT-9b within an equilibrium chemistry framework, the presence of TiO or VO cannot be explained without invoking totally unexpected disequilibrium processes, such as horizontal quenching from the planet's nightside. The alternative (and unsatisfying) solution is that the observed dayside features are due to the presence of an unknown absorber. Without a suitable explanation for this benchmark ultra-hot Jupiter, we propose for JWST to observe a full-orbit phase curve of KELT-9b. Our program asks two overarching science questions that can be readily answered using NIRISS/SOSS spectroscopy: (1) Is the relatively efficient redistribution of heat on ultra-hot Jupiters due to hydrogen recombination? (2) Does the emission spectrum of KELT-9b show evidence of complex molecular abundances as a function of longitude? By combining information from all phases, we will provide robust constraints on the atmospheric metallicity and phase-resolved abundances of KELT-9b. The lessons learned from the hottest of hot Jupiters will shed light on the relative importance of various atmospheric processes and timescales within the atmospheres of the dozens of coolers planets with previous phase curve observations.

Proposal Category: AR
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 7261
Program Title: JWST Simulations of Molecular Outflows around Star-forming Galaxies

Principal Investigator: Oppenheimer, Benjamin

PI Institution: University of Colorado at Boulder

Theoretical studies of warm (100-1000 K) and hot (>1000 K) molecular superwind outflows traversing from the ISM through the disk-halo interface and into the circumgalactic medium (CGM) are substantially under-developed considering JWST's groundbreaking capability to spectrally resolve and spatially map numerous H_2 transitions. To properly simulate JWST observations of these outflows, one needs 1) ultra-high-resolution hydrodynamic simulations of galaxies with 2) sophisticated treatment of stellar feedback including supernovae, stellar winds, and radiation pressure while 3) self-consistently tracking the creation and propagation of molecular species and finally 4) mocking realistic observations using 3-dimensional radiative transfer. We propose hydrodynamic simulations of galaxies using the FIRE-2 code integrated with the novel CHIMES (CHemistry of the Interstellar Medium and Extragalactic Sources) module that tracks the non-equilibrium molecular chemistry and thermodynamics to create synthetic MIRI and NIRSpec spectra and Integral Field Unit (IFU) data cubes. A state-of-the-art multi-element dust depletion and shielding model makes it possible to simulate molecular outflows traversing from dense, HII regions in the ISM to the diffuse multi-phase CGM for the first time. We will diagnose how the underlying physical properties of superwinds (mass-loading, velocity, & total power) are observed across a variety of star-forming galaxies, how outflow properties scale with star formation rate surface density, and create a public data repository of synthetic MIRI, NIRSpec, and NIRCam observations to interpret existing observations and inform future endeavors.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 7268
Program Title: Easing the Tension: Near-Infrared Spectroscopy of HR 8799 b,c,d,e

Principal Investigator: Nasedkin, Evert

PI Institution: Trinity College Dublin

HR 8799 is the most iconic of the directly imaged exoplanetary systems. With four planets orbiting a single host star, it offers both a unique opportunity for comparative exoplanetology, and insight into the early history of a scaled-up version of our own solar system. Even with nearly two decades of study, there remains tension in both measurements of the atmospheric properties of the planets and uncertainty into how this peculiar system formed. Ground-based observations produce incompatible spectroscopic measurements due to contamination from atmospheric turbulence and differences in instrumental calibration, making interpretation of the planetary spectra difficult. We therefore propose to obtain high SNR observations using NIRSpec/G140H and G235H, resolving the tension between the different spectroscopic observations, as well as between atmospheric measurements and predictions from formation models. While other JWST programs will trace the disequilibrium chemistry and cloud properties in the mid-infrared, this near-infrared window is critical to inferring basic properties such as the bolometric luminosity, metallicity, surface gravity, and carbon-to-oxygen number ratio. Without these parameters, interpretation of the existing JWST spectra will be biased, as they will rely on existing ground-based measurements, or model-dependent predictions of the near-infrared spectra. The HR 8799 planets are a benchmark system for direct imaging, but it is of fundamental importance that such a benchmark has reliable measurements, which can only be obtained through these JWST observations.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7280
Program Title: Linking the outer structure with inner chemistry in disks around the most common planet hosts

Principal Investigator: Long, Feng

PI Institution: University of Arizona

Very low-mass stars (VLMS, spectral type later than M3) are known as favorable hosts of small planets, which are now being intensively studied with JWST. To fully understand the formation, evolution, and chemical compositions of these planets, it is essential to examine the physical and chemical properties of their birthplaces - the disks surrounding VLMS. The exceptional sensitivity of JWST has opened new avenues for investigating these faint VLMS disks, revealing rich and diverse C, O chemistry in their inner regions. One prevailing hypothesis links the variations in gas chemistry to the structure of the outer disk, which controls the inward drift efficiency of icy pebbles and the delivery of water. However, the current JWST VLMS sample is dominated by disks that are faint at millimeter wavelengths, making it difficult to characterize their outer disk structures. To thoroughly test the influence of outer disk structures on inner gas chemistry, we propose MIRI/MRS observations towards a complementary sample of mm-bright disks around VLMS, for which high-resolution ALMA images are already available. By conducting a joint analysis of high-quality JWST and ALMA data, we aim to test if disks with a high inner gas C/O ratio exhibit deep/wide gaps that inhibit pebble drift, while sources with prominent water emission display only shallow features that allow icy pebbles to continue flowing inward.

Proposal Category: AR
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7292
Program Title: SuperDisks: A high-fidelity public database of protoplanetary and debris disk MIRI-MRS spectra

Principal Investigator: Pontoppidan, Klaus

PI Institution: Jet Propulsion Laboratory

Our understanding of the physics and chemistry of planet-forming regions in the inner parts of protoplanetary disks (~<a few au) is currently undergoing a revolution due to the incredible spectroscopic data returned from JWST-MIRI and NIRSpec. We propose SuperDisks, a legacy archival program to uniformly process every public MIRI-MRS observation of protoplanetary disks observed during JWST Cycles 1-3, and conduct the first complete demographic analysis of planet-forming disks across the stellar mass and age range, from 1 Myr to the debris disk stage at 100 Myr. Using the proven reduction process from the JDISCS collaboration and their dedicated asteroid calibrators, SuperDisks will yield ~240 high-quality, homogeneously reduced spectra from Cycles 1-3 of molecular and atomic emission lines, solid-state features, and spatially extended H2 emission maps from disks. The data products will have significantly improved spectral fidelity of 0.3% (1sigma), spectro-photometric precision to 1%, and wavelength calibration better than 5 km/s across the MIRI-MRS range. We will further decompose components in multiple systems, where present, and recover observations that were mispointed or incomplete. We will use the database to search for global relations between molecular emission luminosities and stellar and system parameters. All data will be delivered to MAST as highl-level science products (HLSPs), as well as to the SpExoDisks database to enable the community to fully leverage MIRI spectroscopy of planet-forming disks.

Proposal Category: AR (GO-Archival)
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 7301
Program Title: A New Modeling Toolkit for JWST Ice Observations

Principal Investigator: Shingledecker, Christopher

PI Institution: VMI Research Laboratories

JWST is unique in its ability to probe the composition and structure of cosmic ice, particularly the dust grain ice mantles found in star-forming regions. Nevertheless, the fraction of JWST programs making use of this critical capability is still small. One reason for the "glacial" pace of JWST-enabled ice science is perhaps the current difficulty of accurately predicting the molecular composition of ice in the interstellar medium: a critical component of planning new observations or analyzing data from existing studies. We propose to address this troubling barrier to progress through the development of new open source theoretical/computational tools which incorporate recent advances in modeling the chemical evolution of ice under astrophysical conditions. Specifically, we will take a tripartite approach to this problem, focusing on: how reactions occur within solids at low temperatures, the physics of UV photon and cosmic ray ice bombardment and, the underlying chemical reactions driven by energetic ice processing. These three objectives are closely interrelated and essential to consider together, since Objective 2 describes how reactive species are made in ice, Objective 1 describes how those species react, and Objective 3 describes which reactions occur. As a theory project, our work will yield well-documented, publicly available tools that unleash the power of JWST as an ice observatory, all without taking up any valuable observing time. The proposed modeling toolkit will not only represent the state of the art in the astrochemical modeling of ice in the ISM, but will also be of great interest to the study of icy bodies in our Solar System and exoplanetary systems.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7306
Program Title: The Formation of Crystalline Silicate Dust -- Testbed Observations of post-AGB Stars with JWST

Principal Investigator: Sahai, Raghvendra

PI Institution: Jet Propulsion Laboratory

Silicate dust is a very important ingredient of the cosmic life cycle of matter. It has been identified in very diverse environments, ranging from objects in the Solar System to luminous quasars. It is a key constituent of the dust in the interstellar medium of most galaxies, and generally dominates their spectral energy distributions (SEDs). Cosmic silicates have generally been found in an amorphous state through broad and structureless bands at 10 and 18 micron, and their origin is well understood. They are believed to be generated in the winds of ~1-8 Msun (and more masive) stars and then ejected into the ambient interstellar medium. In addition, a small but significant fraction (~10% by mass) of cosmic silicates are found to be crystalline, detected through a forest of distinct solid-state features. However, despite their ubiquitous presence in and profound influence on the spectra of an extensive and diverse astrophysical population, how crystalline silicate grains form remains one of the most elusive puzzles in our understanding of dust in the Universe. We therefore propose JWST/MRS observations of a sample of pre-planetary nebulae and young planetary nebulae to resolve this puzzle, as these represent the best laboratories for studying the genesis of crystalline silicate because of their (a) well-defined spatially-resolved density structures and (b) their well-defined radiation environments. Both of these factors are believed to play important roles in the the formation and evolution of crystalline silicates, and our proposed survey will allow us to assess the role of each independently.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7313
Program Title: Determining the Origin of the Gas in the 49 Ceti Debris Disk

Principal Investigator: Worthen, Kadin

PI Institution: Space Telescope Science Institute

Millimeter observations of debris disks have revealed that many are surprisingly gas rich in molecular CO. The origin of this gas is debated, as it could be leftover primordial gas from the parent protoplanetary disk, or it could be of a secondary origin where the destruction and outgassing of volatile rich minor bodies releases CO into the circumstellar environment. Answering this question on the gas origin is key to understanding this late stage of planet formation. The key prediction that distinguishes primordial versus secondary gas is that primordial gas is dominated compositionally by H2, which can shield the CO to the age of the system if it is dense enough in the disk surface. 49 Ceti is a 40 Myr old star that is host to a large reservoir of CO detected with ALMA; however, the ALMA observations have not determined the origin of the gas in this system. In Cycle 1, astronomers used the NIRSpec IFU PRISM mode to search for water ice in this system, but surprisingly discovered fluorescent CO emission that traces the upper most surface level of this gas disk. Here we propose to follow up this discovery but at the highest NIRSpec IFU spectral resolution. This will enable the measurement of each individual ro-vibrational line to determine the level populations of each rotational level of CO in the disk surface layer. We will use the rotational level populations to determine the H2 density in the disk surface with a non-LTE model, thus determining the origin of the gas. This proposal will serve as a pathfinder that demonstrates that the NIRSpec IFU can determine the H2 content in these disks surfaces and ultimately unveil the origin of the gas in debris disks.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 7321
Program Title: SN 2008S and NGC 300 2008-OT: Are They Terminal Electron Capture Supernovae?

Principal Investigator: Rose, Sam

PI Institution: California Institute of Technology

SN 2008S and NGC 300 2008-OT are the archetypical members of a class of highly reddened transients called intermediate luminosity red transients (ILRTs). All observed ILRT progenitors, including the progenitors of SN 2008S and NGC 300 2008-OT, are heavily obscured by circumstellar dust and the transients themselves are also very dusty. It is unknown what physical mechanisms produce ILRTs. One proposed explanation for ILRTs is that they are electron capture supernovae (ECSNe) resulting from the core-collapse of eight to ten solar mass super asymptotic branch stars (SAGB). We propose to obtain very late time infrared photometry of SN 2008S and NGC 300 2008-OT to investigate whether or not ILRTs have a luminous remnant. With the sensitivity of JWST in the infrared we are able to detect dust-obscured luminous remnants down to 10% the luminosity of their progenitors. No detection would confirm that ILRTs are terminal ECSNe.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 7335
Program Title: Forever Blowing Bubbles: What Powers a 24-kpc Ionized Gas Nebula Around a Normal Galaxy at z=6?

Principal Investigator: D'Eugenio, Francesco

PI Institution: University of Cambridge, Kavli Institute for Cosmology

It is thought that powerful galactic outflows may be responsible for disrupting and quenching star formation in massive galaxies at high redshift. This proposal will explore outflows in ID518794, a quenching galaxy hosting a 24 kpc extended [OIII] emission nebula at z = 6. This shell-like nebula, the most extended observed across the GOODS extragalactic fields, is extraordinary in size and luminosity (2 10^10 LSun), but is even more notable since it is centered not around a massive quasar, but rather a more typical (10^10 Msun) galaxy with evidence of a recent drop in star-formation rate. This unique system is at least 5-10 times more rare than quiescent galaxies at z = 4-5, and we may be observing a short-lived phase of a powerful gas outflow just before the onset of long-term quenching. To test this hypothesis, we seek to understand whether the giant nebula is an outflow, an AGN ionization echo (a "voorwerp""), or tidally stripped material, and then to confirm the quenching nature of the central galaxy. To achieve these goals, we propose NIRSpec/IFS observations with the prism and g395h dispersers to 1) investigate the star-formation history and stellar-population properties of the central galaxy 2) search for evidence of an active galactic nucleus in ID518794 and 3) measure the kinematics, chemistry and physical conditions of the gas, in both the host galaxy and the giant nebula. If confirmed to host a massive, 24-kpc outflow, this system may help to explain how AGNs are able to quench massive galaxies in the first 1-2 billion years after the Big Bang.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7336
Program Title: Commission a new R~2500 `IFU` on JWST: Calibrating second-order spectra of NIRCam/WFSS through Hubble Ultra Deep Field

Principal Investigator: Sun, Fengwu

PI Institution: Harvard University

All NIRCam WFSS scientific results so far are based on first-order spectra, mostly obtained at 3-5 micron. However, NIRCam can also obtain second-order spectroscopy at 2.4-3.0 micron, reaching a medium-high spectral resolution of R~2500. Compared with first-order, second-order spectroscopy takes advantage of lower sky background (because of twice higher R) and comparable throughput (~30%). This could offer highly efficient emission-line spectroscopy over ~3-arcmin^2 field of FoV, extremely powerful for spatially resolving galaxy kinematics out to z~5 as a "poor-man's IFU". Archival data are insufficient for the calibration of NIRCam WFSS second-order spectroscopy. Only one wavelength calibrator has been observed with very limited dither positions, leaving enormous extrapolation error across the whole FoV. We propose to fully calibrate the second-order slitless spectroscopy function of NIRCam WFSS. This will be achieved by observing the Hubble Ultra Deep Field (HUDF) through the F277W filter and all four module x grism combinations. HUDF has the highest surface density of accurate spectroscopic redshifts thanks to decades of multi-wavelength observations. We will detect second-order emission lines from galaxies at z~0-5 with known redshifts and wavelengths, providing accurate wavelength calibration and sensitivity characterization of second-order spectroscopy to the broader JWST user community. Scientifically, F277W grism is only missing piece for JWST near-IR spectroscopic campaigns in HUDF over Cycle 1-3. The request observation will enhance the JWST legacy in HUDF, opening a new window for wide-field galaxy kinematics survey around and beyond cosmic noon.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7340
Program Title: A NIRCam - MIRI - ALMA synergy to constrain planet formation at large orbital separations

Principal Investigator: Facchini, Stefano

PI Institution: Universita di Milano

Observations of different tracers by ALMA reveal striking evidence for the presence of one protoplanet candidate in the outer disk of AS 209, with both kinematic and chemical localised signatures of a massive accreting body. Available Cycle 1 JWST/NIRCam data do not detect thermal emission from the putative protoplanet, suggesting that the planet is either cold, or that radiative reprocessing by circumstellar and circumplanetary dust is still significant at 4.1 um. We propose to observe the AS 209 system with the MIRI coronagraphic instrument at 10.6 um to reach the following goals: a) confirm or discard the protoplanet nature of the candidate; b) mark the initial steps in discerning different planet formation models; c) empirically determine a correlation between the luminosity of growing protoplanets and chemical hotspots in a disk; d) benchmark kinematic searches of protoplanets. In synergy with the ALMA data, the proposed JWST/MIRI observations will provide the sorely needed proof of the strong connection between small anomalies in the gas kinematics and chemical properties in a protoplanetary disk and an embedded forming planet. Additionally, comparative observations in both the NIR and the MIR regimes will clarify the wavelength range where the SED of embedded protoplanets affected by circumplanetary dust peaks. The comparison of the NIRCam and MIRI observations will also be crucial in informing on the best strategy to observe protoplanets in disks in the next JWST cycles.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 7345
Program Title: The Dragon survey: A Direct Probe of the Early Stellar Luminosity Function and Dark Matter through Multi-cycle Multi-cadence Microlensing at z=0.73

Principal Investigator: Fudamoto, Yoshinobu

PI Institution: Chiba University

The discovery of microlensed, individual stars at cosmological distance represents one of the major advances in extragalactic astronomy over the past decade. Recently, JWST has serendipitously discovered 44 strongly lensed stars from a single galaxy, the “Dragon arc” at z=0.73 behind the galaxy cluster Abell 370 (z=0.375) in just two epochs. This observation proves that JWST has opened a new window for statistical studies of individual stars in the distant Universe, which will deliver new insights on the physics of star formation and dark matter. We propose a multi-cycle, multi-epoch, and multi-filter imaging survey to systematically capture microlensed, transient individual stars in the Dragon arc. Built upon existing serendipitous observations, our optimized survey will detect >200 individual stars over a wide range of stellar types / temperatures with well-sampled light curves through multiplex cadence, paving a new parameter space for ground-breaking discoveries. We will (1) directly model the bright-end stellar luminosity function and thus the initial mass function in a z=0.73 star-forming galaxy. We will also measure the spatial distributions and timescales of microlensed stars, to (2) unveil the existence of dark matter subhalos and test for primordial black holes and wave dark matter. The proposed observations in Cycle-4 (35 hours), Cycle-5 and Cycle-6 (9.5 hours each) will efficiently survey the multiplex cadences corresponding to several transient timescales. Finally, this survey will build an extragalactic ultra-deep field on Abell 370, revealing high-redshift dwarf galaxies at z>9 and even z>16 by taking the advantages of cluster lensing magnification.

Proposal Category: AR
Scientific Category: Stars and Stellar Populations
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 7358
Program Title: The Other Extreme: Enabling Characterization of Metal-poor Brown Dwarfs and testing our Understanding of Jupiter and Saturn

Principal Investigator: Mukherjee, Sagnick

PI Institution: University of California - Santa Cruz

A population of metal-poor brown dwarfs, subdwarfs, has been identified over the last decade. Most of them are from our galaxy's thick disk and halo. Several JWST observations aim to constrain the composition of subdwarfs as they are essential for understanding low-mass star formation in the farthest reaches of our galaxy. However, we rely on theoretical models of subdwarf atmospheres to constrain their composition from spectra. While significant progress has been made in developing models for solar composition and metal-rich objects, driven by exoplanet science, very few models exist for metal-poor objects. The limited number of available models have ignored critical processes, like impact of atmospheric dynamics on non-C/N/O bearing gasses. Gasses like SiH4 and GeH4, long predicted in Jupiter, may play an outsized role in metal-poor objects, along with other H-dominated gasses. In Jupiter these molecules are all far from chemical equilibrium, suggesting that treating the impact of dynamics on these gasses will be crucial for subdwarfs. Therefore, we must develop models that include these processes and apply them to subdwarf atmospheres. Without such models, it will be very difficult to interpret the composition of subdwarfs from JWST observations. We will fill this major gap by developing a modeling framework for subdwarfs that will include these critical processes. We will use this framework to create atmospheric model grids, which can be used to decipher their composition and constrain several uncertain atmospheric processes from JWST observations. Our results will allow stress-tests of our understanding of Jupiter with JWST by leveraging subdwarfs as laboratories.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Gas, Dust and the ISM
ID: 7390
Program Title: Probing Pair-Instability Supernovae through the Triply-lensed MACS0647-JD at z=10.17

Principal Investigator: Wu, Yunjing

PI Institution: Tsinghua University

Stars with initial masses of 140-300 Msun are predicted to undergo the pair instability stage and explode as supernove (PISNe). PISNe will signifcantly enrich the interstellar medium (ISM) with iron and prevent the formation of black hole seeds. As a cornerstone of stellar evolution theory, PISNe have been the focus for decades of searches in local Universe. Yet, no PISN has been conclusively identified at high redshift. JWST is creating unprecedented opportunities by pushing the redshift frontier to z>10. Only ~400 Myr after the Big Bang, these infant galaxies, with star formation <40 Myr, provide the best laboratories for hunting PISNe. The first hints of PISNe have been tested in GNz11; however, the AGN nature of GNz11 makes it hard to draw any definitive conclusions. Among spectroscopically confirmed galaxies at z > 10, MACS0647-JD at z = 10.2, the brightest one without any AGN signature, is the ideal target for a pilot search. In this proposal, we aim to directly detect iron from PISNe through the FeII absorption (the 1978-index) in the triply-lensed galaxy MACS0647-JD. Using NIRSpec/MOS mode, we can observe all three images of this galaxy simultaneously to reach the continuum signal-to-noise ratio of ~8. With the archival MIRI data, MACS0647-JD has the first direct-measured Oxygen abundance at z>10. The derived [O/Fe] can examine the existence of PISNe after comparing it with that from theoretical models. Additionally, the lensing effect enables us to probe intervening cold gas at z > 8 for the first time along the sightline. Further, thanks to the multiplexing capabilities of MSA, we will have sufficient fillers for investing in their stellar and ISM properties.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7396
Program Title: Exploring the Last Watering Hole of Low Metallicity PAH Emission: Deep Spectroscopic Observations of Sextans A

Principal Investigator: Tarantino, Elizabeth

PI Institution: Space Telescope Science Institute

In typical star-forming galaxies, the mid-infrared (MIR) spectrum is dominated by emission from Polycyclic Aromatic Hydrocarbons (PAHs), the smallest dust grains found in the interstellar medium (ISM). In regions with low metallicities, the fraction of PAHs in the ISM undergoes a significant decline. Recent JWST photometric observations of the dwarf galaxy Sextans A, however, reveal a remarkable detection of PAHs in a 7% solar metallicity environment, making it the lowest metallicty detection of PAHs to date. We propose deep MIRI MRS and NIRSpec IFU observations on the brightest PAH emitting clump found through imaging. With full spectral coverage across the 3-18 micron range, we will identify PAH features that were impossible to see through photometry alone, determine the low metallicity PAH properties through band ratios, constrain the molecular gas environment near the PAHs with the H2 rotational transitions accessible only through spectroscopy, and create the low metallicity MIR spectroscopic template for future JWST observations and models. The low metallicity MIR spectrum combined with ancillary data (HST, MUSE, ALMA, and VLA) will uniquely constrain the lifecycle of the PAHs, which is vital for understanding their importance at high redshift where metallicities are much lower than solar. Sextans A is the ideal galaxy to provide these constraints, as it is the only galaxy with metallicity less than 10% solar that has a robust detection of PAHs and its proximity allows for a detailed, resolved study of PAHs. JWST is the only telescope suitable for these observations due to its superior sensitivity, high spatial resolution, and coverage of the MIR wavelengths.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7404
Program Title: How I wonder what you are -- do JWST's Little Red Dots twinkle? Testing broad-line and continuum variability on week, month, and six-month timescales

Principal Investigator: Naidu, Rohan

PI Institution: Massachusetts Institute of Technology

JWST's ubiquitous Little Red Dots (LRDs) have been called the "biggest discovery in physics in 2023", and yet there is little consensus about what these compact, reddened objects with broad Balmer lines at z>5 actually are. If they are a new class of obscured AGN, what explains their peculiar SEDs, weak x-rays, and self- absorption in Balmer(!) lines? Do their apparent Balmer breaks mean they are massive galaxies that may one day end up as dense cores of ellipticals? Even with large samples and spectra in hand, no unified model is in sight -- we desperately need independent constraints. Here we propose TWINKLE, JWST's first systematic LRD monitoring campaign. AGN are variable on all observed timescales, whereas star-forming galaxies are steady, thereby allowing us to disentangle the LRD SED. We will revisit, thrice, the very first spectroscopic sample reported in Cycle 1 and exploit this long baseline to probe sustained changes as well as short-term stochasticity. With simultaneous NIRCam grism+imaging (the same setup as Cycle 1) we will directly probe the mysterious Balmer lines, as well as the perplexing rest-UV to optical continuum. Our efficient visits capturing 9 LRDs clustered on-sky in the GOODS-North legacy field are expected to guarantee at least 1 source with a >15% flux change in the AGN scenario, delivering a much needed breakthrough in the LRD puzzle. TWINKLE will collect grism spectra for every single source in its field of view from z~0-8, doubling the depth of the Cycle 1 data in a critical JWST legacy field, while piloting a unique spectroscopic time-domain survey that may reveal phenomena such as peculiar high-z supernovae and LRDs coming to life.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7407
Program Title: Completing the sub-Neptune Spectral Sequence with HD 86226 c

Principal Investigator: Nixon, Matthew

PI Institution: University of Maryland

We propose to acquire a panchromatic transmission (1-10 micron) spectrum of the hot (1300 K) sub-Neptune HD 86226 c by observing three transits: two with NIRCam using the DHS mode (one transit with F150W2 + F322W2, the second with F150W2 + F444W), and one with MIRI LRS. This is the best-suited sub-Neptune for atmospheric characterization that has an equilibrium temperature higher than 1000 K, filling an enormous gap in the parameter space of exisiting JWST programs, and presenting a unique opportunity to learn about a host of atmospheric and surface processes. Theoretical studies of HD 86226 c show that it could either host a primary atmosphere, strongly shaped by atmospheric escape and magma-atmosphere interactions, or a secondary atmosphere consisting of evaporated volatile and rocky material. If the planet has a primary atmosphere, we will measure observable signatures of atmospheric escape and magma-atmosphere interactions by constraining the atmospheric metallicity and C/O ratio. If it has a secondary atmosphere, our observations will enable us to probe the surface composition of the planet. We will also be able to identify silicate cloud features if present. This will allow us to determine whether the hottest sub-Neptunes retain cloud-free atmospheres, similarly to the proposed cloud-free nature of sub-Neptunes with equilibrium temperatures close to 1000 K, a theory that is consistent with early JWST observations. Alternatively, if a cloud feature is detected, this would demonstrate that silicate clouds which form in hot Jupiter atmospheres can also exist in hot sub-Neptune atmospheres.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7417
Program Title: Brightest & Farthest: Confirming intrinsically luminous z~10-12 Galaxies in COSMOS

Principal Investigator: Casey, Caitlin

PI Institution: University of Texas at Austin

Spectroscopic confirmation of the brightest, highest-redshift galaxies is needed to constrain galaxy formation models and the assembly of the first massive halos formed after the Big Bang. Here we propose to confirm 30 luminous (MUV < -21), robust candidate z~10-12 galaxies from wide-field JWST imaging. They are as bright or brighter than current record-holders like GN-z11, GL-z12 and GS-z14-0 (the only comparably bright, z>10 confirmed galaxies known) and are likely the most luminous JWST will ever find. Only NIRSpec can deliver spectroscopic confirmations at these redshifts, and only wide-area surveys like COSMOS-Web can select such luminous, rare targets. We design 16 efficient NIRSpec/PRISM MSA pointings across the field where we will observe 30 (of 50) extremely luminous candidates plus ~2700 fillers. Our goals are to precisely constrain the bright end of the UVLF at z~11; with precision volume densities boot-strapped to clustering measures that also use photometric redshifts, we can infer the halo masses of our primary targets and set limits on their stellar masses and efficiencies. Our PRISM spectra will also be sensitive to several rest-frame UV high-ionization lines (NIV, CIV, CIII], Ne IV) at equivalent widths sufficient to distinguish between AGN and star-forming drivers and detect continuum at high signal-to-noise. With a population of spectroscopically confirmed sources >10x larger than existing samples at these redshifts and luminosities, these observations will be transformative to our understanding of the brightest galaxies at cosmic dawn.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Gas, Dust and the ISM
ID: 7429
Program Title: Unraveling Effects of Different Modes of AGN Feedback via PAH Features

Principal Investigator: Zhang, Lulu

PI Institution: University of Texas at San Antonio

Widely regarded to coevolve with their galaxies, supermassive black holes can influence their hosts and large-scale surroundings via different feedback effects. Inspired by some recent studies of Polycyclic Aromatic Hydrocarbons (PAHs), we propose to observe a sample of nearby Seyferts sharing the similar PAH properties to those of quasars to explore the capability of PAH features in diagnosing the radiative effects of the quasar mode AGN feedback. With the spatially resolved NIRSpec/IFU and MIRI/MRS spectroscopy, we will combine the observed PAH characteristics and modeled PAH grids, to ascertain the changing trend of PAH sizes and ionization fractions in the central regions of our target Seyferts. Meanwhile, the emission line measurements will be fitted to corresponding excitation models to constrain the fundamental physical parameters and input energetics, essentially explaining the changing trend of PAH sizes and ionization fractions. We can then use PAH characteristics to quantify the impact of AGN feedback, via the calibration between derived fundamental physical parameters and input energetics with derived PAH properties, i.e., PAH sizes and ionization fractions. Additionally, archived JWST observations specifically for very low luminosity AGN, especially the low-ionization nuclear emission-line regions (LINERs), will be combined as the supplementary sample, to explore the capability of PAH features in diagnosing the mechanical effects of the radio mode feedback. The significance of this proposal lies in that it will provide an easily observable and practical method in the infrared band to quantify the impact of AGN feedback effects.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 7433
Program Title: Mass inflow structures in star formation from filaments to streamers: the unique field of Orion Molecular Cloud 3

Principal Investigator: Juvela, Mika

PI Institution: University of Helsinki

We propose to image the Orion Molecular Cloud 3 (OMC-3), to trace mass transfer along the star-formation (SF) process. Mid-infrared (MIR) extinction will be used to measure column density N(H) at an unprecedented resolution, independent of the large temperature and gas-phase abundance uncertainties that affect ALMA studies. Further aided by NIR-MIR scattering, we can measure in exquisite detail structures from large-scale massive filaments (~0.5 pc field) down to the smallest scales (0.3", ~120 au), over a wide range of column densities, N(H) ~ 1e21 - 1e23 cm-2. Together with the existing line and dust polarization data, this will help to unravel the formation mechanisms of filaments and confirm the the role of fibers in the growth of protostellar cores. Most importantly, JWST data will give an unprecedented view into the mass inflow at the smallest scales, such as the streamers that feed prestellar cores and potentially even young stellar objects (YSOs). The results will have profound impact on our understanding of SF, the evolution of protostellar disks, and the planet formation. Thanks to the wavelength coverage, it is also possible to separate the contributions of light scattering (<5 μm; very sensitivity to grain growth) and thermal dust emission (>10μm; measure of small-grain populations). Together with spatially resolved extinction curves, the data will also lead to full characterization of dust evolution in the field. OMC-3 is a unique target, being located in the closest high-mass SF cloud (d~390 pc), with known strong MIR extinction. The science case is similarly unique to JWST, unable to be addressed with any other past or present instrument.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7436
Program Title: The Last Neutral Islands at the End of Reionization? Characterizing the Nature of the Longest Dark Gaps in IGM Transmission at z~5.3

Principal Investigator: Jin, Xiangyu

PI Institution: University of Arizona

Understanding when and how reionization happened is crucial for studying early structure formation and the properties of first galaxies in the Universe. During cosmic reionization, ionized regions gradually grew and overlapped in the IGM. At z>6, complete Gunn-Peterson troughs observed in the Ly-a forest of quasar spectra indicate ongoing reionization. At z~5.5, the average Ly-a effective optical depth suggests that most of the IGM is already highly ionized. However, some quasar sightlines still exhibit long troughs with no detectable flux (so-called “dark gaps") in Ly-a forests even at z<5.5. These long dark gaps could be the last remaining neutral islands in the IGM at the end of a highly inhomogeneous reionization process.
If confirmed, it will have profound impact on the physics of reionization. We propose for joint JWST and Keck observations to study galaxy properties around two lowest-redshift long dark gaps known detected quasar absorption spectra at z=5.3. NIRCam/WFSS will measure the H-a redshift of ~230 galaxies (~75 in dark gap regions) and joint Keck observations will probe Ly-a emission from detected galaxies. If long dark gaps are indeed neutral islands, we expect a significant lower Ly-a visibility, and a large Ly-a/Ha velocity offset, among JWST-detected H-a emitters in the dark gap regions due to saturated IGM absorption. We will also characterize the galaxy density field around long dark gaps. This joint program will allow us to directly test the ultra-late reionization model and to place robust constraints on the topology of reionization and the nature of inhomogeneous reionization.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 7457
Program Title: Quenching physics and age demographics of stellar populations in a massive radio-loud AGN host galaxy at z~3.5

Principal Investigator: Wang, Wuji

PI Institution: California Institute of Technology

Feedback from actively accreting supermassive black holes (AGN) impact their host galaxies in multiple ways which can be traced on pc to kpc scales. Quenching is frequently modeled as heating up the gas such that it can no longer form stars. We propose a pilot MIRI/MRS observation targeting the warm molecular gas (H2) in a high-redshift radio galaxy (J0121) at z=3.5. We also propose NIRCam imaging to cover the old stars in the host and scattered blue AGN light. J0121 already has robust evidence for quasar-mode and radio-mode feedback and merger process through the study of optical, UV and submm emission lines. JWST/MIRI will open the study of a crucial gas phase of active galaxies at the onset of Cosmic Noon to address the long-standing question on how and when AGN quench massive galaxies. The 3D coverage with MIRI MRS will provide a unique opportunity to map the warm H2, a previously inaccessible ISM tracer in HzRGs at z>3. The diffraction-limited resolution of MIRI and NIRCam photometry will cover the broad spectral energy distribution from restframe 0.1 to 6μm, determining the spatial distribution of old stellar population on sub-kpc scales, isolate the AGN-heated dust emission, and constrain the young stars beneath AGN. This proposal will tell us if the AGN can prevent warm H2 from cooling efficiently and determine the age (and spatial distribution) of all stars. J0121 has a plethora of multi-wavelength data (incl. JWST NIRSpec IFU for the warm ionized gas and ALMA for cold gas) and is ideal for linking the energy output of AGN through different phases and studying its impact on the ingredients of the host galaxies—the warm H2 and stars—of powerful AGN at z=3.5.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7488
Program Title: Echoes of Silence: Absorption Line Spectroscopy of a Massive Quiescent Galaxy at z=7.3

Principal Investigator: Weibel, Andrea

PI Institution: University of Geneva, Department of Astronomy

The recent discovery of a massive quiescent galaxy at z=7.3, RUBIES-UDS-QG-z7, has pushed the most distant known such galaxy ~500 Myr closer to the Big Bang. Its mere existence challenges models and simulations which predict number densities that are ~100 times lower than implied by RUBIES-UDS-QG-z7, and struggle to reproduce its formation pathway. While the available PRISM spectrum shows no emission lines and a strong Balmer Break, absorption features are only tentatively detected. Deeper, medium resolution spectroscopy is needed to confirm the quiescence of the source through direct detection of individual (Balmer) absorption lines. This will further enable the first ever measurement of a stellar velocity dispersion at z>7, providing an independent probe of the total mass of the system, and yield much tighter constraints on the star formation history. These information are pivotal to gain confidence in the nature of the source, to better understand how it formed and quenched so rapidly so early on in the Universe, and to provide valuable constraints for models and simulations of high redshift galaxies.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 7491
Program Title: Probing hidden active SMBHs in the epoch of reionization: the missing link between classical quasars and faint JWST AGNs

Principal Investigator: Matsuoka, Yoshiki

PI Institution: Ehime University

AGNs in the epoch of reionization (EoR) provide critical constraints on the formation and evolution of supermassive black holes (SMBHs). Recent JWST observations revealed the prevalence of low-luminosity AGNs in the EoR, signaled by broad H-alpha line in a surprisingly large number of galaxies. Such broad H-alpha galaxies (BHaGs) are 10 - 100 times more numerous than inferred from the extrapolation of the classical quasar luminosity function (QLF). This may imply the presence of numerous quasars missing in the existing surveys at their faint end ($-22 < M_{UV} < -24$). Alternatively, BHaGs may represent a new AGN population, forming an additional hump on the QLF. Discriminating between these scenarios has a huge impact on our understanding of SMBHs growing in the EoR, as well as the evoltion of their host galaxies and sources of reionization. Here we propose an ambitious NIRSpec program to search for broad H-alpha in UV-luminous galaxies, in the gap between the classical quasars and BHaGs. Such galaxies are too sparse on the sky to fall in randomly chosen JWST fields, but hold the key to finding the missing link between the two AGN populations. Our targets, 30 galaxies at $5.7 < z < 6.7$, are drawn from the largest sample of spectroscopically-confirmed luminous galaxies in the EoR, established by the Subaru HSC survey. We will test the above scenarios with the number of detected AGNs, and will answer the following pressing questions on the SMBH populations in the EoR: (i) Do luminous galaxies host missing AGNs?; (ii) What is the true shape of the QLF?; (iii) Do broad H-alpha really signal the presence of AGN?; (iv) Will we find the first cases of "undermassive" SMBHs?

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7492
Program Title: MILAN - MIRI LRS Program of AGN at Cosmic Noon

Principal Investigator: Wylezalek, Dominika

PI Institution: Universitat Heidelberg

The energy output from rapidly growing supermassive black holes at the centers of galaxies (Active Galactic Nuclei, or AGN) is widely considered to be the main driver in regulating the evolution of massive galaxies in the Universe. The impact of luminous AGN was probably strongest around Cosmic Noon, the peak of both star formation and quasar activity at $1.5 < z < 3$. To explore the feedback of AGN on the ISM, we are now able to access the all-important dust phase with the JWST. Mid-IR dust features in AGN indirectly probe feedback by tracing star formation, obscuration and the destruction of small dust grains. Taking advantage of the high sensitivity of the MIRI / LRS, we propose a JWST program to efficiently construct a library of 20 mid-IR spectra of luminous AGN at Cosmic Noon. Our targets are drawn from five different luminous quasar samples at $z \sim 2$ that span a range in AGN properties (red vs. blue, jetted vs. non-jetted, low-L vs. high-L). Our program adds to the legacy of ongoing LRS surveys of star-forming galaxies at the same cosmic epoch. We will disentangle the effects of different AGN types on dust, assess AGN feedback at Cosmic Noon using PAH, Ice and HAC absorption features and provide a legacy library of 1.5 - 4.5 um spectra of powerful AGN at $z \sim 2$.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 7503
Program Title: CACTUS: Comprehensive Analysis of Compton-Thick AGN in the early UniverSe

Principal Investigator: Parlanti, Eleonora

PI Institution: Scuola Normale Superiore, Pisa

JWST observations have revealed the presence of a new population of high-redshift AGN identified through the detection of broad permitted emission lines, or thanks to narrow line ratio diagnostics, but undetected or very weak in the X-ray band, challenging traditional AGN classification paradigms. This raises the question of whether such AGN represent a more extreme version of the known Compton Thick (CT) AGN population or are fundamentally different AGN types to the ones detected in X-ray surveys. Several JWST programs have targeted this newly discovered AGN population, but they lack an adequate control sample of X-ray detected CT AGN. We aim to address this gap with a systematic study of 15 X-ray detected CT-AGN at z>2.5. In this proposal, we will assemble the first statistical sample of CT-AGN at cosmic noon observed with NIRSpec. This large sample will allow us not only to put into context the properties of the newly discovered AGN from public surveys, but also to characterize the evolution of CT AGN properties across cosmic time, assess the extent of misclassification between X-ray and optical classification, and analyze outflows and host galaxy properties. Our observations will exploit NIRSpec/IFU high-resolution gratings to explore the main optical emission lines, ultimately enhancing our understanding of obscured black hole accretion in the early Universe.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7511
Program Title: Sleeping Beauties: On the Search for Dormant Galaxies in the First Gyr

Principal Investigator: Covelo-Paz, Alba

PI Institution: University of Geneva, Department of Astronomy

The first year of JWST has revealed extremely strong rest-frame optical emission lines in the average z>4 galaxy together with very blue UV spectra. The first generations of galaxies thus grow extremely rapidly through multiple generations of stochastic bursts of star formation. This explains the extremely high average Halpha fluxes and specific star formation rates. However, among this tumultuous frenzy of early star formation, one can also find a few sleeping beauties: galaxies whose star formation is off. One of these sources was hiding in plain sight, among all the other Lyman Break Galaxies (LBGs) in the Hubble Ultra Deep Field. A surprising JADES NIRSpec spectrum revealed it as a dormant galaxy at z=7.3 based on absent rest-optical emission lines, but still showing the blue UV colors typical for LBGs. Its star formation must have shut off just recently, ~10-20 Myr ago. How many more such galaxies exist is completely unclear, however, and to date only three of them have been confirmed at z>5. Here, we exploit the complete spectral coverage at 3-5 microns from the FRESCO and CONGRESS NIRCam/grism datasets for a first systematic search for candidate dormant galaxies at z~4-6 with absent or unusually low inferred Halpha flux. NIRSpec/prism spectroscopy is needed to confirm their redshifts and constrain the Halpha fluxes to 5x better sensitivity. The prism spectra will reveal their star formation histories through spectral fitting. By combining these sources with the "normal" z~4-6 galaxy population, this will lead to the first systematic constraint on the timescales between the ups and downs of early, bursty star formation.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 7519
Program Title: How do dark matter halos connect with supermassive black holes and their host galaxies?

Principal Investigator: Arita, Junya

PI Institution: University of Tokyo, Graduate School of Science

JWST NIRCam WFSS observations have played an important role in measuring the dark matter halo (DMH) mass of high-z quasars but these measurements are limited to bright quasars. We propose NIRCam WFSS observations to identify [O III] emitters around 12 faint quasars at z~6. Our targets have been well studied with JWST NIRCam and NIRSpec observations, and the stellar mass and black hole mass relation appears to be consistent with the local relation. In this new effort, we will measure the average DMH mass from the cross-correlation analysis of quasars and surrounding [O III] emitters, and evaluate the DMH mass probability density function for individual quasars based on cosmological simulations. This program will allow us, for the first time, to obtain a quasar sample in which the black hole mass, stellar mass, and halo mass are all measured simultaneously. This sample will reveal their lifetime and the scaling relations in the early universe, underling the SMBH growth of SMBHs over cosmic time.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 7532
Program Title: A Joint Mid-IR and X-ray Investigation of the Physics Driving Sgr A*'s Flares

Principal Investigator: Hora, Joseph

PI Institution: Smithsonian Institution Astrophysical Observatory

The Galactic Center offers the closest opportunity for studying accretion onto a supermassive black hole. Flares from Sgr A* are detected across the electromagnetic spectrum and may originate in the accretion flow or the jet. Recent models indicate that this variability can be produced by a tilted inner disk, gravitational lensing of bright spots in the disk by the black hole, or particle acceleration in reconnection events. These models produce different flare characteristics, and better characterization of flares' spectral energy distributions will enable us to distinguish between emission models. Meanwhile, the circumnuclear environment of Sgr A* contains dozens of IR sources and structures that are critical to understanding both the accretion-feeding processes and the nature of the nuclear star cluster and nearby dusty gas features. Only JWST's MIRI has the high angular resolution and mid-IR sensitivity to probe this complex and dynamic region. MIRI can detect changes in the mid-IR spectral index, which is an important diagnostic of physical conditions in the flare. The X-ray flux will constrain the energy distribution of non-thermal particles in the flare. Thus, we propose MIRI MRS IFU time-series together with Chandra X-ray monitoring of Sgr A* (and its surroundings) to determine the nature of its flare emission and to test models of the accretion and radiation processes near our closest supermassive black hole.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7534
Program Title: A MIRI spectroscopic atlas of irradiated disks in Orion

Principal Investigator: Schroetter, Ilane

PI Institution: Institut de Recherche en Astrophysique et Planetologie

Most low-mass stars, including the Sun, form in stellar clusters that host massive stars which emit strong ultraviolet (UV) radiation. This radiation is thought to have a significant impact on protoplanetary disks—the birthplaces of planets. Despite the prevalence of UV radiation in these environments, its role in shaping the chemical composition of those protoplanetary disks remains poorly understood. The first JWST observations of the d203-506 disk in the Orion Nebula Cluster (ONC) suggest that UV radiation can alter the chemical makeup of protoplanetary disks. These observations revealed the presence of radicals, ions, and organic molecules indicative of UV-driven chemistry, including polycyclic aromatic hydrocarbons (PAHs) and the methyl cation (CH3+), marking the first detection of this molecule in such an environment. Interestingly, the mid-infrared spectrum of d203-506 differs from that of isolated protoplanetary disks, where neutral species like H2O, HCN, CH4, C2H2 dominate. However, it is unclear how widespread the UV-driven chemical changes are across protoplanetary disks in star-forming regions. This proposal seeks to conduct a comprehensive mid-infrared spectroscopic survey of externally UV-irradiated protoplanetary disks in the ONC using the JWST's MIRI Medium Resolution Spectrograph. Observing a large, diverse sample of disks, we aim to assess the influence of UV radiation on their chemical composition. The results will provide critical insights on the chemistry of planet-forming disks, thereby enhancing our understanding of how planetary systems, including our own Solar System, might form and evolve under such conditions.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7538
Program Title: Giants in the making: the composition of circumplanetary disks with JWST MIRI-MRS

Principal Investigator: Cugno, Gabriele

PI Institution: Universitat Zurich

JWST's Medium Resolution Spectrometer (MRS) is redefining our understanding of protoplanetary disk chemistry and physics. By targeting a range of stellar and substellar hosts, programs in Cycles 1–3 are revealing the diversity in disk composition while also allowing us to make fundamental strides in our understanding of disk chemistry and its link to evolution. After demonstrating that JWST can capture the complex interplay of gas and dust in protoplanetary disks, we propose to expand these groundbreaking studies to a new class of targets: circumplanetary disks (CPDs) surrounding planetary-mass companions (Mp < 20 MJup). Our proposed observations will leverage MRS's spectral and spatial resolution to obtain high quality spectra of 5 CPDs to unravel their gas chemistry, dust properties, and disk structure. These targets will complete the known sample of CPDs that are characterizable with MRS, and all of our sources are vetted to have robust signatures of infrared excess and ongoing accretion and have complementary data to study the planetary atmospheres. This investigation will reveal whether the CPD chemistry is consistent with trends seen for isolated low-mass hosts. At the intersection between the fields of disk chemistry, direct imaging, planet atmospheres, and planetary formation and evolution, these data will serve as a benchmark for understanding the final assembly stages of gas giants, bridging the gap between young disks and mature planets, while also giving unique insight into the ingredients available for satellite formation.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7564
Program Title: A Search for Life Around Two Dead Stars

Principal Investigator: Limbach, Mary Anne

PI Institution: University of Michigan

Recent detections and theoretical modeling suggest that rocky planets may find their way into the habitable zone of white dwarf stars, and may even possess conditions necessary for the development of life. However, finding these planets has so far been very difficult. This program seeks to conduct the first search for terrestrial planets in the habitable zones of white dwarfs by targeting the two nearest (4-5 pc) solitary white dwarf systems, vMa 2 and GJ 440. Utilizing JWST's MIRI/MRS and imaging, the program will search for unresolved infrared excess from warm (T > 200 K) rocky planets and will also be capable of detecting cold gas giants (T > 95 K) at a wide range of separations (0-400 AU). Detecting the first HZ terrestrial exoplanet orbiting a white dwarf, or any exoplanet around one of these extremely nearby white dwarfs, would be a very useful outcome with broad implications. Furthermore, if the expected sensitivities are achieved, this program could pave the way for future, larger-scale efforts to constrain the occurrence rates of habitable zone planets around white dwarfs. These worlds could provide crucial insights into the survival and evolution of planetary systems after their stars leave the main sequence and could reveal key information about habitability in this unique environment. Any planets detected through this program would be prime candidates for detailed atmospheric characterization and possibly in-depth biosignature searches. Biosignatures on HZ planets orbiting either of these white dwarfs can be detected with a relatively modest follow-up effort, requiring between 12 and 50 hours of observation time, depending on the planet's size.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 7570
Program Title: Exploring the magnetic environments of Uranus and Neptune with JWST

Principal Investigator: Stallard, Tom

PI Institution: Northumbria University

The magnetic environments of the Ice Giant planets, Uranus and Neptune, are complex and poorly constrained. Aside from the brief insight provided by Voyager 2, the sparsity of either remote or in-situ measurement has meant that their characteristics have remained elusive. Recent JWST observations have finally lifted that veil, with H3+ emissions revealing these planets' aurorae clearly for the first time. We propose to map the H3+ from both Uranus and Neptune, observing each planet in three steps of longitude, each 120 degrees apart, every other Earth day, over 28 days (a full solar rotation), to capture the changing auroral and ionospheric conditions as the surrounding magnetospheres are battered by a varying solar wind. This will provide answers to many NASA planetary decadal survey questions, and specifically test four leading hypotheses: 1. Ice Giant aurorae are dominated by auroral spots localized in planetary location, suggesting a specific region of reconnection in the magnetopause. 2. Neptune's aurorae differ morphologically from those of Uranus only because we observed Neptune during a solar wind compression. 3. Solar wind pressure is the principal driver of upper atmospheric temperature. 4. The Ice Giants' complex magnetic fields have drifted since Voyager. JWST's capabilities provide us with the opportunity to defy the gloomy projections of NASA's planetary decadal survey that anticipated no progress until the late 2040s or even 2050s: in doing so, JWST will fast-forward our understanding of these worlds by thirty years, providing essential insights into the magnetic environment of Uranus.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 7573
Program Title: The first complete picture of the star-formation cycle at z=1 from molecular clouds to star cluster complexes

Principal Investigator: Dessauges-Zavadsky, Miroslava

PI Institution: University of Geneva, Department of Astronomy

Galaxies at z~1-3 host UV-bright clumps, recognised as star cluster complexes formed via disk fragmentation. A521-sys1, a strongly lensed galaxy at z=1, resolved down to 30 pc, sets a record in hosting both 13 stellar clumps detected in HST rest-UV images and 14 giant molecular clouds (GMCs) detected in ALMA CO data at matched ~0.1" resolution. The comparison of GMC and UV clump masses suggests so far a star formation efficiency of 30%, much higher than in local GMCs (<6%). This is a striking result that needs to be confirmed with the requested NIRSpec-IFU Ha mapping of A521-sys1 that will spatially (~0.1") cross-match GMCs with Ha clumps tracing star formation at much shorter timescales than UV emission. If confirmed, this would suggest an increase in the efficiency of forming stars in high-z galaxies, as advocated by several JWST discoveries. NIRSpec-IFU observations will further reveal: clump metallicities (from Ha+[NII]) to be compared to the underlying disk metallicity; clump outflow signatures and contribution to the stellar feedback at galactic scale; and spatial variations of the Toomre instability (when combined with ALMA CO) to be correlated with stellar clump and GMC locations. The requested NIRCam rest-optical images will determine clump ages and solve the long-standing debate on clump survival timescale as transient features or long-lived star-forming regions. NIRCam will also evidence old, dust extincted or embedded clumps (if any) missed by HST. Our JWST observations will provide the complete picture of the star-formation cycle in this z=1 galaxy from GMCs to star cluster complexes and nail how clumps contribute to the overall evolution of the host galaxy.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7575
Program Title: Shocks and destruction of dust in the ring of Supernova 1987A

Principal Investigator: Matsuura, Mikako

PI Institution: Cardiff University

Dust grains present in the circumstellar and interstellar medium are destroyed by shocks generated by their interaction with fast-expanding supernovae (SNe). The current theoretical estimates of SN dust destruction rates are uncertain, ranging from 1% to nearly 100%, requiring a better constraint. SN 1987A has ongoing shocks against the circumstellar ring, which was expelled by the red-supergiant progenitor about 20,000 years ago. Spitzer's spatially unresolved observations have shown that the total brightness of the ring declined on a yearly time scale, suggesting shock destruction of dust grains. Now, spatially resolved NIRCam and MIRI imaging can pinpoint the ongoing shocked regions and dust destruction sites. The physical properties of shocks can be measured in a spatially resolved manner for the first time. By comparing cycle 1 and the requested cycle 4 observations, the reduction of the dust mass and the cooling rate of the dust emission will be measured. This cooling rate will allow us to evaluate the dust grain size, as smaller dust grains cool more rapidly than larger grains due to their lower heat capacity. This experiment is possible in a unique target SN 1987A, which is only 50 kpc away so that the progress of shocks can be spatially resolved with JWST. Its shocks are about to exit from the circumstellar ring, and this will be one of the last chances to assess the dust destruction rate in SNe.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 7583
Program Title: Unique H-alpha imaging of a z=3.95 starbursting protocluster

Principal Investigator: Jin, Shuowen

PI Institution: Technical University of Denmark-DTU Space

We propose to obtain highly sensitive H-alpha imaging of the starbursting protocluster LH-SBC3 at z=3.95 with the NIRCam F323N filter. This protocluster hosts an integrated SFR of 4000 Msun/yr in its compact 100 kpc core, making it one of the most distant and intensely star-forming structures known to date. Fortunately, the H-alpha emission at z=3.95 falls perfectly within the narrowband (NB) filter F323N, making LH-SBC3 the only known protocluster where one can conduct NB H-alpha imaging at z~4. This is a unique opportunity to spectroscopically confirm a large number of protocluster galaxies and investigate the early phases of structure formation. Our primary goal is to robustly characterize star formation activity, stellar mass assembly, and quantify the environmental effects in a z~4 massive protocluster. Second, the supporting broadband imaging will pioneer the detection of intracluster light (ICL) at z~4 and place a stringent constraint on the ICL fraction, providing crucial insights into the origin of ICL.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7605
Program Title: Disclosing the nature of GN-z11 with MIRI rest-frame near-IR imaging

Principal Investigator: Colina Robledo, Luis

PI Institution: Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.

The galaxy GN-z11 at z=10.6 is the brightest known galaxy before the main Epoch of Reionization (EoR). GN-z11 belongs to the class of luminous galaxies in the early Universe detected by JWST in numberswell above predicted by the models. The nature of this galaxy as an extreme young and compact starburst or as a massive super-Eddington accreting black hole is under debate based on existing NIRCam and NIRSpec data covering a limited rest-frame spectral range (<0.4 microns). This program proposes MIRI F1000W and F1280W imaging of GN-z11, securing for the first time the detection of the rest-frame 0.86 and 1.1 micron continuum emission in a pre-EoR galaxy. These new data, together with archival MIRI F560W and F770W, will be able to distinguish between the near-IR emission of an accreting massive black hole (i.e. AGN) and that of different stellar populations. The proposed imaging will provide the key measurements to establish the star formation history and the nature of the dominant ionizing source, an extreme compact young starburst or an early AGN. This program, together with existing public JWST data, gives a unique opportunity to identify the nature of GN-z11, constraining the history of the early stellar mass buildup and the BH growth in a galaxy well before the main Epoch of Reionization, when the Universe was just 250-400 Myr old.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 7607
Program Title: Unveiling the Role of Stellar Density in the Formation of Free-Floating Planetary-Mass Objects in the Milky Way

Principal Investigator: Muzic, Koraljka

PI Institution: Universidade de Lisboa, Dept. of Fisica

Brown dwarfs (BDs) and free-floating planetary-mass objects (PMOs) represent a significant portion of the star-like population in the Galaxy. Yet their formation mechanism remains an open question. BDs are generally understood to form similarly to stars, exhibiting characteristics like disks and outflows. However, PMOs (masses < 12 MJup), may form either through cloud fragmentation (similar to stars) or through disk fragmentation followed by ejection (similar to planets). Microlensing surveys suggest an increase in PMO numbers below 20 MJup, conflicting with observations from nearby star-forming regions (SFRs), where a declining trend is noted. One possible reason is that PMOs are predominantly formed in massive, dense star forming regions, which are underrepresented in the solar neighbourhood. Here we propose to determine the number of PMOs in a massive dense cluster, where dynamical interactions might favor the ejections of free-floating planets. Our target for this proposal is RCW 38, the densest stellar cluster within 4 kpc around us, 10 times denser than the Orion Nebula Cluster. We have designed a survey that allows us to study its planetary-mass population and derive its Initial Mass Function down to 2-3 MJup using JWST's NIRCam. By comparing RCW 38 to other clusters, this study will shed light on the discrepancies between young and field planetary populations, offering critical insights into the processes that govern the formation of the lowest-mass objects in the Galaxy.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7612
Program Title: We can directly image super-Earth-sized planets near the habitable zone of Sirius B with JWST/MIRI

Principal Investigator: Pearce, Logan

PI Institution: University of Michigan Ann Arbor

We propose to use JWST/MIRI coronagraphy to conduct a direct imaging and infrared excess search for terrestrial and cold gas giant planets around Sirius B, the closest white dwarf to our solar system. Given Sirius B’s proximity (2.6 pc) and its high temperature (T = 26,000 K), JWST's unparalleled ability to achieve remarkable sensitivity enables the direct imaging of super-earth-sized planets near the outer edge of the habitable zone. This program will use the infrared excess and direct imaging detection techniques to enable detection of planets spanning from the Roche limit (0.004 au) to the Hill sphere (3.9 au). With just 16 hours of integration time, it will set the most stringent direct imaging limits on planets ever achieved by any observatory. Our program holds the potential to detect rocky planets and cold (>70K) gas giants—a feat unlikely to be possible until the next generation of observatories comes online decades from now. If a planet-like signal is detected, follow-up proper motion measurements or spectroscopy will confirm its planetary nature and provide a detailed characterization of its physical and atmospheric properties. This program could be JWST's singular chance to directly image rocky planets in a nearby system, offering profound insights into planetary evolution around post-main sequence stars and in binary systems.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 7648
Program Title: N6946-BH1: Fading following a failed supernova, or post-merger recovery?

Principal Investigator: Beasor, Emma

PI Institution: University of Arizona

Recent JWST imaging revealed a luminous infrared source at the location of failed supernova (SN) candidate N6946-BH1. While significantly fainter than the progenitor (13-25% of the bolometric luminosity), the spectral energy distribution (SED) is consistent with both a failed SN and a stellar merger or outburst event. Curiously, observations taken one month later in matching filters revealed a 50% flux reduction in the shortest MIRI filter (5.6μm). The mid-IR fluxes also appear to resemble Case C Polycyclic Aromatic Hydrocarbon (PAH) emission, typically produced when dust is irradiated by a UV field. We are requesting a total of 16 hours of JWST time in Cycle 4: 5 hours for continued monitoring of N6946-BH1 to assess variability across the near- and mid-IR, and 11 hours for medium-resolution MIRI spectroscopy to search for PAH features. In addition, we are requesting another 5 hours in Cycle 5 to repeat the photometry observations so that we can determine the rate of change in brightness of the source. If the near-IR flux continues to fade, it will strongly suggest the formation of a black hole. If the source remains constant or brightens in the near-IR while fading in the mid-IR, this will support a merger scenario, with the dust clearing to reveal the surviving star. These observations will not only constrain the timescales for such events but also help estimate the ejected dust mass from mid-IR emission, ultimately resolving a long-standing debate over the fate of N6946-BH1.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7651
Program Title: JWST-YSES: a Young Suns Exoplanet Survey to study the demographics of sub-Jovian planets around Sun-like stars and unveil the formation and evolution history of widely separated companions

Principal Investigator: Kammerer, Jens

PI Institution: European Southern Observatory - Germany

As of now, the vast majority of wide separation giant planets around FGK-type hosts have been imaged around stars in the ~10–15 Myr Sco-Cen association or younger. To this date, the origin of this population of widely-separeted massive (>5 MJup) giant planets remains elusive. However, today JWST presents a unique opportunity to resolve this mystery, by probing the giant planet frequency for less massive (0.1-5 MJup) companions which only JWST can detect. This proposal aims to (1) measure the frequency of young long-period sub-Jovian exoplanets which still lacks observational constraints and (2) distinguish between in-situ formation via gravitational instability vs. formation via core accretion closer to the star followed by outward migration/scattering as the origin of the existing massive (>5 MJup) Sco-Cen giant planets. These goals will be achieved by searching for new 0.1-5 MJup giant planets around 30 Sun-like stars in the Sco-Cen association using NIRCam coronagrapy and comparing observations to planet population synthesis simulations. Should the core-accretion+migration scenario prevail, this proposal will uncover a large reservoir of wide separation sub-Jovian planets. On the other hand, if the existing massive Sco-Cen planets formed via gravitaional instability, this proposal will detect no new sub-Jovian planets because in-situ formation is extremely inefficient for these low-mass planets at wide separations from the star. As such, this proposal will provide the first demographic evidence for giant planet migration/scattering - or lack thereof - of giant planets orbiting wider than 10 au, and further populate the age-luminosity diagram for sub-Jovian planets.

Proposal Category: GO (GO-Archival)
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7662
Program Title: Can accretion explain the carbon dichotomy in planet-forming disks?

Principal Investigator: Colmenares Diaz, Maria Jose

PI Institution: University of Michigan

Planet-forming disks show a striking dichotomy in their chemical makeup: disks around low-mass stars often exhibit a higher carbon-to-oxygen ratio, while those around solar-mass stars display more oxygen-rich chemistry. These differences are believed to result from the sublimation and freeze-out of volatile species like CO, CO2, and H2O, but the precise origin of this carbon dichotomy remains uncertain. We hypothesize that the composition dichotomy in disks arises from the irreversible sublimation of carbon-bearing grains, and that the accretion rate, rather than stellar mass, plays a key role in driving carbon enrichment. Initial analyses of MIRI data published in the literature show a clear trend of higher C2H2 (relative to H2O) columns with decreasing accretion rate, supporting our hypothesis, though much remains unexplored. To provide a stringent test, we propose to conduct a survey of 14 protoplanetary disks using MIRI-MRS, targeting systems across ranges of unexplored accretion rates and stellar masses, complemented by archival data from 8 low accretion sources. By measuring the relative amount of hydrocarbons like C2H2 and oxygen-rich species like H2O, we will determine whether low accretion rates indeed promote carbon-rich chemistries. To complement the observational analysis, we will perform a combination of thermochemical and dynamical modeling to investigate how accretion, pebble drift, and sublimation processes influence the molecular content of disks. This will offer new insights into how these factors shape disk chemistry, with direct implications for JWST observations of disks, and help us understand the composition of planets forming in these systems.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7675
Program Title: Confirming a Tentative Terrestrial Atmosphere Detection on LHS 1478 b with JWST/MIRI

Principal Investigator: August, Prune

PI Institution: DTU-Space

We have yet to definitively detect an atmosphere around a rocky exoplanet, and LHS 1478 b (R_p = 1.24 R_Earth, M_p = 2.33 M_Earth; Soto et al. 2021) is currently the most promising candidate. Initial observations from the Hot Rocks Survey (GO 3730) suggest tentative evidence of an atmosphere, with JWST/MIRI 15um photometric data revealing a shallow eclipse inconsistent with a bare-rock, A_B = 0.1 Bond albedo blackbody at 3.1 sigma significance. However, inconsistencies between the two eclipse observations necessitate follow-up to confirm this result. Our proposed program will provide follow-up observations with broader spectral coverage using MIRI LRS and additional observations at 15um to definitely confirm or reject the presence of an atmosphere. If confirmed, this program would enable the first detection of a rocky planet atmosphere and allow for subsequent characterization of its atmosphere, focusing on likely constituents such as CO2 and H2O. Conversely, in the event of no atmosphere, this program would challenge the current atmospheric diagnostic methods based on single-band photometry and offer a unique opportunity to study the composition and surface properties of rocky exoplanets. Either outcome will significantly advance our understanding of rocky planets orbiting M dwarfs and guide future atmospheric studies.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 7677
Program Title: Pushing the Faintest Limits: Extremely Low-Luminosity and and Pop III-like Star-Forming Complexes in the Early Universe

Principal Investigator: Vanzella, Eros

PI Institution: INAF - Osservatorio di Astrofisica e Scienza dello Spazio

We propose JWST NIRSpec/IFU spectroscopy of two extraordinarily faint and strongly lensed Ly-alpha emitters at z=5.663 and z=4.194, each straddling their respective critical lines. The primary target at z=5.663 (dubbed LAP2) is an exceptional ionizing source with a remarkably large Ly-alpha equivalent width (>320 A rest-frame) and an extremely faint ultraviolet magnitude (Muv > -11.6, delensed > 35). LAP2 remains undetected in all NIRCam bands, including stacked SW and LW images, suggesting an ultra-low stellar mass of < 10^4 Msun. Its identification as an isolated, low stellar mass star-forming complex within the first Gyr offers an unparalleled opportunity to investigate star formation in near-pristine conditions. The secondary target at z=4.194, also straddling its critical line, has Muv ~ -12.3 and is detected in NIRCam with a de-lensed size of <10 pc, potentially resembling a proto-globular cluster hosting massive O-type stars. This study will allow us to measure the metallicity of both sources and assess the presence of massive stars in such elusive systems by evaluating their ionizing photon production efficiency. These observations will expand (at least double) the sample of ultra-faint sources with these measurements which only JWST can perform, pushing the frontier of understanding toward Population III-like star formation conditions. The fortunate angular proximity of the two targets allows for simultaneous observation within the same IFU field of views.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7683
Program Title: A Parched Giant orbiting a Red Dwarf: Fact or Fiction?

Principal Investigator: Kanodia, Shubham

PI Institution: Carnegie Institution of Washington

JWST has revealed the lowest water abundances ever seen for an exoplanet, in the mid M-dwarf hosted gas giant --- TOI-5205b. Given the presence of obvious star spot crossings in three JWST transits of TOI-5205b and clear impacts of stellar contamination on the transmission spectra, we propose to observe two secondary eclipses of TOI-5205b with MIRI/LRS. Our observations will either (I) independently confirm this extraordinarily low water abundance \& validate existing transit light source (TLS) corrections, or (II) accurately estimate a higher water abundance, which will inform existing TLS models and benchmark new techniques for correcting against stellar contamination effects.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Stars and Stellar Populations
ID: 7686
Program Title: Brown Dwarf Broiler: Probing Chemical Quenching and Heat Redistribution in a Highly-Eccentric Brown Dwarf

Principal Investigator: Mullens, Elijah

PI Institution: Cornell University

JWST observations have begun to shed light on insufficiencies of the chemical networks and dynamical models we currently use to understand highly irradiated exoplanets and isolated brown dwarfs. Eccentric, high mass, transiting targets allow for a nature-given laboratory to study how interconversion timescales vary with changing levels of incident stellar flux, and therefore allow us to disentangle which processes dominate in high-mass substellar object atmospheres. TOI 2490 b is the most eccentric transiting brown dwarf in the brown dwarf desert and provides a high-mass comparison object to the highly eccentric hot Jupiter HD 89060 b, allowing us to bridge the exoplanet and brown dwarf population. Our program will observe a partial phase-curve (26.385 hours total) using the NIRSpec G395H grism to obtain spectra from 2.87-5.27 microns, including both periastron passage and secondary eclipse. This wavelength range encompasses strong spectral features of the key carbon-bearing species (CH4, CO2, and CO) that are tracers of the physical and chemical processes, such as chemical quenching, we aim to track. The precision of G395H allows us to track their abundances over our time-series observation and test the favored reaction pathways for CH4-CO interconversion, and how much chemical timescales lag behind heating timescales. By observing secondary-eclipse, we will probe dynamical mixing and heat redistribution through eclipse mapping.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 7700
Program Title: The supremely deep trans-Neptunian object survey: A critical test of planet formation models

Principal Investigator: Trilling, David

PI Institution: Northern Arizona University

We propose to execute a supremely deep imaging program of a single NIRCam field to measure the size distribution of extremely small cold classical trans-Neptunian objects — with sizes as small as 1 km — as a deep and detailed probe of the process of planetary system formation. This experiment connects evidence from New Horizons spacecraft data for Pluto, Charon, and Arrokoth with outstanding questions from theoretical models, and can only be carried out with the unmatched sensitivity of JWST. This information on planetesimal sizes will not be obtainable in any exoplanet system within our lifetimes. Our results can be used as input for planetary system formation models, and will provide significant "ground-truth" comparisons for observations of protoplanetary disks made by many observatories.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 7711
Program Title: Warm Dust in the Circumgalactic Medium in Formation around the Makani Galaxy

Principal Investigator: Veilleux, Sylvain

PI Institution: University of Maryland

Deep NIRCam and MIRI images of Makani, a massive compact galaxy with a record-breaking 100-kpc scale starburst-driven wind at z = 0.459, reveal warm dust (PAHs) out to ~ 30 kpc from the galaxy center. The warm dust emission, detected beyond the inner cool-gas wind associated with the more recent (7 Myr ago) starburst episode, is apparently taking part in the outer warm-ionized gas wind produced by the older (0.4 Gyr ago) episode. This discovery of PAHs in the outer wind indicates that the PAHs have survived the long (r/v > 10 million yrs) journey to the halo despite the harsh environment of the galactic wind. Here we propose deep NIRSpec and MIRI/MRS integral-field spectroscopy (IFS) of the circumgalactic dust to determine whether dust grains experience growth or erosion as they travel to large distances from the host galaxy. The PAH 7.7/3.3 and 11.3/3.3 ratios will provide constraints on the size distribution of the dust grains, while PAH 11.3/7.7 will trace the state of ionization of the PAHs, a marker of PAH destruction or growth. The radial PAH ratio gradients that are tentatively inferred from the images will be put on more quantitative footing with the analysis of the spectra. The new JWST IFS data will also be combined with the published flux and kinematic maps of the warm-ionized, cool-neutral, and cold-molecular gas phases to provide a holistic view of the dust-gas cycle in this galaxy-CGM ecosystem in formation. These data will inform next-generation simulations that incorporate dust physics in multi-phase outflows to explain galaxy formation and evolution and the large amount of dust inferred to exist outside of galaxies in the CGM and IGM.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 7715
Program Title: Unique insights into the chemical composition of interstellar silicate dust grains in the Milky Way

Principal Investigator: Decleir, Marjorie

PI Institution: Space Telescope Science Institute - ESA

We propose to observe a carefully selected sample of 26 Milky Way stars with the MIRI Medium-Resolution Spectrometer to measure the detailed characteristics of the 10 micron silicate extinction feature. Variations in the feature properties (such as its strength, width and peak wavelength) will reveal variations in the properties of interstellar silicate grains between different sightlines. Combining these measurements with existing elemental abundance measurements of Mg, Fe, Si and O for the same sample of sightlines, will provide unprecedented insights into the detailed chemical composition of silicate dust grains in the interstellar medium.

Proposal Category: AR (GO-Archival)
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 7717
Program Title: Topological Mapping of Superbubbles and ISM Structures with JWST

Principal Investigator: O'Neill, Theo

PI Institution: Center for Astrophysics | Harvard & Smithsonian

Feedback-driven superbubbles are known to influence the progression of star formation and the evolution of the interstellar medium (ISM) on galactic scales. JWST has transformed our ability to resolve the precise geometry and local environments of superbubbles in nearby galaxies, but current methods for the identification of candidate bubbles are not easily scaleable and struggle to simultaneously map both superbubbles and their local environments (such as molecular clouds and filaments) in a self-consistent framework. We propose an archival program to develop and release an open-source software package for the topological analysis of structures in astronomical images. We will apply this method to a sample of 81 galaxies observed by JWST, and map the structure of 100,000 superbubbles, molecular clouds, and filaments. This analysis will reveal how superbubbles influence the interstellar medium and star formation across diverse galactic environments.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7722
Program Title: To catch an AGN: Ionizing Emission and AGN Activity of COLA1 in the Epoch of Reionization

Principal Investigator: Torralba, Alberto

PI Institution: Universidad de Valencia, Observatorio Astronomico

One of the main open questions about the Epoch of Reionization (EoR) is identifying the primary sources of ionizing photons. Direct detection of ionizing continuum (LyC) during the EoR is impossible due to total IGM absorption, so we rely on indirect methods, calibrated with lower-redshift observations or simulations. Rest-frame UV spectroscopy of EoR objects is key to identifying the main ionizers. COLA1, a highly luminous galaxy at z=6.6, stands out with its unusual double-peaked Ly-alpha profile. This feature is rare in the EoR, where the neutral IGM should absorb the blue peak, suggesting that COLA1 resides inside a highly ionized region. Previous NIRCam WFSS and photometric studies indicates that it is a strong LyC leaker, with a moderate overdensity around it. However, if star formation is the main source of UV emission, its compact UV size (<260 pc) would imply extreme star formation rate surface density. Moreover, COLA1's abnormal UV SED measured by NIRCam is poorly reproduced by models. These factors raise the question: does COLA1 host an AGN? We propose deep rest-frame UV spectroscopy of COLA1 and four neighboring galaxies using NIRSpec MOS to achieve two goals: 1) determine if COLA1 hosts an AGN and assess its contribution to the UV luminosity, and 2) map the ionized region around COLA1 through the Ly-alpha emission of nearby galaxies. This will provide a detailed dissection of the UV emission mechanisms of a strong LyC leaker in the EoR, and a precise tomography of the ionized region around it. If confirmed, it would be the first case of a bright AGN significantly contributing to reionization, providing insights into the role of luminous sources in the EoR.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7728
Program Title: Investigating a New Evolutionary Channel for Dying Stars

Principal Investigator: Sahai, Raghvendra

PI Institution: Jet Propulsion Laboratory

The demise of most stars in the Universe has traditionally been thought to occur as a result of heavy mass-loss (with rates as high as 1e-4 Msun/yr) on the Asymptotic Giant Branch (AGB), when the stars are very luminous (5000-10,000 Lsun) and cool (Teff < 3000 K). However, recently, an exciting new evolutionary channel has been identified from a study of evolved stars in the Magellanic Clouds (MCs). This channel operates when the primary star is much less luminous, i.e., still on the Red Giant Branch (or RGB), likely as a result of a strong binary interaction. The most prominent Galactic representative of this process is the Boomerang Nebula (also the coldest object in the Universe): in it the mass-loss that stripped the primary star of its envelope was driven at an extreme rate (1e-3 Msun/yr) and expansion velocity (165 km/s), much higher than found for any AGB star, and occurred over a relatively short period (3500 yr). The binary companion most likely merged with the core of the primary, producing a jet-driving central dusty disk/torus around the merged object. We propose a JWST study of a select sample of post-RGB objects in the LMC to obtain 5-28 micron spectra that are vital for probing the properties of the mass-ejecta and thus constrain the ejection process . Our results will help constrain existing theoretical models of strong binary interactions for producing post-RGB objects; important diagnostics include the mass of material ejected in the equatorial plane, compared to that in a shell, and the chemical composition of the ejecta.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7729
Program Title: Unveiling Early Cosmic Enrichment: Direct Metallicities in z>6 Galaxies from Deep JWST Spectroscopy

Principal Investigator: Roberts-Borsani, Guido

PI Institution: University of Geneva, Department of Astronomy

What are the metal contents of galaxies, how quickly did they form, are strong-line diagnostics sufficiently robust to measure them? JWST has extended the frontier of galaxy metallicity studies, enabling measurements of strong diagnostics lines out to z~12. However, tracing the build up of metals across the first billion years remains extremely challenging and current constraints are sorely lacking. At z>6, simulations yield contrasting predictions due to different feedback physics, while observationally only 17 objects observed with JWST have benefited from gold-standard, electron temperature-based metallicities. The vast majority of objects have instead relied on inferences using uncertain Oxygen and Balmer strong-line calibrations anchored to small numbers of 2<z<9 Te-based measurements. Comparisons between those calibrations indicate large discrepancies (up to 0.5-1 dex), casting serious doubt on the robustness of metallicities inferred thus far and indicating a need for stronger constraints. This proposal aims to address these issues by determining direct metallicities for a statistical sample of confirmed z>6 galaxies in the GOODS fields, through deep NIRSpec G395M/F290LP spectroscopy of [O III]4963 and [O II]3728,3730. With a ~4x increase in detections compared to current samples, we will: (i) Establish the most robust R23 and O32 calibrations to date, and explore [Ne III]-based indices for applications at z>10. (ii) Utilize those calibrations to obtain robust metallicities in >500 sources at z=6-13 for mass-metallicity characterizations. (iii) Examine evolutionary trends and characterize the intrinsic scatter of galaxy metallicities over the first billion years.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7760
Program Title: Testing the gravitational lens origin of SAV events -- MIRI/MFS IFU observations of PKS 1413+135

Principal Investigator: Perlman, Eric

PI Institution: Florida Institute of Technology

Time-domain surveys are an exciting new frontier, having discovered tidal disruption events, gamma-ray bursts and fast radio transients. Symmetric achromatic variability (SAV) events are a new class of new class of variability events, identified in 7 AGN out of 1830 monitored regularly by the Owens Valley Radio Observatory. SAV events have lightcurves that are time-symmetric and achromatic. They have been modeled by gravitational milli-lensing, which can occur when relativistically moving jet components in a background AGN, move through caustics created by 10^3-10^6 solar mass features in a foreground galaxy. Confirmation of the lensing nature of SAV could give us a powerful new tool, allowing future multiwaveband observations to reveal <0.01pc scale structure in distant galaxies. We propose to test this idea with MIRI/MRS IFU observations of PKS 1413+135, which has had four SAV events between 1992-2015. PKS 1413+135 is one of the most puzzling blazars known, due to uncertainties about its host galaxy, redshift and nature. The apparent host galaxy, a z=0.247 edge-on spiral, shows no evidence of activity in its optical spectrum. This is incongruent with the blazar projected on the sky 13 +/- 4 mas (52 +/- 16 pc) from its isophotal centroid in HST/NICMOS observations. The host also has a GMC complex projected within 25 mas of the AGN, with time-variable absorption. Confirming the lens model would require identifying AGN lines at z>0.247. This can only be done in the infrared, as the AGN suffers 30 mag of extinction in the optical. Existing Spitzer data are too low S/N and resolution to do this. We will also re-examine whether the AGN is centered in the z=0.247 spiral.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Stars and Stellar Populations
ID: 7763
Program Title: J-Virgo: A JWST Treasury Survey of the Virgo Cluster

Principal Investigator: Weisz, Daniel

PI Institution: University of California - Berkeley

We propose to undertake the first systematic study of Virgo cluster galaxies using resolved stellar populations. We will acquire NIRCam (F115W, F150W, F277W) and NIRISS (F115W, F277W) imaging of resolved red giant branch (RGB) and asymptotic giant branch (AGB) stars for 80 luminous and diverse galaxies (-16 < M_V < -23) in "subcluster A", the dominant substructure in the Virgo cluster, in order to construct and analyze each galaxy's resolved star color-magnitude diagram (CMD). From these CMDs we will: (1) make the first resolved 3D map of galaxies within Virgo's virial radius (Rvirial~1.6Mpc) using precise relative TRGB distances (~1.5%; 240kpc; 0.15Rvirial in Virgo); (2) use resolved AGB stars to measure the SFH (and SFH gradient) for each galaxy to a similar quality and level of detail as galaxies near the Local Group (e.g., the ANGST program); (3) calibrate surface brightness fluctuation (SBF) distance indicators for JWST using precise TRGB distances and detailed knowledge of each galaxy's resolved stellar populations for a statistical sample of galaxies that span a range of morphological types and stellar populations (e.g., colors); (4) use parallel NIRISS observations to resolve and map the diffuse, intracluster stellar populations. This Treasury program will (i) provide qualitatively new insight into Virgo and the impact of cluster environment on galaxy evolution and (ii) anchor a uniform SBF distance scale that will enable a broad range of science for a diversity of galaxy types to ~300 Mpc (e.g., distances to transient hosts, mapping matter distributions, local H0). JWST is the only telescope that can systematically resolve stars throughout Virgo.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 7772
Program Title: Interstellar PAHs: separating the neutrals from the ions

Principal Investigator: Peeters, Els

PI Institution: The University of Western Ontario

JWST observations are dominated by strong emission bands at 3.3, 6.2, 7.7, 8.6, and 11.2 um, referred to as the Aromatic Infrared Bands (AIBs) and generally attributed to polycyclic aromatic hydrocarbons (PAHs). PAHs play a key role in several physical and chemical processes highly relevant for large-scale astrophysical processes such as star and planet formation and galaxy evolution. These physical and chemical processes strongly depend on the PAH charge distribution. The PAH charge distribution also governs the spectral characteristics of the AIB emission spectra. However, we are currently unable to derive a consistent quantitative value for the PAH ionization fraction from observations. This in turn affects the quantitative role PAHs play in the Universe, e.g. an incorrect PAH ionization fraction strongly influences the heating rate of the neutral ISM. We request NIRSpec IFU and MIRI MRS observations of a sample of reflection nebulae illuminated by central stars of a range of spectral types. This will include the first good quality, medium spectral resolution spectrum of PAH emission from a single charge state, i.e. neutral PAHs. We will separate the spectroscopic properties of neutral and cationic PAHs and systematically calibrate these in terms of the radiation field. This program will thus provide observational templates of purely neutral and purely cationic AIB emission as well as the molecular properties of their carriers. We will directly quantify the PAH ionization fraction from the observations which will allow us to assess methods currently employed to derive the PAH ionization fraction and to quantitatively validate PAH models and thus the PAH hypothesis!

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Exoplanet System Formation and Dynamics
ID: 7782
Program Title: A Spectroscopic Survey of the Orion Nebula Cluster: Protostars, Proplyds, and Planetary Mass Objects

Principal Investigator: Luhman, Kevin

PI Institution: The Pennsylvania State University

The Orion Nebula Cluster (ONC) is the richest and densest nearby star-forming cluster. As such, it is uniquely suited for imaging and multi-object spectroscopy with JWST. During Cycle 1, brief observations with NIRSpec provided spectra for 22 brown dwarf candidates identified with HST/WFC3, 21 of which were confirmed. Those targets included two of the coolest and least massive known proplyds and a strong candidate for a protostellar brown dwarf. Meanwhile, NIRCam images were obtained for a 11'x7.5' field in the center of the ONC, which have been used to identify >200 brown dwarf candidates that lack spectroscopy, the faintest of which could have masses of 1-2 Jupiter masses. This sample includes dozens of candidates for protostars and proplyds at substellar masses. We propose to use NIRSpec to obtain PRISM spectra (1-5 um) of most of the brown dwarf candidates (~200) from the NIRCam images of the ONC. We will use these spectra to confirm the youth and cool nature of the candidates, search for ice absorption features from protostars, and search for strong emission lines from proplyds. Through these observations, we seek to significantly increase the numbers of spectroscopically confirmed protostellar brown dwarfs and brown dwarf proplyds (beyond the current values of ~1 and ~2-3) and obtain the best available measurement of the mass function and minimum mass of brown dwarfs, all of which are important for testing theories for the formation of brown dwarfs. Our survey will also make it possible to investigate the origin of the abundant unidentified hydrocarbon that has been detected by NIRSpec in planetary mass objects in the Perseus star-forming region.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7792
Program Title: Does the apple fall far from the tree? Comparative chemistry between a CPD and its host disk

Principal Investigator: Cugno, Gabriele

PI Institution: Universitat Zurich

GQ Lup B, an accreting companion surrounded by a circumplanetary disk (CPD), presents a unique opportunity to study i) the CPD chemistry, ii) the comparison between the chemistry in the CPD and the primary, and iii) potentially the dynamical interaction between the two. While extensive efforts have focused on the dust component of this CPD in both the infrared and mm, the gas remains uncharted. We will now leverage the power of MIRI/MRS to fill this gap. Shallow Cycle 1 data, focused on the bright primary, serendipitously revealed molecular gas signatures in GQ Lup B's CPD through cross-correlation with a reference spectrum of an isolated object with a molecule-rich disk. This molecular detection is significant, meaning that (at least some of) the molecules in the isolated disk are also present in GQ Lup B's CPD; however, the SNR is not sufficient to determine which species are responsible for the correlation or what their properties are. Our proposed observations, optimized for the faint emission from GQ Lup B, will allow us to not only determine the molecular inventory, but with state-of-the-art retrieval tools, determine the gas conditions — temperature, column density, and emitting area — in a CPD for the first time. By probing the molecular composition of both circumstellar and circumplanetary disks, we can do comparative chemistry in the same system to explore the impact that they have on each other (e.g., companion-induced radial drift). Finally, by accessing the CPD chemistry we can investigate a potentially moon-forming environment, shedding light on the chemical diversity seen in the moons in our own Solar system, such as water-rich Europa vs. carbon-rich Titan.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 7793
Program Title: A Deep Dive Spectroscopic Study of an Auroral Emitting World

Principal Investigator: Faherty, Jacqueline

PI Institution: American Museum of Natural History

In this JWST proposal, we will obtain NIRSpec and MRS spectra of the cold brown dwarf WISEP J193518.59-154620.3 in order to characterize a spectroscopic example of an auroral emitting extrasolar world. The methane emission seen in a Cycle 1 program on this source is also found in the G395H spectra of planetary objects (e.g. Jupiter, Uranus, Pluto) and expected in extrasolar planets therefore the detailed characterization we propose crosses substellar, exoplanet, and planetary sub-fields. At a Spitzer [3.6] band mag of ~18.1, W1935 is impossibly faint for ground based observatories therefore JWST is the only facility that can complete our science agenda. The power of this proposal will be in answering the following questions: (1) Is there a forest of CH4 and H3+ emission in W1935 like that seen in solar system objects (e.g. Jupiter, Uranus, Neptune) observed with the same NIRSpec G395H set-up? (2) Do the W1935 emission characteristics extend into the mid infrared where a retrieved model predicts we will see more emission from CH4 and NH3+? (3) Will modeling the spectrum of W1935 lead to conclusive evidence about whether the 300K temperature inversion in local thermodynamic equilibirum (LTE) is the correct interpretation of the cause of the emission or if a non-LTE (NLTE) process linked somehow to a magnetic interaction with the atmosphere might be at play? The NIRSpec and MRS spectra of W1935 would be the first ever spectroscopic study of an auroral emitting world beyond our own and would showcase the power of JWST at atmospheric characterization crossing from extrasolar worlds into the solar system.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 7800
Program Title: An Empirical Benchmark for H2 and PAHs at Extremely Low Metallicity

Principal Investigator: Tarantino, Elizabeth

PI Institution: Space Telescope Science Institute

JWST has revealed that high-redshift galaxies can form stars at a much higher rate than previously thought. Since the far distances of these early galaxies prohibits detailed study, observations of nearby, metal-poor galaxies that mimic the pristine gas conditions of these distance galaxies are needed to constrain models of star formation and dust content. Until recently, both the observations of small dust grains known as polycyclic aromatic hydrocarbons (PAHs) and the primary tracer of molecular gas, CO, have been difficult or impossible to detect in low metallicity galaxies. Now with the resolution and sensitivity of JWST, we can detect and characterize this faint ISM emission. Recent MIRI-MRS observations of the closest, extremely metal-poor (3% Solar) galaxy Leo P have directly detected molecular hydrogen through the MIR rotationally excited transition S(1). We propose deep NIRSpec observations centered on the H2 emission to 1) detect the vibrational, FUV-pumped H2 lines in the NIR to constrain the temperature and mass of the warm molecular gas and 2) target the 3.3 micron PAH complex to detect or put a stringent upper limit on the presence of PAHs at 3% Solar metallicity. The requested observations provide the best chance to ever detect PAHs in Leo P due to the strong correlation between the warm H2 and PAHs. We will analyze the H2 and PAHs together, which will determine the level of destruction of the small grains, identify the main heating sources of the H2 gas, and constrain the H2 mass. The characterization of the ISM in Leo P will be tied to star formation models of high redshift and local galaxies, revolutionizing our picture of the metal poor ISM.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Gas, Dust and the ISM
ID: 7802
Program Title: Dust in shocks: The missing link in AGN feedback

Principal Investigator: Haidar, Houda

PI Institution: Newcastle University

Active Galactic Nuclei (AGN) reside at the centres of most massive galaxies and are thought to be responsible for regulating galaxy evolution through feedback processes. While highly luminous AGN can exhibit multiple feedback mechanisms, which are hard to de-couple, low-luminosity AGN (LLAGN) are simpler systems, with mechanically (not radiatively) dominated energy input into the interstellar medium (ISM). A number of LLAGN are found to host subrelativistic radio jets that are double sided and collimated with their extended narrow line region (NLR). In many of these systems, the interaction between the jet and the ISM can drive shocks, which can influence the physical conditions in the NLR and, in some cases, even destroy the dust. Intriguingly, several observations have detected dust within shocked regions. While various hypotheses have been proposed to explain how dust survives in shocks, constraining dust properties in these hostile environments remains the missing link for accurately modeling AGN feedback and defining its efficiency. Mid-infrared (MIR) emission from dust grains serves as a powerful diagnostic tool to assess the extent of grain processing, revealing whether dust survives shocks, is partially destroyed, or undergoes significant alterations. Leveraging the unique spatial resolution and sensitivity of JWST's MIRI/MRS instrument, we propose to study a sample of nearby radio-selected LLAGN to capture dust survival (or not) in shocked regions and constrain the key properties governing grain processing. This will have important implications for AGN feedback and the dust lifecycle, both of which are crucial for understanding galaxy evolution.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7806
Program Title: The infancy of a supernova remnant: Probing ejecta dynamics, dust evolution, and the emerging compact object in SN 1987A with JWST

Principal Investigator: Kavanagh, Patrick

PI Institution: National University of Ireland, Maynooth

SN 1987A in the Large Magellanic Cloud is the closest observed supernova (SN) in centuries and provides a truly unique opportunity to probe various aspects of SN physics and evolution. SN 1987A has been continuously scrutinized as it changes significantly year after year providing new discoveries and insights into the evolution of SNe in general. Previous JWST observations revealed the onset, and early evolution of the interaction between the rapidly expanding, metal-rich inner ejecta and the circumstellar equatorial ring (ER), a new phase in the evolution of the remnant. The observations also revealed the first clear evidence of the compact object created in the explosion. The goals of this proposal are to determine the metal-rich ejecta structure and composition in the interaction regions, and monitor the emerging compact object and evolution of dust in the outer ejecta. JWST NIRSpec and MIRI give access to numerous important diagnostic lines for the ejecta-ER interaction, the ejecta morphology, and is the only telescope that has unambiguously detected emission associated with the compact object. The science objectives rely on analyzing time variations compared to the previous JWST observations. By Cycle 4, the ejecta and the interaction regions will have evolved substantially in the two years since the last JWST observations. The proposed observations also hold great legacy value for the community. SN 1987A has been observed regularly by all major telescopes since the very beginning, which has created a unique observational record of the evolution of a SN into a SN remnant across the electromagnetic spectrum.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 7813
Program Title: The origin of CO2 in the Uranian system and possible geologic activity at Ariel

Principal Investigator: Cartwright, Richard

PI Institution: The Johns Hopkins University Applied Physics Laboratory

Uranus' moons Ariel, Umbriel, Titania, and Oberon have surfaces rich in CO2 ice, and they could have subsurface saline oceans, especially Ariel. At the estimated peak surface temperatures of these moons (80-90 K), CO2 ice is volatile and should sublimate and migrate to their winter poles (20-30 K). Over time, CO2 is gradually lost due to Jeans escape and photolysis. The continued presence of CO2 indicates ongoing replenishment, either from endogenic outgassing or by radiolytic production via charged particle bombardment. Furthermore, volatile transport models suggest that the Uranian moons experience seasonal atmospheric density spikes near equinox as their cold and dark winter poles are exposed to sunlight, driving rapid sublimation of seasonal CO2 ice caps, temporarily ballooning their predicted, but yet-to-be-detected, exospheres. These seasonally-enhanced exospheres are likely very short lived, shrinking to low background levels in early spring. Ariel, however, has a young surface with large-scale fissures that might be conduits to its interior, and it exhibits some of the strongest CO2 (and CO) bands yet detected on an icy moon. Consequently, Ariel might have a sizable exosphere, sustained by venting of CO2 and CO from its interior. Cycle 4 coincides with late northern spring in the Uranus system (subsolar lat. >68°N), long after a density spike from a devolatilized CO2 cap would have dissipated. The detection of a dense exosphere at Ariel would therefore support ongoing outgassing. We will observe these moons with NIRSpec IFU to investigate the origin of CO2 ice on all four moons (G235H) and determine whether Ariel has a geologically-sustained exosphere (G395H).

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7814
Program Title: MINERVA: Unlocking the Hidden Gems of the Distant Universe and Completing HST and JWST's Imaging Legacy with Medium Bands

Principal Investigator: Muzzin, Adam

PI Institution: York University

The deep imaging capability of JWST/NIRCam has revolutionized our understanding of the distant universe, but most extragalactic imaging in the key "cosmic windows" has been limited to broad-band filters with low spectral resolution (R = 4-5). This limitation has hindered our ability to resolve key features in galaxy SEDs, such as the Lyman/Balmer breaks and strong emission lines, leading to challenges in interpreting many results. We propose to obtain 8-filter medium-band imaging, along with F1280W and F1500W MIRI parallels, in the primary HST/JWST fields (PRIMER-UDS, PRIMER-COSMOS, CEERS/AEGIS, JADES-GOODS-N). This will double the total JWST filter coverage in these fields to more than 20 bands and triple the spectral resolution to R~15. By increasing the surveyed area nearly 10-fold compared to existing medium-band programs, we will significantly reduce the effects of cosmic variance and uncover rare populations hiding in existing deep-field catalogs. These observations will allow us to: 1) efficiently identify and characterize galaxies with unusual SEDs including z>12 candidates, high-redshift Balmer breaks, metal-poor extreme emission line galaxies, and extremely red/dusty sources, 2) improve stellar mass and star-formation rate density measurements at $2 < z < 10$ by factors of 2-4, and 3) create resolved maps of stellar mass and star formation across 10 Gyr of cosmic time to model galaxy growth in two dimensions. In addition to these science returns, these data will enhance all future science derived from these legacy fields with improved photometric redshifts and stellar masses and serve as JWST's lasting multiwavelength photometric legacy.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Stars and Stellar Populations
ID: 7824
Program Title: Search for giant planets around white dwarfs with intermediate-mass progenitors in the nearby Hyades cluster

Principal Investigator: Brandner, Wolfgang

PI Institution: Max Planck Institute for Astronomy

What is the incidence of planets around intermediate mass stars? What are their astrophysical properties? How do they survive the post-main sequence evolution? We aim to address these key questions with highly sensitive JWST/NIRCam observations requiring only a modest amount of telescope time. Our sample consists of seven white dwarfs in the nearby Hyades open cluster. These white dwarfs had intermediate mass main-sequence progenitors with masses between 2.8 and 3.6 solar masses. The white dwarfs make ideal targets as i) planetary orbits did widen adiabatically during the stellar AGB phase by a factor of 4 to 5 (e.g. from 5 to 25 au), and ii) the small size and resulting low luminosity of the white dwarfs greatly alleviates the contrast requirements for a direct planet detection. New detections will add to the growing number of known exoplanets in the Hyades. At effective temperatures of 200K, any "white dwarf planet" will also provide an essential link between the considerably warmer (Teff>700K) giant planets imaged thus far around nearby young stars, and the cooler (Teff = 90 to 100 K) giant planets in the solar system. This combined with the well known ages and metallicity of the Hyades will provide new benchmarks for atmospheric and evolutionary planet models, and place comparative planetology on a much more solid footing. The program will establish new constraints on the formation and evolution of planetary systems around intermediate mass stars.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 7827
Program Title: Looking into the core of the explosions of massive stars

Principal Investigator: Kotak, Rubina

PI Institution: University of Turku

The physics governing the core-collapse supernova phenomenon is only indirectly constrained. Yet, knowledge of the yields of heavy elements synthesised in supernovae is a crucial ingredient in many areas of astrophysics. However, such measurements are challenging: the innermost regions -- where the heavy elements reside -- are only visible several hundred days after the explosion, when the ejecta have become optically thin, but the supernova has become faint. Thus, ground-based observations are generally unfeasible. The excellent sensitivity of JWST/MIRI finally allows us a chance to carry out such measurements, but only for the nearest of supernovae. We propose to seize a once-in-a-lifetime opportunity afforded by the fortuitous occurrence of nearby supernovae to take snapshots of the innermost regions of the explosions arising from massive stars and allowing us to directly measure yields of important species from lines that are only available in the mid-IR region. This is a crucial first step towards exploring the parameter space spanned by core-collapse supernovae and the stars or stellar systems that give rise to them. Remarkably, such datasets do not exist for the variety of massive star supernova subtypes, and there is no prospect of deferring this exercise to future years. With our progam of MIRI observations we will take the first steps in this direction. With targets that have excellent ancillary data, including information on the progenitor star, a modest investment of JWST time will lead to the creation of datasets with true legacy value.

Proposal Category: AR
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 7831
Program Title: Development of a Time-Variable Bad Pixel Mask for MIRI LRS from Blank Sky and Failed Observations

Principal Investigator: Barber, Sam

PI Institution: The University of Western Ontario

The bad pixel mask for MIRI LRS is currently constant across all observations. However, it has become apparent that defective pixels have accumulated over time and are not being properly handled by the data reduction pipeline. These defective pixels produce apparent features in extracted spectra that are comparable in scale to known astrophysical features. Consequently, these features may result in spurious results when extracted spectra are analysed. We aim to produce a time-variable bad pixel mask that correctly flags these accumulating defective pixels for handling by the JWST pipeline. The data we aim to use in our development are blank deep-sky observations with MIRI LRS. We are aware of multiple programs containing observations that, for various reasons, do not include any targets. These observations produce deep 2D detector readout images of blank regions of sky, within which defective pixels are readily visible. Through simple statistical analysis of detector pixels in the context of their environments, significant outliers corresponding to defective pixels can be easily flagged. With the full suite of blank-sky observations over an extended period of time, we can produce a time-dependent bad pixel mask that will significantly improve the handling of defective pixels in MIRI LRS. This could be extended to MIRI MRS and imaging modes, and potentially to NIRSpec modes as well.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 7833
Program Title: Planet Authentication in White-dwarf Systems (PAWS): Revealing the Demographics of Exoplanets Orbiting White Dwarfs

Principal Investigator: Vanderburg, Andrew

PI Institution: Massachusetts Institute of Technology

Understanding how post-main-sequence stellar evolution affects exoplanet populations is a key question in the field today, but so far, relatively few planets have been confidently detected around white dwarfs. Recent JWST observations have detected numerous planet candidates in white dwarf systems, but these discoveries require additional observations before they can be confirmed. We request MIRI imaging observations of an unbiased, volume-limited sample of 16 nearby white dwarfs with directly imaged planet candidates from Cycle 2 JWST observations. Our additional MIRI observations will let us measure each candidate's proper motion and distinguish real planets from background contaminants. Our program will result in the confirmation of numerous giant planet candidates (likely including some of the coldest exoplanets ever imaged) and a first measurement of the occurrence rate of giant planets around white dwarfs. Based on main-sequence planet occurrence rates, we expect to confirm 5 +/- 2 planets in our sample (with 99.6% probability of detecting at least one planet). If our actual number of detected planets differs from this estimate significantly, it would suggest that our understanding of post-main-sequence planetary evolution is incomplete.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 7847
Program Title: Saturn's E ring in 2025: A rare opportunity to observe material from inside Enceladus

Principal Investigator: Hedman, Matthew

PI Institution: University of Idaho

Saturn's faint and diffuse E ring is composed primarily of particles erupted from Saturn's moon Enceladus. This ring material therefore consists of tiny samples of the interior of an ocean world, making the composition of these particles of high astrobiological interest. During Cycle 4, JWST has the rare opportunity to observe this ring almost exactly edge-on, enabling both NIRSpec and NIRCam to obtain data with the highest possible signal-to-noise ratio (SNR) for the next 15 years. NIRSpec IFU spectra of the brightest part of the E ring will clarify the carbon content of the particles erupted by Enceladus. Meanwhile, deep NIRCam images of the entire E ring at multiple wavelengths will constrain how efficiently material from Enceladus is transported throughout the Saturn system.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7849
Program Title: Meeting their Match: Measuring Cloudy Hot Jupiter Counterparts to Understand the Silicate Cloud Regime with JWST/MIRI

Principal Investigator: Moran, Sarah

PI Institution: NASA Goddard Space Flight Center

Clouds are a fundamental component of all atmospheres, and as such they are key to understanding the physics, chemistry, and overall atmospheric evolution of planets. Silicate clouds are thought to be the most common kind of clouds for a large range of – but not all – hot Jupiter atmospheres. With JWST/MIRI, we are now able to measure the direct absorption of previously inaccessible silicate bonds that manifest from 8-10 microns due to a range of silicate compositions (SiO2, MgSio3, Mg2SiO4, etc.). Detections of silicate clouds have already been made in transmission spectroscopy studies of 3 hot Jupiters; however, these detections do not necessarily fit the prevailing theories about where silicate condensation is expected to occur. To test whether the current cloud detections are indicative of wider trends for such planets or due to something unique to the conditions of the 3 objects with detected silicate clouds, we will observe the MIRI/LRS transmission spectra of 3 "counterpart" hot Jupiters. These counterparts have similar masses and equilibrium temperatures as those with existing silicate cloud detections, as temperature and mass are the expected first-order determinants of cloud formation and persistence. Our observations will enable us to begin understanding the specific regimes in which silicate clouds dominate, and unlock deeper physical insights into their formation and evolution. These insights will lead to a better understanding of hot Jupiters and brown dwarfs, which also contain such clouds, as well as connect optical to mid-infrared spectral information about aerosol particles for a whole range of worlds.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 7874
Program Title: Dust After Quenching: A Mid-Infrared View into the Hidden ISM of Distant Massive Galaxies

Principal Investigator: Alberts, Stacey

PI Institution: University of Arizona

We propose a JWST study of the interstellar medium (ISM) and dust properties in six massive quiescent galaxies at z~0.5, providing a novel view into post-quenching conditions beyond the local universe. Infrared observations have revealed unexpected reservoirs of dust and molecular gas in local quiescent galaxies, challenging the traditional picture of quenching as a rapid depletion of the ISM. Early JWST/MIRI imaging results have shown that mid-infrared excesses are surprisingly common even in more distant galaxies, suggesting that dust may persist through the quenching process at the peak epoch of star formation. To uncover the origin of this mid-infrared excess, we require spatially-resolved, spectroscopic diagnostics of both dust and any residual star formation. Here, we propose to leverage the unprecedented sensitivity of JWST's NIRSpec and MIRI IFUs to map polycyclic aromatic hydrocarbons (PAHs) at 3.3, 6.2, 7.7, and 11.3 microns and examine their relationship with residual star formation traced by Pa-alpha. These observations will reveal dust properties, sources of dust heating, and the state of the ISM, shedding light on the quenching process. Our targets are at the highest redshift where the 11.3 PAH, critical for constraining grain sizes, can be observed in the sensitive MRS channel 3, providing our best possible view into the ISM conditions in quenching galaxies beyond the local universe. This program will offer critical insights into how the link between dust and star formation evolves during the quenching process.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7875
Program Title: The only known atmosphere on a rocky exoplanet?

Principal Investigator: Zhang, Michael

PI Institution: University of Chicago

55 Cnc e is so far the only rocky exoplanet with convincing--though not uncontroversial--evidence of an atmosphere, in the form of a MIRI/LRS eclipse 8 sigma shallower than that of an airless zero-albedo world. It is also the only exoplanet with evidence of emission variability from multiple telescopes spanning multiple years. We propose to observe three eclipses of the planet with MIRI/MRS in the Medium sub-band. These observations will allow us to confirm the existence of an atmosphere, probe the wavelength dependence of its emission variability, and constrain its carbon dioxide abundance through the 15 um CO2 absorption feature. As an old, ultra-hot (Teq=2000 K), and ultra-short-period planet, 55 Cnc e may seem a-priori like a particularly hostile place for any gaseous envelope. Understanding whether and/or how such an envelope exists on 55 Cnc e, the most observationally favorable super-Earth, has strong implications for the survivability of rocky planet atmospheres more generally.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 7881
Program Title: Watching Dust Formation in Real Time in Two Very Nearby Core Collapse Supernovae

Principal Investigator: Andrews, Jennifer

PI Institution: NOIRLab - Gemini North (HI)

The very nearby core collapse supernovae (CCSN) SN 2023ixf and SN 2024ggi (both at ~7 Mpc) will likely be the most well-studied SNe this decade. The combination of pre-explosion data combined with the comprehensive follow-up post explosion has given us an unprecedented chance to study both massive star and CCSN evolution in two completely different galaxies. In particular, these nearby SNe may hold key information in understanding the formation of dust in the Universe. Dust is abundant in the early universe, and CCSN are a likely source. However, existing observations of CCSNe in the near- and short mid-infrared yield dust masses ~2-3 orders of magnitude lower than expected. One possible solution is that this dust is hiding deep in the mid-infrared, at temperatures of ~100-200K, or that it is created over a longer time span than some models predict. JWST+MIRI is able to probe both warm (~300-500K) and cold (~100-200K) dust with unprecedented sensitivity. By observing SN 2023ixf and SN 2024ggi over the next three JWST cycles with MIRI we will create spectral energy distributions out to ~25 microns allowing us to quantify and characterize the amount of cold and warm dust both pre-existing and newly formed. This will help us understand dust formation in real time, explore links between dust formation and other SN properties, and address the issue of cosmic dust formation in the early universe.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Gas, Dust and the ISM
ID: 7890
Program Title: Young and pristine: chemical content of disks at the onset of planet formation

Principal Investigator: Tychoniec, Lukasz

PI Institution: Leiden Observatory

The protostellar stage is a critical phase in stellar evolution: the star is still being built up, and a rotating disk of gas and dust is being formed, setting the scene for new solar systems. Observations and models suggest that planet formation starts early, in the embedded phase of star formation, <0.5 Myr after cloud collapse. The main goal of this program is to use the unique capabilities of the MIRI-MRS to characterize the physical and chemical content of the inner (<10 au) warm planet-forming zones of 21 protostellar Class I disks with known host protostellar mass and to compare the results with those found from gas-phase lines in widely studied disks in the Class II stage. Since the effects of radial drift of icy grains enriching the inner disks and dust traps locking up elements in the outer disk are minimized at early times, these young disks should provide the best view of the pristine chemical conditions and bulk elemental abundances in planet-forming zones. The specific goals of this program are (i) to measure the warm gas composition of young disks which only MIRI can detect, especially of H2O, CO2, and organics (C2H2 and HCN) and thereby also elemental abundance ratios; (ii) to compare this composition with those of more evolved Class II disks; (iii) to link those comparisons to effects of (species-dependent) radial drift timescales and dust traps. This study will impact both the immediate sub-field of protoplanetary disks by showing the most detailed composition of young disks to date, as well as broader planet formation and exoplanetary characterization fields by revealing the starting chemical mixture for forming planets.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 7893
Program Title: Host Galaxy Properties of the Most Massive Quasars at Cosmic Noon

Principal Investigator: Zhuang, Mingyang

PI Institution: University of Illinois at Urbana - Champaign

A key constraint on the co-evolution scenario of supermassive black holes and their host galaxies is the observed correlations between the black hole (BH) mass and host stellar properties at Cosmic Noon (z~2), where both quasar activity and global star formation reached their peak. Such constraints rely on reliable measurements of both BH masses and host stellar properties, and there is currently no consesus on whether or not such corrrelations exist at z~2. This program will observe a sample of seven of the most massive quasars at z~2-3 that have direct reverberation mapping-based BH masses, using NIRCam ~1-5 micron imaging and NIRSpec Fixed Slit spectroscopy. With these data, we will measure host stellar properties in these luminous quasars at Cosmic Noon. The proposed sample will significantly expand the dynamic range in BH mass (by a factor of ~4) beyond existing samples to facilitate the measurement of BH-host scaling relations. This program will provide a benchmark sample for comparative studies of massive galaxies and luminous quasars across cosmic time.

Proposal Category: AR
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 7901
Program Title: Improving JWST/NIRSpec Data Reduction: Addressing Correlated Noise and 1D Spectral Extraction Limitations

Principal Investigator: Pelliccia, Debora

PI Institution: University of California - Santa Cruz

This proposal aims to integrate JWST NIRSpec data reduction capabilities into the PypeIt spectroscopic data reduction package, in order to address critical limitations in the current JWST calwebb_spec3 pipeline. The standard approach in the calwebb_spec3 pipeline of resampling dithered spectra into a regular grid introduces correlation between pixels that reduce the accuracy of noise estimates, affecting particularly the detection of faint sources. Additionally, the lack of optimal extraction tools in the existing JWST pipeline has necessitated the use of custom codes, which creates inconsistencies in data analysis. PypeIt offers a solution by providing native pixel sampling using an irregular wavelength grid, robust noise estimates, and both optimal and boxcar 1D extraction. PypeIt has been successfully used to reduce data from over 50 spectrographs at 18 observatories and is recognized as a valuable community resource. By extending PypeIt to support JWST NIRSpec fixed-slit and micro-shutter assembly observations, we will provide the JWST community with access to highly vetted, well-maintained, open-source algorithms developed over decades. Our proof-of-concept work demonstrates PypeIt's potential to improve JWST data reduction, particularly in noise estimation and spectral extraction. This project will develop automated workflows for various NIRSpec observations, optimize existing code, create new output formats and quality assessment tools, and produce extensive documentation. The integration of JWST capabilities into PypeIt will expedite the path to science, improve result reproducibility, and facilitate comparisons between datasets from different observatories.

Proposal Category: AR
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 7912
Program Title: A New Window on Galaxy Structure: Mid-IR Morphology with MEGA

Principal Investigator: Troiani, Gregory

PI Institution: University of Kansas Center for Research, Inc.

In the local universe, the dustiest galaxies are universally mergers. Previous studies of optical morphologies indicate this is not necessarily the case at cosmic noon, but no study to date has directly examined the morphology of the dust. Optical morphologies are insufficient to tease out relationships in an obscured population. JWST has given the astronomical community access to sub-arcsecond resolution imaging well into the mid-IR, making these dust morphologies attainable for the first time. We propose a novel and comprehensive morphological study on mid-IR data from the MEGA survey, as well as archival data from the CEERS and CANDELS programs. We will produce and publish a value-added catalog of IR and optical morphological metrics, comprised of visual classifications from Zooniverse, Sérsic indices from GALFIT, bulge-to-light ratios and effective radii from GaMPEN, and CAS, GINI, and M20 measurements. We will also map the surface density of obscured star formation, stellar mass, and dust, for resolved objects at redshifts where PAH emission falls into a MIRI band. We will use this, coupled with global galaxy properties derived from SED fitting with CIGALE, to: describe how dust and stellar morphology evolves with cosmic time and varies with physical properties; to examine how AGN growth correlates with merger signatures in faint, high-z, and obscured populations; and to shed light on how and where star formation is quenched.

Proposal Category: SNAP
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 7929
Program Title: JWST Near-Infrared Dust Extinction Survey: Taking it to the Next Level from Space

Principal Investigator: Gordon, Karl

PI Institution: Space Telescope Science Institute

We propose to measure the Milky Way near-infrared (NIR, 1-5 micron) diffuse dust extinction at spectroscopic resolution for a statistically significant sample of sightlines. Our sample targets are distributed around the entire Galactic plane and are OB stars selected from a parent sample with existing measured ultraviolet extinction curves. These proposed observations will provide the first complete measurements of dust extinction from 1-5 micron as observing from space removes the significant limitations in wavelength coverage and noise of ground-based NIR observations. This survey will provide new constraints on dust grain properties and provide empirical dust extinction, significantly improving our knowledge of dust grains and extinction.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 7934
Program Title: A Deep, High Resolution NIRCam Mosaic of Cas A: Keeping Up with its Rapidly Evolving Structure

Principal Investigator: Fesen, Robert

PI Institution: Dartmouth College

The Galactic supernova remnant Cassiopeia A (Cas A) is the youngest Galactic core-collapse SNR known and, at an estimated distance of 3.4 kpc provides us with the clearest look at the properties and explosion dynamics of a high mass supernova. Cas A's ejecta knots are typically sub-arcseconds in size and can show emission and morphological changes on timescales from a few months to a few years. No other remnant, with the exception of SN 1987A, shows such rapid optical changes across large portions of its structure. We propose a deep NIRCam image of Cas A remnant in Cycles 4 and 5 using a filter especially sensitive to the remnant's bright emission lines to match existing WFC2 and ACS HST images but with a resolution 3-4 times better. Three other NIRCam filers will be used to match those taken in JWST's Cycle 1. These data will extend and complement the existing HST/JWST images and be an HST-JWST transition for the study and MHD modeling of Cas A and other high mass, core-collapse SNe.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 7935
Program Title: Efficient Measurement of the Emergence Rate of AGN in Legacy Deep Field

Principal Investigator: Sun, Fengwu

PI Institution: Harvard University

Despite a large number of AGN found by JWST at z>4, we still do not have a clear answer on the fraction of galaxies hosting active nuclei at this epoch. To enhance the completeness and accuracy in AGN selection, we propose a highly efficient NIRSpec MSA survey in the GOODS-N field. By targeting star-formation-rate (SFR)-selected galaxies with secure redshifts from previous NIRCam WFSS surveys at 3-5 um, we will obtain highly multiplexed NIRSpec G395M/F290LP spectroscopy of 842 galaxies with just 6 MSA configurations, all of which are at z=4-9. We will determine the broad-line AGN fraction among galaxies with diverse SFR (1-50 Msun/yr) and large-scale environment (over/underdensity) with 1% accuracy. We will also characterize other key diagnostics of AGN including BPT diagram, high-ionization lines and mid-infrared spectral energy distribution through joint analyses with the rich archival dataset in this legacy deep field. In addition to AGN investigations, our survey will also produce a large library of deep rest-optical spectra of galaxies around Epoch of Reionization. This will enhance the metallicity calibration accuracy of high-redshift galaxies through direct-Te method, and also characterize galaxy growth and metal enrichment history as a function of environment. To further enhance the legacy value of this survey, we plan to release the fully processed spectra and value-added catalogs timely to the community.

Proposal Category: AR
Scientific Category: Solar System Astronomy
Alternate Category: Exoplanet System Formation and Dynamics
ID: 7937
Program Title: Cometary and Asteroidal Dust in our Zodiacal Cloud from Archival MIRI Observations of the 10-μm Silicate Feature

Principal Investigator: Bryden, Geoffrey

PI Institution: Jet Propulsion Laboratory

Most or all stars have orbiting debris, remnants of the process of planet formation. While the dust produced by colliding asteroids and sublimating comets is readily detected around many nearby stars, only in the solar system do we have a clear view of the overall system architecture: the spacing of the planets and the families of small bodies that produce such dust. Despite its proximity, the composition of the Solar System's zodiacal cloud of dust is not well known. Most is thought to come from Jupiter-family comets, but some models find a large fraction from asteroids. Dust from long-period comets (perhaps 10% of the total) has never been concludingly detected. The best way to disentangle the various components of the zodiacal cloud is to look for differences with ecliptic latitude. Asteroids are closest to the midplane while Jupiter-family comets are more dispersed and long-period comets are isotropic. Fortunately JWST provides a dataset ideal to address this issue. JWST regularly observes zodiacal dust, which manifests itself as a smooth mid-IR background. Normally considered noise to be removed, MIRI background observations are in fact scientific data waiting for analysis. We propose to analyze the entire set of archived MIRI spectra spanning the entire sky, to measure the shape of the 10-μm silicate feature. Webb's much improved sensitivity and stability compared with previous observations will enable much more sensitive tests for gradients in the zodiacal grains' composition and size distribution which would reveal the signatures of the different source populations in the only planetary debris disk where we can directly observe the parent bodies.

Proposal Category: AR
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 7942
Program Title: From data-driven to physics-based: improving exoplanet imaging with differentiable coronagraph models

Principal Investigator: Ferrer-Chavez, Rodrigo

PI Institution: Northwestern University

We propose the use of a new GPU-accelerated, physics-based image processing method to improve the sensitivity of all NIRCam coronagraphic data of known directly-imaged exoplanets. Currently, our ability to directly detect faint planets is limited by our ability to model and supress the glare of the star. This work will use a post-processing method based on using a NIRCam coronagraph model to jointly fit the glare of the star and instrumental aberrations in the optical system. This is an extremely high-dimensional problem, which only recently has become computationally tractable thanks to the innovation of auto-differentiation from the machine learning community. By making our coronagraph model differentiable, this method efficiently optimizes more than one million free parameters and acheives a detection performance up to 7 times deeper than traditional methods. The proposed analysis will: 1) demonstrate the effectiveness of this new method leveraging the extraordinary stability of JWST, 2) obtain higher precision astrometry and photometry of known companions thanks to higher signal-to-noise detections, 3) search for undetected companions in archival data with improved sensitivity, and 4) characterize unknown defects in the NIRCam optical system, which will result in higher fidelity JWST simulations for the broader astronomical community through software such as webbPSF.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7944
Program Title: A MIRI/MRS Deep Dive into Dust Loss and Disk Chemistry for Three Archetypical Proplyds

Principal Investigator: Ballering, Nicholas

PI Institution: Space Science Institute

Most stars and planets form in clusters in the presence of massive stars. This UV-rich environment can drive a substantial loss of gas from protoplanetary disks via a photoevaporative outflow. While Hubble, ALMA, and JWST images have glimpsed the photoevaporating “proplyds” in Orion, there is still much we do not understand about the effect of strong external UV fields on planet formation. How much dust, and what grain sizes, is entrained in the outflowing gas? How does a disk’s warm molecular chemistry respond to a strong external UV field? To answer these questions, we propose deep MIRI/MRS observations of three archetypical proplyds in Orion, enabling a spatial/spectral analysis of the central disk and outflowing material. We will search for mid-IR silicate emission features in the proplyd outflows to measure dust abundance and grain sizes entrained in the photoevaporating gas. The spectra of the central disks will reveal their warm molecular gas inventory, which we will compare with systems in low-mass star-forming regions. We will also search for telltale signs of UV-driven chemistry, e.g., OH and CH3+. Approved cycle 3 NIRSpec IFU measurements of these three systems will yield the temperature and density of the warm outflowing gas, setting the stage to maximize the scientific return from these MIRI observations. Two of the three systems also have existing complementary high-resolution multi-band ALMA data. We propose for ALMA observations of the third systems to reveal its large dust population, cold molecular gas, and the free-free emission from the surrounding ionization front.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 7953
Program Title: Exo-Geology: Surface Spectral Features from a Rocky Exoplanet

Principal Investigator: Paragas, Kimberly

PI Institution: California Institute of Technology

JWST offers the very first opportunity to spectroscopically characterize the surfaces of rocky exoplanets. Observations in previous cycles have constrained their surface albedos, but this is degenerate with a wide range of surface properties. Here we propose to observe the most promising surface characterization target known, LHS 3844 b, to robustly (greater than 3 sigma) detect surface spectral features from an exoplanet for the first time. This will allow us to leverage the vast expertise developed for Solar System rocky bodies to establish a new field of ‘exo-geology’ whose goal is to explore the geological histories and mantle compositions of rocky exoplanets.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 7957
Program Title: MEGA Spectra: Black Hole Growth and ISM Conditions at Cosmic Noon

Principal Investigator: Kirkpatrick, Allison

PI Institution: University of Kansas Center for Research, Inc.

We propose NIRSpec MSA observations of the EGS field in 4 pointings with the G140M, G235M, and G395M gratings covering a wavelength range of 0.9 - 5.0 microns. We will observe for 7965s in all gratings, designed specifically to find low luminosity AGN and probe the ISM of galaxies with SFRs < 5 Msun/yr at z=1-2. All targets (130 primary + potentially 150 filler sources) have been selected from the MEGA survey, which covers the EGS field with MIRI imaging from 7.7 - 21.0 microns. The near-IR spectroscopy + mid-IR photometry will be combined to create a complete census of the ISM, star formation, and black hole growth within our targets. Our primary sample is selected from z=0.5-5.0 to: 1) confirm low luminosity or obscured AGN candidates (mid-IR selected) through high ionization lines such as [OIII]; 2) measure black hole masses (via H-beta) in unobscured AGN, down to M(BH) = 10^7 M(sun); 3) measure metal content via lines such as [OII], [SII], [NII] and correlate with strength of PAH features; 4) use Halpha, Paschen-alpha to calibrate PAH SFR indicators in main sequence galaxies. Our filler sample is selected to: 1) confirm the AGN / obscured nature of little red dots; 2) distinguish between conflicting photometric redshift estimates. NIRSpec follow-up of MIRI-selected sources offers a unique window into the obscured assembly of mass within galaxies.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 7965
Program Title: Probing the chemical evolution of the carriers of the Aromatic Infrared Band emission.

Principal Investigator: Peeters, Els

PI Institution: The University of Western Ontario

The IR spectra of regions associated with gas and dust often exhibit strong emission features known as the Aromatic Infrared Bands (AIBs). In circumstellar environments of both young stellar objects and old stars, the AIBs display clear spectral variations that reflect changes in their chemical make up, more specifically in the aromaticity of the AIB carriers. The aromaticity of the AIB carriers has a profound influence on key physical processes such as the photo-electric effect and ionization. This in turn sets the thermal and ionization balance in planet-forming disks around young stellar objects (among others) which may influence the formation of planetesimals and planets. Here, we propose 0.97-28 micron NIRSpec IFU and MIRI-MRS spatially resolved observations of the planetary nebula NGC 6644 to characterize the spatial behaviour of the AIB emission in its circumstellar toroid. The goal of the program is to study the processes that regulate the aliphatic-to-aromatic character of the AIB carriers as well as the relationship between the degree of aromaticity and the spectral characteristics of the AIB emission. We aim to establish an evolutionary link between the highly aromatic AIBs typically seen in the ISM (class A) and the more aliphatic AIBs seen in circumstellar environments (class B), and determine the conditions that promote this evolution.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 7973
Program Title: Mid-Infrared Abundances of Gaseous Environments (MIRAGE): A MIR Approach to the Abundance Discrepancy

Principal Investigator: Rogers, Noah

PI Institution: Northwestern University

The metallicity of the Interstellar Medium (ISM) directly traces star-formation and is a strong indicator of galaxy evolution. However, the methods used to measure the ISM metallicity are a matter of intense debate. Namely, abundances measured from optical temperature (Te) sensitive collisionally-excited lines (CELs) are ~2 times lower than abundances derived using metal recombination lines of the same ion. This Abundance Discrepancy (AD) calls into question the true abundance scale of the ISM, complicating our interpretation of chemical enrichment in local and high-z star-forming galaxies. Te inhomogeneities in the ISM have been argued to be a main contributor to the AD, which can be directly assessed with the Te-insensitive MIR fine-structure lines of Ne, S, and Ar. These emission lines enable an alternative abundance measurement and, when compared to metallicities derived from optical CELs, directly probe the magnitude of Te variations. Prior MIR observations could not explore this abundance method owing to a combination of poor sensitivity and inability to aperture match to ground-based data. JWST/MIRI, with its IFU capabilities and superior sensitivity, allows for the only direct comparison of MIR and optical ionic abundances. We propose the Mid-Infrared Abundances of Gaseous Environments (MIRAGE) survey to obtain the most accurate MIR gas-phase abundances to date. Combined with high-quality optical/NIR spectroscopy, MIRAGE will definitively address inhomogeneities in the ISM (both temperature and density fluctuations) as a potential source of the AD and resolve whether such fluctuations should be accounted for when deriving chemical abundances from optical CELs.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 7978
Program Title: Our grasp of star formation, feedback, and galaxy evolution is incomplete without a JWST+HST look at the HI-dominated, outer disk of a spiral galaxy

Principal Investigator: Thilker, David

PI Institution: The Johns Hopkins University

Outer disks of galaxies, so easily overlooked in the glare of their spectacular central regions, offer unique information regarding: the physics of the interstellar medium (ISM) and of the star formation (SF) process; the intimate relation between stellar populations and the conditions of the surrounding ISM; and the evolution of galaxies. Analysis of outer disks is required for fully understanding the physics of SF, as the low-density environment provides a stress test. We propose JWST's first detailed look at the outer disk ecosystem of a spiral galaxy, NGC 628 (M 74), paired with commensurate joint HST UV-visible imaging, to document dusty ISM and stellar components of the matter cycle. This project crucially informs studies of the Milky Way for which we lack an external perspective. As a nearby, face-on galaxy with an extended HI/UV-disk hosting low-level SF, and with existing inner disk JWST imaging, the benefit of leveraging the Cycle 1 dataset is clear. Our goals are two-fold: (1) tracing diffuse and structured ISM properties (via morphology metrics, spectral energy distribution) as a function of estimated SF feedback strength from the galaxy center to the atomic-dominated, low SFR surface density, outer disk regime; (2) looking for elusive ingredients of SF -- a novel PAH-based search for the yet undetected cold neutral medium (CNM) clouds supporting outer disk SF. Pursuing these topics will test current model predictions, advancing theory and simulations with rare constraint in a regime not yet sampled.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 7982
Program Title: Warm Jupiters: the next step in uncovering giant planet formation and migration

Principal Investigator: Claringbold, Alastair

PI Institution: University of Warwick

Understanding planetary formation and migration via their atmospheric composition is a key goal of exoplanetary characterization. However, for any individual planets, the knowledge about the protoplanetary environment is too uncertain to relate formation to current composition. Only by using samples of planets with similar dynamical properties that imply shared formation pathways, and comparing composition between these samples, can we understand how formation impacts composition. We identify a third key population with a distinct formation pathway, warm Jupiters with inner companions. Standard disc migration is disfavoured for these planets, as it would destroy the inner planetary system, implying these warm Jupiters underwent only weak migration. We would therefore expect their atmospheric composition to reflect the local inner disc. We can compare this to the populations of the BOWIE-ALIGN programme, which is testing for differences in composition between misaligned hot Jupiters believed to form via high-eccentricity migration, and aligned hot Jupiters believed to form via disc migration. We will observe the transmission spectra of three warm Jupiters, NGTS-11b, TOI-216c, and TOI-1670c, combining them with planned observations of TOI-1130c and TOI-2525c. This will allow us to measure the C/O ratio and metallicity for these targets, which we can combine and compare to the BOWIE-ALIGN populations. We simulate our observational test, and perform 1000 random draws to demonstrate we can robustly detect a difference in composition in the face of both theoretical and observational uncertainties with 5 targets, meaning even a null result would be informative.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 7985
Program Title: Resolving the thin disk of a nearby Milky Way analog

Principal Investigator: Leroy, Adam

PI Institution: The Ohio State University

We propose panoramic MIRI and NIRCam mapping of the prototype nearby edge-on galaxy, NGC 4565 (inclination = 87.5 degrees). With < 20h total time, we will resolve the vertical structure of PAH emission, dust continuum, and multiple star formation tracers over the whole disk. Measurements of vertical structure are critical to test models of self-regulation in galaxies. Such vertical self-regulation is predicted by simulations and widely used to interpret observations of all types of galaxies but not yet strongly tested by direct, edge-on observations of other galaxies. JWST imaging will change that, achieving < 20 pc resolution and detecting emission all the way out to galactocentric radius > 30 kpc, far into the outer, HI-dominated regime. These observations are also ideal to identify and characterize giant interstellar filaments, which appear as extended in-plane structures in Milky Way dust observations. Thus, this program will test the generality of an emerging new paradigm in ISM structure.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Stars and Stellar Populations
ID: 7988
Program Title: Multiplexed Planet Discovery and Binary-Star Disk Demographics in the Young Cluster IC 348 with a Pilot for Full-Frame NIRISS AMI

Principal Investigator: Kraus, Adam

PI Institution: University of Texas at Austin

Directly imaged planets offer our best window into outer-planet demographics, provide exquisite spectra of planetary atmospheres, and (at young ages) capture planet assembly and circumplanetary disks in action. Binary systems offer repeatable tests of planet-formation models, directly connecting initial conditions (sculpting of disks by stellar companions) to final outcomes (planet demographics in (identical) older binaries). JWST is revolutionizing both, but it is limited by finite spatial resolution, most acutely for the youngest (but most distant) stellar populations where planets are brightest and planet assembly is ongoing. Ironically, those stars also still saturate. Fortunately, NIRISS AMI (Aperture Mask Interferometry) solves both problems, and the new full-frame mode finally allows multiplexing across the full 2.2 arcmin NIRISS FOV. We propose an extremely efficient multiplexed pilot survey with NIRISS Full-Frame AMI for the young cluster IC 348, simultaneously observing 25 cluster stars in 4 filters across the NIRISS FOV with just one pointing and costing just 13.2h. We will search for Jovian planets (down to 2 MJup) on solar-system scales (20 AU), testing if dense cluster environments produce as many giant planets as sparse moving groups. We will distinguish circum-primary/secondary disks within ~10 binaries via resolved colors, assessing where and how quickly planets form in binary systems. Finally, we will optimize strategies needed for future large surveys of planets/disks around hundreds of young stars using multiplexed AMI. Our pilot survey thus achieves cutting-edge stand-alone science, while also unlocking revolutionary future opportunities.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 7993
Program Title: Do protoplanetary disk substructures regulate water enrichment and pebble drift across different environments?

Principal Investigator: Huang, Jane

PI Institution: Columbia University in the City of New York

The inward radial transport of icy pebbles in protoplanetary disks influences the masses, compositions, and habitability of forming planets. Observations of disks in nearby star-forming regions have shown that the cool water vapor content in the inner disk and inferred pebble flux are anticorrelated with disk size, a trend that has been ascribed to larger disks having prominent substructures that trap dust and and reduce the icy pebble flux to the inner disk. Planet-disk interactions are the leading explanation for disk substructures, suggesting that the formation of wide-separation giant planets regulates whether the inner disk is water-rich or poor and thus the properties of planets that form there. However, the relationship between the inner disk water reservoir and outer disk structure has thus far only been studied in star-forming regions with mild UV fields. Most stars emerge in high UV environments, which can drive mass loss in the outer regions of disks through external photoevaporation and thus reduce pebble drift to the inner disk. To investigate whether the observed link between the inner disk water content and outer disk structure generalizes to more typical star-forming environments, we propose to obtain MIRI MRS spectra of disks in the irradiated Sigma Orionis cluster that have been imaged at high resolution with ALMA. These observations will shed light on the universality of processes that control the composition and architecture of planetary systems.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 7996
Program Title: ToO Observations of Stellar Occultations by TNO Ring Systems

Principal Investigator: Proudfoot, Benjamin

PI Institution: University of Central Florida Board of Trustees

In recent years, ring systems have been discovered around trans-Neptunian objects (TNOs) and dwarf planets Haumea and Quaoar. These ring systems were discovered during stellar occultations, when the target passes in front of a distant background star. Rings around small bodies are mysterious and subject to intense study and debate in the small body community. Currently, no consensus has been reached regarding the formation, evolution, and stability of these rings system. To enable further study of these enigmatic ring systems, we propose a 6 hour target-of-opportunity (ToO) program to observe stellar occultations by Quaoar and Haumea. We request two activations, one each for Haumea and Quaoar, totalling 6 charged hours. We estimate the probability of activation is 22% and 78% for Haumea and Quaoar, respectively. Given the low activation probability (esp. for Haumea), we request carry-over status, allwoing lifetime activation probabilities of 40% and 95% for Haumea and Quaoar. Our observations will allow us to (1) complete a census of the ring systems, (2) search for spatial and temporal variability within each ring system, and (3) examine the material properties of the rings using NIRCam's multi-channel observing capabilities. JWST's aperture, ultra-fast readout, and multi-channel observing make JWST the premier facility to observe stellar occultations of dwarf planet rings. Understanding dwarf planet rings opens up various avenues of research with broad interest across the astronomy and planetary science communities, as well as the public at large.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 8004
Program Title: Cliff Hangers: Testing for Atmosphere-Mantle Interactions in Radius Cliff Planets

Principal Investigator: Batalha, Natasha

PI Institution: NASA Ames Research Center

Remarkable progress has been made in recent years to understand the demographics of exoplanets from transit and Doppler survey data. The sharp drop in exoplanet occurrence between 2.5 Rearth and 4 Rearth, known as the Radius Cliff, is arguably the most dramatic feature in the occurrence distribution of small planets, yet, planets along the cliff remain unexplored by JWST. These "radius cliff" planets are hypothesized to have distinct elemental ratios, when compared to their larger radius neighbors, because of large-scale magma-atmosphere interactions that could modify the Carbon and Oxygen abundances, ultimately lowering the atmospheric C/O ratio. Our program will test this hypothesis by obtaining NIRSpec G395H transmission specroscopy of two radius cliff planets and answer the question: do the atmospheres of radius cliff planets trace the chemical changes predicted by theory? Focusing on the radius cliff regime will have a far reaching out-of-field impact on theoretical models that are tuned to reproduce the position and steepness of the radius cliff. Our program will leverage JWST's unique capabilities to detect the major carbon and oxygen-bearing species in transmission for this high-priority temperature-radius regime. Combined with JWST observations of sub-Neptunes at the top of the cliff and Neptune-size planets at the bottom of the cliff, our sample will provide meaningful constraints on theoretical models of the physical processes that sculpt the frequency distributions of small planets.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 8007
Program Title: Characterizing C60 cations in the cavity of NGC 7023

Principal Investigator: Tielens, Alexander

PI Institution: University of Maryland

Buckminsterfullerene (C60) is a large carbonaceous molecule consisting of 60 C atoms, that is widespread and abundant in the universe. C60 belongs to a family of large aromatic molecules comprised of polycyclic aromatic hydrocarbons (PAHs) and fullerenes. These aromatic species play an important role in the heating and the charge balance of the interstellar medium (ISM). C60 is the only large aromatic molecule to be firmly identified in space and is thus a reference point for the studies on the behaviour of other aromatic species in space. Because of its low ionization potential and harsh conditions in the ISM, we also expect the presence of C60 cations, C60+ and C60++, in the ISM that have eluded detection till date. We propose to obtain MIRI-MRS observations of 3 positions in the cavity of the reflection nebula NGC 7023, to firmly identify and characterize the infrared spectral signatures of C60+ and C60++. Given its strong radiation field and well studied photodissociation region, the reflection nebula, NGC 7023, is well suited for this study. We will use the measurements obtained from the proposed observations to study the processes that determine the ionization balance of C60 and hence other large aromatic molecules in space. This will significantly advance our understanding of the physics and chemistry of large aromatic molecules in the universe.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 8017
Program Title: Resolving Atmospheric Uncertainties and Building a Legacy Dataset for WASP-39b

Principal Investigator: Welbanks, Luis

PI Institution: Arizona State University

Despite extensive observations of WASP-39b with multiple JWST instruments, the atmospheric metallicity and elemental abundance ratios of this benchmark planet remain unconstrained, with current estimates of O/H in particular ranging from solar to over 100× solar. The lack of precision in the at wavelengths from 1-3 μm, due to NIRSpec/PRISM saturation and unresolved degeneracies in the NIRISS/SOSS spectrum, has prevented a definitive determination of the planet's metallicity and water abundance. We propose to observe two additional transits of WASP-39b using JWST's NIRSpec/G140H and NIRSpec/G235H, which will cover the critical 1–3 μm range at higher resolution and precision. These observations will resolve the current bimodal solutions for WASP-39b's atmospheric composition, allowing us to constrain the metallicity and determine the planet's true elemental abundances, including its C/O and S/O ratios. By achieving closure on this long-standing mystery, our program will cement the legacy of the JWST Transiting Exoplanet Early Release Science Program and provide a robust dataset for future studies of exoplanet atmospheres. In addition to resolving WASP-39b's atmospheric properties, our observations will contribute to broader planetary science by testing mass-metallicity trends and core accretion models of planet formation. With the Saturn-mass WASP-39b serving as a fulcrum in these analyses, we expect our results to provide key insights into the relationship between atmospheric and bulk planetary metallicity. Our data will also enable further studies of atmospheric escape and photochemistry, setting the stage for future high-resolution atmospheric characterization efforts.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 8018
Program Title: DIVER: Deep Insights into UV Spectroscopy at the Epoch of Reionization

Principal Investigator: Lin, Xiaojing

PI Institution: University of Arizona

JWST has ushered in a new era for spectroscopic studies of galaxies at the Epoch of Reionization (EoR). Early observations have revealed hard radiation fields and bursty star formation, sometimes accompanied by extreme interstellar medium (ISM) conditions and unusual chemical abundance. High-quality rest-frame UV spectroscopy of EoR galaxies is urgently needed to address the knowledge gap in young stellar populations and nucleosynthesis history in the early Universe, paving the way for future studies on first galaxies. However, such data are very limited even after three cycles, restricting studies to individual cases or stacking analyses. DIVER will conduct a deep G140M/F070LP spectroscopic survey with unparalleled efficiency in the GOODS-N field, targeting more than 140 galaxies at z=5-9. Complementary PRISM observations will place the observed UV features in a broader context of ISM conditions. Covering key UV lines (e.g., CIV, HeII, CIII], OIII]), DIVER will establish the largest and deepest UV spectral database for EoR galaxies. DIVER will directly (1) clock the star formation history by determining the distribution and redshift evolution of carbon abundance, and (2) probe the prevalence of extremely high electron density and its connection to bursty star formation and chemical peculiarity. DIVER will also lead to various high-profile science including the UV demographics of AGNs and massive stellar populations, and constraining the reionization history through LyA. With great legacy values, DIVER will advance our understanding of star formation and chemical enrichment history in the early Universe, providing a crucial foundation for studies of z>10 galaxies.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 8047
Program Title: Extremely massive galaxies in the early universe? Confirming the nature of the most model-breaking object by hunting for stellar absorption features

Principal Investigator: Wang, Bingjie

PI Institution: The Pennsylvania State University

The discovery of a population of red, compact objects at redshifts z > 6 is among the most surprising and significant findings from JWST. Initial stellar mass estimates from photometry suggest values as high as 10^11 Msun, exceeding theoretical limits. Follow-up 48 min spectroscopic observations have only deepened the puzzle, revealing evidence that supports two drastically different interpretations: unexpectedly massive galaxies indicated by the observed Balmer breaks, which are signatures of old stars, or dust-reddened AGNs contributing to the red continuum, suggested by the presence of broad Balmer emission lines. The resulting uncertainty in the inferred stellar mass spans over 1 dex. To resolve this, we propose NIRSpec/G395M spectroscopy to measure velocity dispersions in stellar absorption lines in the brightest massive galaxy candidate at z > 6, RUBIES-49140. It also has the most extreme stellar mass of 10^11 Msun if all the light is emitted by stars. A direct measurement of the dispersion in the most model-breaking object at the most discerning wavelengths is our best and only way forward. With a small investment of JWST time, we would be able to finally determine the origins of JWST's most enigmatic new population.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 8051
Program Title: MIRI Spectroscopic survey at z~10: Insights into the Nature of Primordial Galaxies

Principal Investigator: Alvarez-Marquez, Javier

PI Institution: Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.

One of the most unexpected discoveries of JWST has been the large number of luminous galaxies at very early epochs in the Universe (z>10), far exceeding the predictions for current galaxy formation models. While several astrophysical scenarios have been proposed, the nature and formation of these galaxies remain largely unknown and a subject of active debate. The primary limitation comes from the narrow rest-frame spectral coverage (<0.4um) of the NIRCam and NIRSpec instruments. This survey aims to address these gaps by leveraging MIRI LRS spectroscopy to detect key optical emission lines, such as Hbeta+[OIII]4960,5008 and Halpha, and the underline optical continuum. These observations will constrain critical astrophysical parameters, including SFR, burstiness, ionizing production efficiency, stellar mass, metallicity, and also, establish the dominant ionizing source (starburst and/or AGN) in these primordial galaxies. The survey targets a sample of ten galaxies at redshift of ~10, including two X-ray AGN candidates. The sample spans a wide range in UV absolute magnitudes (-17.6 to -20.5), extending well below the characteristic M*_UV (-20.6 mag) at z~10. This proposal will provide critical insights into the nature of primordial galaxies, offering a comprehensive view of the build up of stars, metals, and dust in the early Universe, and the processes driving the formation of luminous galaxies in the pre-Reionization Epoch.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 8060
Program Title: JWST Multi-Cycle Deep Transient Survey in GOODS-S

Principal Investigator: Egami, Eiichi

PI Institution: University of Arizona

JWST is revolutionizing the study of high-redshift transients, opening up a new window on supernova (SN) science in particular. The power of JWST as a supernova discovery machine was most spectacularly demonstrated by the recent JADES Transient Survey (JTS), which detected 79 SNe in the ~25 square arcmin area of the JADES Deep Field in the GOODS-S down to ~30 mag (45 in 2022, 34 in 2023; ~1-2/square arcmin per epoch). Remarkably, nearly half of the sample (38 SNe) are at z>2 (reaching up to z~5), which can be compared with only four z>2 SNe discovered by HST despite an investment of ~1400 orbits (e.g., CANDELS, CLASH). Leveraging ~230 hours of the JADES observations that produced the 2-epoch deep NIRCam data in 2022 and 2023, we propose here to conduct a first comprehensive survey of high-redshift transients by revisiting the same field over the next three cycles. In each cycle, we will carry out 3-epoch multi-band NIRCam imaging to sample light curves and follow up brighter (<29 mag) sources with deep (~7 hr on-source) NIRSpec/MSA prism (R~100) spectroscopy. Scaling from JTS, we expect to detect ~90 SNe over 3 years (~45 at z>2), ~30 of which can be targeted for NIRSpec follow-up. The obtained data will not only allow us to study the physics of individual SNe but also enable us to investigate the evolution of their properties toward high redshift, such as Type Ia luminosities (critical for dark-energy constraints) and core-collapse SN rates (effective for tracing IMF evolution). With the combination of ~30 mag depth and 5-year time baseline, this program will be uniquely powerful for probing high-redshift transients, pushing the transient frontier beyond z~5.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 8063
Program Title: Beyond C/O and metallicity: Can refractory abundances reveal the origin of the largest planets?

Principal Investigator: Ruffio, Jean-Baptiste

PI Institution: University of California - San Diego

We propose to measure the abundances of four refractories (Potassium, K; Iron, Fe; Sodium, Na; Sulfur, S) in eight massive, directly imaged gas giant exoplanets (5-15 MJup; 10-160 au) with JWST/NIRSpec IFU. Refractories are elements that reside exclusively in solid form in the protoplanetary disk. In contrast, volatiles (e.g., C, O) evaporate from icy pebbles as they continuously migrate inward and cross evaporation fronts due to drag in the planet-forming disk. By measuring the relative enrichment of individual volatiles and refractories, the goal of this program is to yield new insight into the enigmatic formation mechanisms of gas giant planets on wide orbits and enable a comparison with the population of transiting planets. While young planets continuously accrete the volatile-rich gas, they can accrete various amounts of pebbles and planetesimals, but the refractory-rich pebbles get trapped by pressure bumps in the disk while larger planetesimals do not. Therefore, the volatile-to-refractory ratio (vol/ref) could indicate if massive directly-imaged planets formed preferentially through the accretion of pebbles (super-stellar vol/ref) or planetesimals (stellar vol/ref). However, disentangling the complex physical processes involved in planet-forming disks requires the measurement of multiple refractories and volatile species beyond even the recently measured and tantalizing C/S ratios. JWST now provides a unique opportunity to answer these fundamental questions by leveraging the unprecedented high-contrast sensitivity of the NIRSpec IFU at moderate spectral resolution (R~2,700; 1-2 um and 3-5 um), which has not been achievable from the best facilities on the ground.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 8105
Program Title: Are Supernovae Dust Builders or Wreckers? Let's Settle This!

Principal Investigator: Shahbandeh, Melissa

PI Institution: Space Telescope Science Institute

For too long, the supernova dust community has been focused on Type II supernovae (SNe II) as the primary dust factories in the Universe, mainly overlooking stripped-envelope supernovae (SESNe). However, the earliest cosmic dust likely emerged from the explosions of massive, short-lived stars--SESNe. With JWST's unparalleled capabilities, we can now monitor SESNe in the infrared and unlock the secrets of early dust formation and evolution. SESNe provide a unique laboratory for studying molecules like CO and SiO, which cool the ejecta to temperatures conducive to dust formation. The detection of CO in SESNe signals their untapped potential to reshape our understanding of cosmic dust production. This proposal aims to observe four SESNe over five epochs, capturing the rapid, evolving CO and SiO formation processes, their potential condensation into dust, dust onset, and dust growth over time. These multi-epoch observations will reveal the birth of dust in these SNe and distinguish between dust formed after the explosion and dust preexisting in the environment. SESNe, once neglected cousins of SNe II, may play a key role in contributing to the dust we observe in galaxies near and far, a hypothesis that this study aims to explore. By tracking the evolution of molecules and dust in SESNe, we will not only advance our understanding of stellar deaths, but also gain insights into the origins of cosmic dust, insights that may help us piece together the puzzle of the early universe's first metal-rich environments. This is an exciting and transformative moment in our exploration of cosmic dust. With JWST, the stage is set to rewrite the story of dust production in the cosmos.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8106
Program Title: Probing the chemical (in)homogeneity of free-floating brown dwarfs and planets in the Upper Scorpius star-forming region

Principal Investigator: Zhang, Zhoujian

PI Institution: University of California - Santa Cruz

A key challenge in star formation theory is explaining the origins of free-floating brown dwarfs and planets with 3--25 M_Jup. Both star and planet formation processes likely contribute at these low masses, but their relative roles remain unclear. Traditional IMF-based studies address this problem by surveying star-forming regions, but contamination and sample incompleteness can pose challenges. We propose a new approach to investigate these objects' formation by probing their compositional (in)homogeneity across a wide range of masses in the Upper Scorpius (USco) star-forming region. We will obtain NIRSPEC/G395H spectra for 42 carefully selected M8--L6 members with 7--40 M_Jup masses. Our observations will precisely measure [Fe/H], C/O, and isotope ratios (13C/12C, 16O/17O, 16O/18O), enabling robust hypothesis testing. If star-like formation dominates, these objects are expected to exhibit consistent compositions across the full mass range. However, if both processes contribute, we will identify a transition mass, above which objects show chemical homogeneity, while objects below have significantly larger scatter in compositions. USco is unique for this study as it is one the nearest and youngest star-forming regions, with the largest confirmed sample of free-floating planets. Our observations will not only characterize the atmospheres and origins of young free-floating brown dwarfs but also offer critical insights into the origins of directly imaged exoplanets. Moreover, the potential transition mass between star-like and planet-like formation, to be identified by our program, will provide a more physics-driven critical mass for defining exoplanets and brown dwarfs.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 8139
Program Title: Local Analogs of JWST's high-z AGN: Uncovering a deeply embedded IMBH in a compact metal poor dwarf

Principal Investigator: Satyapal, Shobita

PI Institution: George Mason University

Observing the earliest galaxies and their black holes during the epoch of reionization is one of the major goals of JWST. While JWST has delivered spectacular rest-frame optical and UV observations of galaxies at high redshift, these observations lack the spatial resolution, sensitivity, and access to longer wavelengths necessary to constrain the ionizing radiation field, and map the state and structure of the ISM of these galaxies. Thus, despite the tremendous progress in uncovering faint AGNs in the early universe, our understanding of the earliest black holes and their impact on their host galaxies remains incomplete. While it is not possible to uncover faint AGNs in metal poor dwarfs and study the detailed physics of their interaction with their host galaxies at high-z, objects like the faint AGNs discovered by JWST at high-z do exist in the local universe. We propose a MIRI/MRS investigation of J1201+0211, a compact metal poor dwarf recently found by JWST NIRSpec to display a striking unresolved nuclear source with steeply rising continuum suggestive of an accreting IMBH and inconsistent with even the most extreme stellar population known, yet no high ionization lines are detected in the NIR. Our observations are designed to confirm or refute the presence of an accreting IMBH, constrain the radiation field and stellar population, and map the ISM on scales down to parsec scales in local primordial galaxy analogs, paving the way for a new understanding of the high-z AGNs now being discovered by JWST. These observations can uncover an IMBH with mass two orders of magnitude lower than any known, or identify crucial unknown physics in metal poor stars and the ISM.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8140
Program Title: Empirically anchoring the physics of silicate clouds using L0- T9 benchmark brown dwarfs

Principal Investigator: Zhang, Zhoujian

PI Institution: University of California - Santa Cruz

The frontier of brown dwarf studies is the accurate determination of their atmospheric compositions. However, this task is challenging, as the spectra of L and T brown dwarfs are influenced by silicate clouds, which causes their spectroscopically measured compositions to differ from these objects' actual bulk compositions. To tackle these challenges, we propose NIRSPEC/PRISM and MIRI/LRS 0.6--14 um spectroscopy for 16 carefully selected high-mass benchmark brown dwarfs, spanning the full L and T spectral types. These brown dwarfs orbit well-characterized FGK parent stars with uniformly measured stellar abundances across sub-solar to super-solar values, providing us with precise bulk compositions (C/O, [M/H], Mg/Si) from their parent stars, making them unique benchmarks for silicate cloud physics. (1) Our targets --- including four L0--L2, eight L3--L9, and four T5--T9 benchmark brown dwarfs --- trace the physics of silicate clouds at temperatures before, during, and after cloud condensation. By measuring their C/O and [M/H] from our JWST observations, we will establish the first empirical calibration linking the observable and bulk compositions across the full cloud formation cycle. (2) Our L3--L9 targets, with their silicate cloud features uniquely probed by MIRI, will allow us to investigate the causal relationship between bulk compositions and the specific types of silicate clouds that form in their atmospheres, directly assessing modern cloud formation theories. These observations will produce a legacy spectroscopic dataset, offering quantitative context for atmospheric and formation studies of directly imaged exoplanets.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Stars and Stellar Populations
ID: 8142
Program Title: JEDIS: The JWST Eccentric debris DIsk Survey

Principal Investigator: Lovell, Josh

PI Institution: Smithsonian Institution Astrophysical Observatory

Disk observations are key to understanding the histories and evolution of exoplanetary systems. Whilst bright protoplanetary disks provide crucial insights into the early formation of giant planets over the first ~1–10 Myr, fainter debris disks provide essential clues on the formation of planets and the evolution of exoplanetary architectures over 10s–1000s of Myr. By resolving rings of circumstellar material produced in debris disks, it is possible to pinpoint the locations of perturbing bodies that are either in the act of sweeping up dust, or have already cleared out dust-producing planetesimals. We propose to image two eccentric debris disks with MIRI to complete observations of all MIRI-resolvable eccentric rings. Based on their characteristic emission profiles at mid-infrared wavelengths, resolved eccentric disks in the mid-IR provide important constraints on models of planet-disk interactions. Our observations will enable tests of new theoretical predictions for mid-infrared debris disk morphologies, only possible with the sensitivity and resolution of JWST MIRI. By fitting such models to the proposed observations, we will connect eccentric debris disk images to their underlying exoplanetary architectures. Our investigation will jointly utilize the latest available ALMA data, to simultaneously model and fit mid-infrared JWST MIRI and millimeter ALMA data. Our proposed eccentric disk observations follow directly from the release of iconic JWST MIRI images of Fomalhaut's eccentric ring, and promise brand-new science to place in context how extra-Solar planetary systems are shaped after their formation.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8147
Program Title: Chasing the Great Red Spot: Exploring Coupling Between Jupiter's Atmospheric Layers

Principal Investigator: Tiranti, Paola

PI Institution: Northumbria University

The upper atmospheric global energy budget of gas and ice giants remains a mystery. This is because ground-based and space instrumentation campaigns have been unable to characterize coupling between different atmospheric layers. Understanding coupling mechanisms, and how depositions of gravity waves generated in the deep troposhere dissipate through upper layers, is the key to understand the global energy balance. During JWST ERS #1373 Jupiter’s Great Red Spot (GRS) observations revealed for the first time small-scale upper-atmospheric features in the planet’s ionosphere. These appeared to be a result of upward propagating waves generated in the lower atmosphere. Being just one snap-shot observation, there were no additional means to constrain to what extent does wave dynamics affect the upper atmosphere. We propose to track the GRS across the planet with NIRspec-IFU for 3 rotations, which allows to to distinguish between stochastic and secular trends in wave activity, and therefore how waves affect the upper atmosphere above the most famous storm in the Solar System. JWST acquires high spectral resolution spectra of ionospheric H3+, enabling to study changes in temperature and density, and how these vary as waves propagate in the upper atmosphere. Exploring dynamics of energy transport at Jupiter will enable us to further our understanding of the other giant planets, as little is known about these. Furthermore, output from this program will enable calculations of important wave parameters for exoplanetary atmospheric models and therefore contribute to the detection and characterization of exo-ionospheres.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8155
Program Title: Storms are Brewing in the ONC: Variability Monitoring of 50 Substellar Worlds

Principal Investigator: Limbach, Mary Anne

PI Institution: University of Michigan

We propose NIRCam dual-band variability monitoring of 50 substellar worlds in the Orion Nebula Cluster (ONC) for 36 hours. This program will observe a similarly aged (1-3 Myr) population of substellar worlds (2-75 Jupiter masses), probing two distinct atmospheric depths by capturing light curves in two bands simultaneously—on and off the water absorption feature, with the ability to measure phase lags between the two different pressure levels. These observations will offer crucial insights into how atmospheric variability shapes the characteristics of substellar objects, helping to identify trends, outliers, and targets for future spectroscopic follow-up. We will be able to detect variability with amplitudes below 0.5% for most of the sample. The program will provide measurements of rotation periods for dozens of substellar objects, including the free-floating planetary-mass worlds down to 2 Jupiter masses, aiding in extending gyrochronology into the substellar regime and tracing the angular momentum evolution of planetary-mass objects and brown dwarfs. Additionally, these data will allow us to explore how slowed rotational collapse may influence the radii of young substellar worlds. The resulting time-domain catalog of the ONC produced from this program would provide a legacy resource for a wide range of future studies.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8170
Program Title: The power of the dark side: Weighing a super-massive neutron star with JWST

Principal Investigator: Linares, Manuel

PI Institution: Norwegian University of Science and Technology

JWST spectroscopy provides a unique opportunity to accurately measure the mass of the heaviest known pulsars, within compact binary millisecond pulsars (also known as redbacks and black widows). The maximum mass that a neutron star can support, Mmax, has important implications across multiple research fields, including astrophysics, nuclear physics and gravitational wave astronomy. In 2018, ground-based observations revealed one of the most massive neutron stars in the redback pulsar PSR J2215+5135, with 2.3 Solar masses (Msun). This gave tantalizing evidence that Mmax is higher than 2.3 Msun, yet the he relatively large (7%) uncertainty prevents firm conclusions. This GO program capitalizes on the superior NIR spectroscopic capabilities of JWST-NIRSpec in order to improve the accuracy of this mass measurement, down to 2%. JWST observations at 1-2 microns can measure the velocity and temperature of both the dark and bright sides of the irradiated companion star. Establishing with high confidence the existence of super-massive neutron stars, well above 2 Msun, would have profound consequences for our understanding of matter at supra-nuclear densities (>3E14 g/cm^3).

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8173
Program Title: The evolution of comet-impact products in Jupiter's atmosphere: a benchmark for auroral chemistry in giant (exo)planets

Principal Investigator: Rodriguez Ovalle, Pablo

PI Institution: Observatoire de Paris

We propose to extend the monitoring of exogenous species in Jupiter’s atmosphere by leveraging JWST’s MIRI/MRS observations, focusing on the evolution of H2O, CO2, and HCN. These species, initially introduced by the comet Shoemaker-Levy 9 (SL9) impact in 1994, have since exhibited a puzzling chemical behavior. Our analysis of archived JWST data from programs ERS#1373 and GTO#1247 demonstrates that MRS can effectively map the meridional distribution of CO2, H2O, and HCN, revealing unexpected trends in their abundances across Jupiter’s southern hemisphere. Notably, CO2 and H2O exhibit intricate latitudinal evolution in the South Polar Region, suggesting oxygen exchange between the two species, with the direction of exchange varying with latitude . These findings challenge existing models of polar chemistry and point to the involvement of multiple processes such as auroral ion-neutral chemistry, polar aerosol heterogeneous chemistry, and possibly an external oxygen influx from Io’s torus. To disentangle these processes, we propose a comprehensive mapping of HCN, H2O, and CO2 across both hemispheres, targeting regions within and outside auroral zones. By comparing the temporal abundance trends since 1994, and by studying the impact of auroral precipitation, we aim to uncover the key chemical pathways governing the destruction and production of these molecules. These observations will not only refine our understanding of Jupiter’s atmospheric chemistry but also provide insights into similar processes occurring on other giant planets and exoplanets, with potential implications for understanding the chemical evolution of exoplanetary atmospheres under cometary impacts.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Exoplanet System Formation and Dynamics
ID: 8185
Program Title: A pocket of last resistance: characterizing the evaporating globule near a massive O-star binary

Principal Investigator: Bik, Arjan

PI Institution: Stockholm University

Stellar feedback, in the form of UV radiation from massive stars, gradually destroyes the molecular cloud the stars formed in. The last pockets of last resistence agains the progressing ionization front are the densest cores in the molecular cloud. These pre- and protostellar cores become exposed to the UV radiation when the lower density material around them evaporates and they become visible as evaporating globules. The mass of the forming proto stars in these globules as their protostellar envelopes are evaporated by the UV field. We propose NIRSPEC and MIRI/MRS spectroscopy of a large evaporating globule located very close to one of the most massive binaries in our Galaxy, Pis24_1. The exceptionally high levels of FUV and EUV radiation incident on this globule make it a unique case. These observations will provide a benchmark for studying the physical and chemical properties, as well as the evolution of the evaporating wind, under extreme EUV and FUV irradiation — far beyond the reach of current modeling efforts. Moreover, the proposed spectra will help us identify the nature of the various observed components within this globule, allowing us to derive mass-loss rates and e life time of the globule and the proto-planetary disks harbored inside.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 8204
Program Title: Give me a break: the search for stars in a prototypical Little Red Dot

Principal Investigator: Greene, Jenny

PI Institution: Princeton University

We propose a search for stellar absorption in the Balmer break of the brightest known `Little Red Dot'. Despite two years of intense study with JWST, we still do not know whether these abundant and compact red sources are extraordinarily dense stellar systems, or red active galactic nuclei. A clean test will be provided by detecting (or not) Balmer absorption around the break. This is the only source bright enough to do so unambiguously, and so stands to teach us the nature of these new enigmatic objects.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 8213
Program Title: Warm or gone? Searching for molecular gas in a massive quiescent galaxy at z = 3

Principal Investigator: Scholtz, Jan

PI Institution: University of Cambridge, Kavli Institute for Cosmology

The discovery of massive quiescent galaxies at z>3 with JWST has shown that the galaxy evolution is much faster than previously thought. Galaxies need to grow to 1e11 Msol and quench within the first billion years of cosmic time. Such short timescales may require significantly stronger and faster feedback from supermassive black holes than at Cosmic Noon, but the exact quenching mechanism still eludes us. In the search for clues, an overlooked direction has been the warm ISM/CGM, which theoretical models suggest should hold the key to understanding feedback. We propose deep MIRI-MRS observations of warm molecular gas in GS-15078 - a massive quiescent galaxy at z~3.06, hosting an AGN with strong neutral gas outflows yet no evidence for cold molecular gas or dust from ultra-deep ALMA observations. These pioneering observations will illuminate the last corner where molecular gas can still be found, answering the question of whether this gas phase is indeed gone, or if it is still present, but heated to higher temperatures. Regardless of the detection, this observation will determine the quenching mechanism of this quiescent galaxy: 1) starvation of the galaxy or 2) preventative feedback by heating the gas

Proposal Category: AR
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8214
Program Title: Mining JWST data for hidden asteroid gems

Principal Investigator: Burdanov, Artem

PI Institution: Massachusetts Institute of Technology

While the smallest bodies in Earth vicinity are abundant, they are challenging to observe due to their faintness. Yet, they hold the keys to major endeavors ranging from studying meteorite sources (and thus planetary-defense efforts) to understanding the collisional and dynamical evolution of asteroidal bodies through the solar system history (2023-2032 Decadal Survey Q4.1). Fortunately, JWST's unique infrared capabilities covering the emission peaks of asteroids located up to 10 au, can be combined with synthetic-tracking techniques to detect main-belt asteroids (MBAs) as small as 10 m. Recently, 138 of such decameter MBAs were detected serendipitously crossing MIRI/F1500W's field of view (FoV) during exoplanet observations of the TRAPPIST-1 system. These observations enabled for the first time to sample a size regime associated with meteorite parent bodies, commonly transported from MBAs to near-earth objects (NEOs). They revealed a break in the sampled size-frequency distribution (SFD) around 100 m—as expected for a population driven by collisional cascade with the lowest material strength at this diameter. Here, we propose a Legacy Archival Reseach program to mine 10x more data with FoVs sampling a wide range of inclinations. The larger data set will yield O(600) decameter MBAs and thus provide (1) strong constraints on the SFD's slopes, (2) an inclination-dependence study of the SFDs, and (3) a color-dependence of the SFDs (using data in various MIRI filters). Associations of decameter MBAs to asteroid families, informed by the corresponding inclinations and colors, will be used for studies of the meteorite source regions (in particular of H, L, CM, or CI classes).

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 8217
Program Title: Pushing the limit of supermassive black holes correlations to ultramassive galaxies

Principal Investigator: Nguyen, Dieu

PI Institution: Centre for Astronomical Research of Lyon (CRAL)

Supermassive black holes (BH) are a crucial ingredient for galaxy evolution. They closely correlate with galaxy properties, especially velocity dispersion, below a critical stellar mass of about two hundred billion (2e11) Solar masses. But the situation is less clear and highly debated for larger galaxy masses. This uncertainty is due to the lack of nearby very massive galaxies for which their BH masses can be measured reliably with current instruments. With its stable and well-characterized PSF and high spatial resolution, JWST allows us to expand the volume where BH mass can be measured via stellar dynamics and reach the most massive galaxies. Here we propose to observe with JWST/NIRSpec and NIRCam the ultimate full-sky sample of 12 ultramassive galaxies accessible with JWST in various environments. We make detailed simulations of the BH extractions for all target galaxies and show that different BH formation scenarios provide unambiguously different results for the galaxy sample we propose. This program will provide a definitive view of this essential yet poorly-understood regime of ultramassive black holes.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 8233
Program Title: Mapping the Atmosphere and Interior of HAT-P-13b: The Next Benchmark for Exoplanetary Science

Principal Investigator: Miguel, Yamila

PI Institution: Universiteit Leiden

We propose to observe two transits of HAT-P-13b using JWST's NIRISS and NIRSpec instruments to perform the first atmospheric characterization of this unique exoplanet. HAT-P-13b stands out due to its precise Love number measurement, comparable to those of Solar System planets, offering valuable insights into its internal structure. However, the planet’s atmosphere remains unexplored, and measuring its atmospheric metallicity is crucial to fully interpreting its internal composition. This proposal aims to achieve two primary objectives: (1) Determine the atmospheric metallicity of HAT-P-13b by targeting the CO2 spectral feature at 4.5 microns and H2O features at wavelengths below 4 microns, and (2) Use this data to refine models of the planet’s interior structure. Combining atmospheric metallicity with the Love number will make HAT-P-13b one of the most comprehensively understood exoplanets, setting a new benchmark for planetary studies and enhancing our understanding of planetary formation and evolution.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 8245
Program Title: Mid-infrared overview of the turning on AGN candidate and X-ray QPE emitter SDSS1335+0728

Principal Investigator: Sanchez Saez, Paula

PI Institution: European Southern Observatory - Germany

The galaxy SDSS1335+0728, which had exhibited no prior optical variations during the previous two decades, began showing significant nuclear variability in the Zwicky Transient Facility (ZTF) alert stream in December 2019. In February 2024, more than four years after the first ZTF alert, it started showing variable X-ray emission. A recent NICER monitoring program revealed a Quasi-Periodic Eruption (QPE) X-ray light curve. The X-ray/UV/optical behavior, coupled with the host-galaxy properties, suggests that SDSS1335+0728 hosts a one million solar mass black hole that is currently turning on. We propose JWST MIRI MRS spectroscopy to better understand the nature of the activity observed in SDSS1335+0728, confirm or rule out the ‘turning on’ AGN hypothesis, and probe the formation of a dusty torus in this potential newborn AGN.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Stars and Stellar Populations
ID: 8258
Program Title: Formation and nature of the UV-brightest starbursts in the distant Universe

Principal Investigator: Marques-Chaves, Rui

PI Institution: University of Geneva, Department of Astronomy

We propose JWST observations of a new class of extremely UV-bright galaxies at z~2-4 with properties unlike anything observed so far, but reminiscent of those expected in the early Universe. These sources are the UV-brightest starbursts known, with surface densities and spectral features akin to young massive star clusters. Their rest-UV spectra show indications of Very Massive Stars and potential top-heavy IMFs, rarely seen in the local Universe but predicted at very high redshifts. They are also the strongest LyC-emitting galaxies known so far, questioning the paradigm of cosmic reionization dominated by UV-faint sources. On top of that, they appear to be formed through massive inflows, perhaps monolithically, with exceptionally high star formation efficiencies leading to very short gas depletion timescales (few tens Myr). These enigmatic objects may completely change our understanding of UV-bright galaxies and their potential role in early galaxy formation and cosmic reionization. Does this new galaxy population represent a dominant, yet previously unproved mode of star formation and LyC escape at high redshift? Are they archetypes of the now well-established overabundant population of UV-bright galaxies at z>10, but whose nature remains unknown? In this Small proposal (38hrs), we request high-SNR JWST NIRSpec/IFU and NIRCam observations to unambiguously establish all these exceptional properties, including the confirmation and characterization of extreme stellar populations and their ionizing output, unveil extreme galaxy formation mechanisms and stellar assembly histories, and test a new mode of LyC escape, a game changer in our census of the sources of reionization.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 8273
Program Title: Photometric Quasar Light Echo Tomography at z=5.7 with Subaru/HSC and NIRCam/WFSS

Principal Investigator: Bechtel, Shane

PI Institution: University of California - Santa Barbara

Episodes of luminous quasar activity are directly related to supermassive black hole growth. The ionizing radiation emitted over a quasar's lifetime alters the ionization state of the surrounding intergalactic medium, enhancing the Lya forest transmission, which can be observed in absorption spectra of background sources. We propose a new technique to photometrically map these quasar light echoes through Lya forest tomography, using high-redshift [OIII] emitter galaxies selected via NIRCam/WFSS with the F356W filter. By measuring their UV continua with the NIRCam F115W and F200W filters, and existing Subaru/HSC narrowband imaging, one can measure the Lya forest transmission in the vicinity of a foreground quasar. In this proposal, we request NIRCam/WFSS observations to measure Lya forest transmission values in the vicinity of a foreground quasar at z~5.7, towards efficiently selected background [OIII] emitters at z~5.8-7.0. This program will allow for unprecedented constraints of the quasar emission geometry, providing a new window for studying SMBH growth.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 8277
Program Title: A Comprehensive Survey of the Stellar Halos of Milky Way Analogs out to 20 Mpc: Revealing Galaxy Merger Histories and Their Effects

Principal Investigator: Smercina, Adam

PI Institution: Space Telescope Science Institute

What role does merging play in driving the structural, star formation, and kinematic evolution of Milky-Way mass galaxies? Galaxy formation simulations predict that these impacts depend on numerous factors, particularly the stellar mass and time of the merger. Stellar halos contain debris from these mergers, and studies of the Milky Way and M31 show that measurements of these halos can reveal merger mass and time, linking merger history with galaxy features. Resolving stars in the halos of highly-inclined galaxies is key to measuring halo mass and merger time. Pilot studies using HST and from the ground have clarified the most useful observational strategies and aided in the development of interpretive tools, but the samples are too small to distinguish between the wildly different predictions of modern cosmological simulations. We propose a NIRCam F115W/F277W resolved-star survey of the stellar halos in a sample of 28 highly-inclined Milky Way-mass galaxies, with distances of 9-20 Mpc. With the power of JWST, we will target the minor axes of these galaxies, and use the tested method of individual resolved RGB stars to measure stellar halo masses and average metallicities, determine precise TRGB distances (22 new distances, including 5 SN1a hosts), and estimate the dominant merger time by combining with resolved age-sensitive bright AGB stars. When combined with existing measurements for nearby galaxies, this survey will measure stellar halo properties and merger histories for a diverse, volume-limited, and representative galaxy sample to 20 Mpc; a sample with the statistical power to reliably assess the role of merger history in galaxy evolution for the first time.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 8281
Program Title: A gravitational perturber in B1938+666: a challenge for CDM or an unusual globular cluster?

Principal Investigator: Vegetti, Simona

PI Institution: Max Planck Institute for Astrophysics

Cold Dark Matter (CDM) is the current standard paradigm for galaxy formation and successfully reproduces a wide variety of observations. Still, it remains largely untested in the non-linear sub-galactic regime. A clear prediction of this model is that many low-mass halos should surround any galaxy and should populate its line of sight. As most of these objects are expected to be completely dark, strong gravitational lensing provides a unique channel to detect them and determine their properties. Very long baseline interferometric observations at 1.7 GHz of the gravitational lens system B1938+666 have led to the gravitational detection of an unprecedentedly low-mass object of unknown nature. With a total mass of just 10^6 M_sun, it could be a non-luminous CDM halo, a globular cluster, or an ultra-compact dwarf galaxy. However, its inferred properties are inconsistent with those predicted for CDM dark matter halos, and unusual when compared to globular clusters in the Local Universe. Its high concentration agrees better with that of a core-collapsed dark matter halo, as is possible in self-interacting dark matter models. The JWST observations requested here are the final and crucial ingredient in determining the nature of this detected object. Measuring or placing a meaningful lower limit on its mass-to-light ratio is the most reliable avenue to robustly distinguish between a globular cluster, a highly concentrated dark matter halo, and an ultra-compact dwarf galaxy. These JWST observations will unleash the full impact of this remarkable discovery, with implications either for the nature of dark-matter or for the evolution of compact stellar systems across cosmic time.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 8290
Program Title: The obscured regions of the nearest Lyman continuum leaker: massive stars or accreting black holes?

Principal Investigator: Oestlin, Goeran

PI Institution: Stockholm University

Escaping Lyman continuum radiation from low mass star forming galaxies likely were the agents of cosmic reionization at a redshift z>6. At the redshifts in question, the sightlines are completely opaque to Lyman continuum (LyC), making direct measurements of the LyC escape fractions impossible to measure directly. Therefore attention has been drawn to local universe analogs, where the escape fraction can be measured directly, and physical conditions studied in a detail noit possible at high redshifts. Haro11 is the nearest known Lyman continuum emitting galaxy and thereby offers unique opportunities to explore the physical conditions that allows LyC to escape into intergalactic space. It is a dwarf galaxy merger, and present 3 starburst knots (A, B, and C), each of which have been studied extensively, and it contains an unusually rich population of young massive star clusters. Recent COS spectroscopy shows LyC to be emitted from knots B and C. Curioisly, both these knots contain a luminous compact X-ray source, while knot A does not. This raises questions as to whether the LyC escape is connected to accreting balck holes. With the proposed observations we will search for the sites of X-ray emission and determine if they are low mass AGN by revealing themselves through hot dust and [NeV], [NeVI] emission. We will in parallel probe young obscured star clusters, for a full census of the ionizing photon production contributed by massive stars, and map the dust geomertry Hence we will be able to gauge the relative contributions from stars and X-ray sources to the ionization budget of Haro11 - the nearest Lyman continuum leaker.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Stars and Stellar Populations
ID: 8301
Program Title: JWST Mid-IR Observations of Warm Debris Disks around Nearby M-dwarfs

Principal Investigator: Song, Inseok

PI Institution: University of Georgia Research Foundation, Inc.

M-type dwarfs are the largest constituent of the Universe and the most likely host star of the nearest exoplanetary system. Disks around main-sequence stars are very important environments as the initial condition of planet formation and the blueprint of an underlying planet's dynamical evolution. Therefore, disks around M-dwarfs can inform us of the most important planet formation/evolution environment around the most ubiquitous exoplanetary systems. Unlike their more massive main-sequence counterparts, discovered debris disks around M-dwarfs, hereafter M-dwarf disks, are extremely rare. The paucity of M-dwarf disks has been interpreted either as non-existence or non-detection. The non-existence scenario ties closely to the fundamentally different dust grain dynamics around M-dwarfs where the stellar wind plays a main role in grain removal mechanisms (drag or blow out), replacing the role of radiation around more massive stars. Recently, from the cross-correlation of Gaia DR2 dwarfs against sources in the AllWISE catalog, 49 late-K and M-dwarf disks (37 new) have been discovered. We propose to obtain MIRI/LRS spectra covering the wavelength range of 5-15 micron of 20 brightest M-dwarf disks from this list. With LRS spectra, we will (1) assess the existence of solid state emission features, (2) evaluate the potential different evloutionary pathways of dust grains around M-dwarfs, and (3) better constrain disk parameters [T_disk and fractional IR luminosity] of the statistically significant sample of M-dwarf disks.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 8309
Program Title: It’s (poly)Morphin’ Time! Solving the quartz quandary of WASP-17b

Principal Investigator: Mullens, Elijah

PI Institution: Cornell University

The discovery of SiO2 clouds on the hot Jupiter WASP-17b marked the first time the composition of clouds on a transiting exoplanet has been conclusively determined. This initial detection gives us a unique opportunity to dive deeper and reveal the structure of cloud particles themselves. It is still a mystery of whether SiO2 condenses out on the limb and sublimates on the dayside, or if it is thermally processed via advection. Silicate materials can have different polymorphs --i.e., crystal arrangements-- depending on their initial formation mechanism and thermal processing. Leveraging the large scale height and fantastic signal-to-noise of WASP-17b, we will be able to understand the planet's overall atmospheric composition, thermal gradients throughout its atmosphere, and its ongoing cloud processing. Our program will observe two transits and one eclipse (29.6 hours total) using MIRI-LRS to obtain spectra from 7-12 microns with an observing plan optimized to 1) precisely determine the polymorph of SiO2 and constrain the thermal and dynamical conditions on the limb, 2) unearth the full story of SiO2 processing by probing for dayside silicate gas or quartz, and 3) additionally probe for forsterite clouds and cloud grain orientation. Our findings will paint a full picture of quartz in WASP-17b, which can be applied to silicate mineralogy in hot Jupiters, brown dwarfs, and discs as a whole

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 8317
Program Title: The Return of the Giants: Constraining the TP-AGB Phase across Cosmic Time

Principal Investigator: Kriek, Mariska

PI Institution: Leiden Observatory

The thermally pulsing asymptotic giant branch (TP-AGB) phase plays a critical role in shaping the spectral energy distributions of galaxies, particularly at near-infrared wavelengths. However, the treatment of TP-AGB stars in stellar population synthesis (SPS) models remains highly uncertain. Existing models are calibrated using stars in the Milky Way and nearby galaxies, which do not fully capture the diversity of stellar environments in terms of age and metallicity. As a result, different SPS models handle the TP-AGB phase differently, potentially leading to significant systematic uncertainties in the stellar masses and other population properties of distant galaxies. In this proposal, we aim to improve the treatment of TP-AGB stars by leveraging data from the public JWST-SUSPENSE program, which obtained ultradeep, medium-resolution spectra of quiescent galaxies at redshifts 1–3. These spectra enable robust age and metallicity measurements for 15 such galaxies. Additionally, the galaxies span a range of ages and metallicities, capturing the phases where TP-AGB stars are most dominant (0.6–2 Gyr). We propose to observe these galaxies for 5 hours with the JWST/NIRSpec prism (0.6–5.3 μm) to assess the contribution of TP-AGB stars as a function of age and metallicity. The prism mode provides sufficient resolution to detect the broad spectral features characteristic of TP-AGB stars. By comparing the spectra with multiple SPS models and tuning TP-AGB parameters, we will constrain this evolutionary phase. The resulting improved TP-AGB treatment will directly impact galaxy evolution studies, yielding more accurate stellar population properties of galaxies across cosmic time.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Stars and Stellar Populations
ID: 8322
Program Title: Astrometric monitoring of the fast stars around the intermediate-mass black hole in Omega Centauri

Principal Investigator: Haeberle, Maximilian

PI Institution: Max Planck Institute for Astronomy

The existence and frequency of intermediate-mass black holes is an unresolved mystery with important implications for our understanding of the formation of supermassive black holes in the early universe. Omega Centauri has long been suspected to host such a black hole and the recent detection of several fast-moving stars in its center has provided new, strong evidence, placing a lower limit on the black hole mass of 8200 M?. Weighing this intermediate-mass black hole more precisely requires additional observations. Due to its superior resolution and high sensitivity, JWST is perfectly suited to follow up on the faint, fast stars and to determine their orbits. By combining existing HST and JWST data with our proposed multi-cycle observations, we will measure their astrometric accelerations, allowing the first direct mass measurements of the intermediate-mass black hole. With just a single 2.6 hr observation in Cycles 4, 5, and 6, we can improve the acceleration measurements of these stars by more than a factor of 2 over the measurement from hundreds of HST observations taken over 20 years. In addition, the proposed multi-cycle observations will detect any additional faint stars in the vicinity of the black hole, monitor potential variable accretion emission, and provide an important astrometric reference for future observations.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 8325
Program Title: Understanding the nature of the first wandering AGN candidate in a clump

Principal Investigator: Delvecchio, Ivan

PI Institution: INAF - Osservatorio di Astrofisica e Scienza dello Spazio

The growth of supermassive black holes (SMBHs) and galaxies is intertwined with the accretion history of cosmic gas reservoirs, which can fuel star formation and Active Galactic Nuclei (AGN) activity through gas filaments and/or galaxy mergers. Mergers are cosmic beacons for studying the sought-after off-center ("wandering") SMBHs, but also the formation of clumps, which are predicted to host AGN, though no such evidence has ever been reported thus far. Here we propose NIRSpec IFU observations of a unique wandering AGN candidate found in a clump, located in a merging system at z=0.93 already observed with NIRCam. The AGN position is inferred at ~0.001'' precision from radio VLBA data, showing 0.38'' (~3kpc) offset from the stellar mass peak (NIRCam/F277W) of the closest galaxy, but spot-on a clumpy stucture detected in the NIRCam/F115W filter and not longward. Ancillary fiber spectroscopy sets a robust zspec=0.93 but spatially-blended (0.6'' radius) among the AGN-clump and the other galaxies. Using a combined G140H/F100LP and G140M/F070LP setup, we ask for only 8.8 hours (including overheads) in order to to: (i) spectroscopically confirm the redshift of the AGN-clump structure; (ii) construct velocity maps via emission line kinematics for distinguishing between ex-situ and in-situ clump formation; (iii) obtain spatially-resolved BPT lines for interpreting gas ionization; (iv) derive reddening maps from Halpha/Hbeta for investigating the puzzling dust obscuration across the system. These observations will carry an immense legacy value, opening new avenues for chasing distant wandering SMBHs and understanding their connection with galaxy mergers and clump formation.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 8328
Program Title: Direct detection of a multi-planet system caught in formation

Principal Investigator: Ginski, Christian

PI Institution: National University of Ireland, Galway

With thousands of extrasolar planets detected in the last decades, we find ourselves asking the question how to explain the huge diversity in planet properties and system architectures. To understand the key processes involved in planet formation we must turn to the initial conditions in the dust and gas rich disks around young stars. Near-infrared and sub-mm observations have revealed a wealth of sub-structures in disks; smoking guns pointing to the presence of embedded planets. Yet the detection of these nascent planets has proven difficult, and until now, only a single system has been identified where multi-wavelength observations could unambiguously confirm the presence of planets. One major difficulty for the direct imaging of these objects is that many of them are too faint to be detected even with the most advanced ground based facilities. The superior sensitivity of space-based observations with JWST now gives us the opportunity for a new observational window into the earliest phases of planet formation. In this program we propose to directly detect the planets in an exceptional disk around a young low-mass star. The disk shows a rare combination of spiral and ring structures in near-infrared scattered light, which strongly indicates the presence of an embedded planet in the inner disk region (30 au). Furthermore complementary ALMA high resolution observations of the disk's gas point to a second planet in the outer disk (116 au). We show that based on existing data and dedicated simulations, both planets can be detected simultaneously with JWST/NIRCam at 4.4 micron. This presents us with the unique opportunity to directly study a multi-planet system in formation.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 8330
Program Title: Calibration of the Brighter-Fatter Effect in AMI with a Reference Binary

Principal Investigator: Pope, Benjamin

PI Institution: University of Queensland

High resolution, high contrast imaging with JWST is severely limited by the 'brighter-fatter effect', or charge migration, whereby bright pixels nonlinearly bleed charge into their neighbours. If this problem can be resolved, the door is open to much more extensive use of JWST for high contrast imaging. We propose using the Aperture Masking Interferometer on NIRISS as an ideal calibration system, as the non-redundant mask makes phase retrieval a well-posed problem and the PSF can be accurately characterized, so that systematic effects from the detector can be separately determined. We propose training a differentiable optical model end-to-end with a neural network to represent this nonlinear detector, but existing data on point sources and flat fields do not contain enough PSF diversity to avoid over-fitting in training the neural network. We therefore request AMI and clear-pupil NIRISS observations of the nearby, well-characterized, moderately-bright M dwarf system EZ Aqr, as a 'ruler' on the sky whose precisely-known geometry will unambiguously constrain a detector model in conjunction with existing point source and flat field observations. With an accurate, data-driven model of the brighter-fatter effect in hand, it will be possible to recover strong science outcomes in exoplanet, disk, and AGN science from archival GO and GTO AMI data; plan future observations with this instrument; and pave the way for applications to enhancing coronagraphic NIRCam and Roman observations.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 8358
Program Title: Revealing the True Nature of Little Red Dots with Deep Continuum Observations of an IR-Bright LRD at z=3.1

Principal Investigator: Barro, Guillermo

PI Institution: University of the Pacific

The first 3 JWST cycles have revealed a surprising population of Little Red Dots (LRDs) at z~3-9, characterized by compact sizes, broad emission lines, and peculiar, V-shaped spectral energy distributions (SEDs) with blue UV emission and very red optical and NIR colors unlike any typical galaxy or active galactic nuclei (AGN). Are LRDs compact, dust-obscured starbursts with UV leaks, or blue, low-mass galaxies hosting obscured AGNs?. Current photometric models are strongly degenerated and follow up spectroscopy, aimed at detecting the emission lines, is typically shallow and can not reveal the true nature of the LRD continuum emission. High resolution (R=1000) continuum spectroscopy provides a definitive answer. Our ~20h, deep NIRSpec/IFU and MIRI/MRS spectroscopic program targeting a typical LRD at z=3.1386 with bright IR emission will a) reveal the galaxy or AGN nature of the optical continuum emission, and NIR dust emission by targeting multiple stellar absorption lines, and, for the first time, a PAH emission at 3.3μm, b) show the true (emission-line free) spatial distribution of the optical and NIR continuum providing another axis to distinguish between galaxy or AGN, and c) obtain precise, black hole masses and attenuations from multiple, narrow, and broad emission lines.

Proposal Category: AR (GO-Archival)
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 8369
Program Title: Making JWST as good as it should be: Bridging the NIRISS/AMI performance gap with model-based post processing

Principal Investigator: De Furio, Matthew

PI Institution: University of Texas at Austin

Over the past two decades, direct imaging has emerged as a vital technique for studying exoplanets, complementing traditional radial velocity and transit methods. The James Webb Space Telescope (JWST) offers unprecedented sensitivity and Point-Spread-Function stability, enabling high-contrast imaging from 0.6 to 28 μm to detect lower-mass planets at wide separations. The Near Infrared Imager and Slitless Spectrograph with its Aperture Masking Interferometry (AMI) mode provides a unique opportunity to investigate gas giants at orbital separations around 3 AU—an underexplored region near the iceline where planet production is expected to peak. However, early AMI observations revealed degraded performance compared to predicted contrast due to systematic errors, necessitating improved calibration techniques. We propose to demonstrate a model-based, forward modeling approach that leverages wavefront sensing data on NIRISS archival data from commissioning, Early Release Science, and General Observer programs. By removing the need for reference star calibration, this image-plane approach is less sensitive to detector effects than techniques such as closure phase, addressing the dominant factor in AMI contrast performance while making observations significantly more time-efficient. The implications of this work extend beyond AMI observations, as the developed modeling techniques will enhance the accuracy of future JWST programs and inform the design of next-generation space telescopes. By addressing the challenges of model-based techniques now, we will be in a much better position to inform upcoming missions, including the Roman Coronagraph and the Habitable Worlds Observatory.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 8391
Program Title: A Triad Mystery: Deciphering a Triple Broad-Line Radio AGN System at Kpc Separation with JWST

Principal Investigator: U, Vivian

PI Institution: University of California - Irvine

We propose NIRSpec IFU and NIRCam imaging to conclusively establish the triple AGN nature of a galaxy merger, theoretically predicted but never before discovered --- until now. Ancillary multi-wavelength observations (e.g., X-ray, optical, and radio) have provided promising evidence that suggest the presence of a triple broad-line and radio-emitting AGN within an ongoing merger system at z = 0.13; however, definitive confirmation requires further proof in the dust-obscured gas close to the supermassive black holes. The combination of unparalleled sensitivity and spatial resolution of JWST is vital for resolving the closely separated nuclei and detecting the broad component of H recombination line or highly ionized line emission. With NIRSpec IFU data, we will validate the triple AGN nature, estimate black hole masses, and resolve the gas kinematics that resulted from the triple merger dynamics; on the other hand, NIRCam will deliver multi-band, high-resolution images, enabling an unprecedented decomposition of the AGNs and their host galaxy in this complex merger and chracterization of the resolved spectral energy distributions. JWST will deliver this final piece of the puzzle to the Triad Mystery and reveal the first triple AGN system at kiloparsec separations, which will serve as the benchmark for future searches and investigations of three-body merger systems.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 8410
Program Title: A Census of Galaxy Kinematics and Outflows to z ~ 7

Principal Investigator: Simons, Raymond

PI Institution: Providence College

We propose deep spatially- and spectrally-resolved NIRSpec 1.7 - 5.1 um (R~2700) MSA spectroscopy of 275 galaxies spanning 1 < z < 10 in the CEERS NIRCam imaging footprint of the Extended Groth Strip. This program is designed around two primary science goals: (1) revealing the spatially-resolved kinematics of galaxies in the early universe (3.5 < z < 7) in large numbers (N~100) for the first time, and (2) detecting and characterizing the physical and chemical conditions of their outflowing gas. The targeted sample spans a wide range in stellar mass (8 < M*/Msun < 10) and cosmic time (~8 Gyr), and will enable a uniform demographic study of the kinematics and outflows of galaxy populations over mass and redshift. We incorporate a unique prioritization scheme to maximize the number of galaxies that are aligned (for spatially-resolved kinematics) or perpendicular (for spatially-resolved winds) with the NIRSpec mask—increasing the scientific efficiency of this program by a factor of two. To facilitate immediate value of this program for the community, we waive the proprietary period and commit to release the high-level 1D- and 2D- spectra within 6 months of the execution of the observations.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 8438
Program Title: The first spectrum of a temperate super-Jupiter planet

Principal Investigator: Berne, Olivier

PI Institution: Institut de Recherche en Astrophysique et Planetologie

Giant exoplanets, characterized by their substantial size and gaseous composition, play a crucial role in enhancing our understanding of planetary formation, evolution, and atmospheric chemistry beyond our Solar System. The aim of this proposal is to achieve the first medium-resolution spectroscopy of a temperate super-Jupiter planet, Epsilon Indi Ab. With a cool temperature of approximately 275 K and its proximity of 3.6 pc, Epsilon Indi Ab is paticularly bright in the mid-infrared. Its wide separation of 4.1" from its host star presents a unique opportunity for direct spectroscopy. These distinctive features make it an ideal candidate for obtaining a medium-resolution spectrum using JWST. Results of this project will deepen our understanding of chemical enrichment processes in low-temperature, older gas giants, while also providing a valuable comparison with the gas giants found in our Solar System. Additionally, preliminary indications suggest that the atmosphere may be carbon-rich, and our spectral analysis will help to test this hypothesis.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 8441
Program Title: The Cold Worlds Spectral Library

Principal Investigator: Faherty, Jacqueline

PI Institution: American Museum of Natural History

While the future of comparative planetology lies in obtaining direct spectroscopic measurements of distant giant planets, they remain an observational challenge even for JWST. That said, JWST has recently been used to directly detect a temperate 250K - 275K gas giant world orbiting the solar type star Epsilon Ind A and there are four other cycle 2 or 3 programs (4982, 5229, 3337, 5037) targeting temperate worlds but the results are pending. While the detection of Epsilon Ind Ab demands a celebration of JWST's capabilities, it was challenging, high risk and -- at this point -- only a photometric detection. The programs in waiting will hopefully add to the cold, directly imaged world collection however, interpreting planets' photometric and low-resolution data will rely heavily on atmospheric model predictions in a largely untested regime. Luckily, cold brown dwarfs (500K > Teff > 250K) are isolated and bright enough that they make ideal spectral targets that can be studied as a population with the precision of JWST TODAY. With this program we will obtain G395H and/or MIRI MRS spectra for 14 cold brown dwarfs, combine those with publically available archival data for an additional two sources so we generate a complete "cold world spectral library". Leveraging the spectral precision attainable for isolated cold brown dwarfs with JWST, we will establish the gold standard of atmospheric properties by probing pressure-dependent abundances, key tracers of clouds, disequilibrium chemistry, vertical mixing, auroral processes, and formation pathways. Our legacy library will enable comparative planetology across the Solar System, exoplanets, and brown dwarfs.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8445
Program Title: Complex Cyanides as Tracers for Unlocking the Chemical History of Trans-Neptunian Objects

Principal Investigator: Cryan, Sasha

PI Institution: IAS, CNRS, Universite Paris-Saclay

Cyanides—compounds that contain one or more C=N functional groups—have a ubiquitous presence in astrophysical environments. The C=N functional group can be incorporated into a diverse range of molecular structures, from simpler cyanides like HCN to larger, more complex polymeric structures. These compounds form and evolve through thermal, photochemical, and irradiation-driven chemical pathways. As such, cyanides are key tracers of nitrogen chemistry in a wide range of astrophysical environments. While C=N-bearing species have been detected in comets, the moons of giant planets, and in micrometeorites, their presence on trans-Neptunian objects (TNOs) is poorly understood. This proposal aims to firmly detect complex cyanides TNOs and investigate their origin and evolution to shed light on the molecular diversity of the primordial Solar System. By linking the molecular composition of TNOs to that of other icy bodies like comets and moons, and interstellar structures such as molecular clouds, our study will bridge crucial gaps in understanding nitrogen chemistry across different environments. We request observations of six medium-sized TNOs and one Centaur using the NIRSpec Fixed Slit (FS) mode to reach unprecedented high-SNR that only this observing mode of the JWST can reach. These observations will enable the robust detection of complex cyanides and associated molecules like N-H-bearing compounds and HCN, providing insights into the processes shaping N-bearing species in the Solar System. Ultimately, this work will enhance our understanding of the role of nitrogen in the emergence of biochemically relevant molecules, contributing to the broader field of astrobiology.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 8457
Program Title: Exploring the Extremes: A JWST Study of Hyper-Eddington AGN

Principal Investigator: Ricci, Claudio

PI Institution: Diego Portales University

Super-Eddington accretion is a crucial yet poorly understood phase in the growth of supermassive black holes (SMBHs), key to explaining the rapid formation of the first SMBHs. Despite its importance, the mechanisms driving these extreme accretion events remain unclear. Using JWST's MIRI and NIRSpec instruments, we will conduct the first systematic infrared study of a well-defined sample of nearby hyper-Eddington AGN, with black hole masses estimated through a dedicated reverberation mapping campaign. These observations will provide spatially resolved emission line distributions, kinematics, and detailed maps of PAH and dust, while probing extreme UV emission through coronal lines. This will allow us to measure accretion rates, star formation, gas dynamics, and detect outflows on scales of 60–200 pc. Combined with existing X-ray and optical/near UV data, we will gain key insights into super-Eddington accretion flows and their impact on the surrounding interstellar medium (ISM). This study will address fundamental questions about SMBH evolution and its role in cosmic reionization, offering strong legacy value for AGN, galaxy evolution, and stellar feedback studies.

Proposal Category: AR
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 8493
Program Title: Spatially resolving obscured AGN candidates in galaxy mergers with JWST photometry

Principal Investigator: Barrows, Robert

PI Institution: University of Colorado at Boulder

Galaxy mergers may play a critical role in the co-evolution of galaxies and their central supermassive black holes (SMBHs) by building stellar mass and triggering accretion onto SMBHs, visible as active galactic nuclei (AGN). The most rapid SMBH growth is predicted at late merger stages (<10 kpc galaxy separations) and under heavy obscuration. Currently, studies testing these predictions have relied on mid-infrared (MIR) photometric colors to identify heavily obscured AGN candidates in galaxy mergers. However, the angular resolution of those facilities (2-6") can not resolve the positions of AGN within late stage galaxy mergers for the vast majority of AGN. Therefore, these selections are unable to measure the merger stage or control for the stellar bulge mass of the AGN to isolate the merger dependence. To overcome these limitations, we propose an archival project to use JWST photometry, combined with the available HST photometry, to spatially resolve the positions of obscured and unobscured AGN candidates in galaxies from the COSMOS-Web treasury field based on sub-galactic modeling of spectral energy distributions. Through this project we will trace how SMBH growth evolves down to late merger stages for the most heavily obscured AGN and the dependence on merger mass ratio down to extreme values. The results produced through this project will also aid future development of spatially-resolved color-based AGN candidate selection from JWST photometry, provide constraints on the dominant growth routes of obscured SMBHs, and provide predictions of binary SMBH formation rates and expected gravitational wave signatures detectable by pulsar timing arrays and LISA.

Proposal Category: AR
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Solar System Astronomy
ID: 8496
Program Title: Searching for New Formation of the Earliest Solar System Materials in the Infant RW Aur A Exoplanetary System

Principal Investigator: Lisse, Carey

PI Institution: The Johns Hopkins University Applied Physics Laboratory

We propose to use archival MIRI/MRS spectral measurements of the RW Aur A infant evolving solar system, taken under PID 1282 (PI Henning) in early 2023 and due to become public on 16 Oct 2024. Our goal is to search for newly created calcium-aluminum inclusions (CAIs), and chondrules in the aftermath of the major planetesimal disruption event in RW Aur A’s inner accretion disk seen in 2014-2020. We will do this by comparing the archival MRS spectrum to archival Spitzer/IRS spectral data of the system taken by Furlan et al. in 2007, and searching for predicted new emission features in the 7-21 um range due to glassy silicates and alumna oxides.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 8507
Program Title: Confirming sub-Jupiter mass planets at 20 au around a nearby star

Principal Investigator: Meshkat, Tiffany

PI Institution: California Institute of Technology

Altair is one of our nearest neighbors (5.13 pc) and its age has recently been revised to a much lower 88 Myr. It is now among the youngest nearby stars, making it an ideal candidate for exoplanet direct imaging searches with JWST. Cycle-3 observations of Altair have revealed several exciting candidate companions. The closest candidate companion to Altair is at a projected separation of about 4", with a contrast of 17.4 mag. Assuming an age of 88 Myr, this candidate corresponds to a mass of 0.5 Jupiter masses at a separation of 20 au. We propose to obtain follow-up images of Altair with NIRCam to confirm the planetary nature of the candidate companions to the North of the star. Due to the very high proper motion of Altair, we will be able to confirm if any of the candidate companions are co-moving with Altair even at the start of the Cycle-4 window. If confirmed, this would be the lowest mass planet ever imaged around a star and would be the target of significant follow-up for characterization.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Gas, Dust and the ISM
ID: 8512
Program Title: Dissecting ?Coalescence of Primeval Galaxies

Principal Investigator: Kashino, Daichi

PI Institution: National Astronomical Observatory of Japan (NAOJ)

How does the formation of primeval galaxies proceed in their earliest evolutionary stages? To answer this question, we propose NIRSpec IFU observations of eight selected galaxies at z~6 which are composed of many distinct clumps. These galaxies have been carefully selected from >900 spectroscopically confirmed [OIII]5008 emission-line galaxies constructed by the JWST GTO EIGER program, one of the most sensitive NIRCam WFSS campaigns. Each of these galaxies has robust spectroscopic redshift confirmation and deep multiband NIRCam imaging (F115W, F200W, and F356W), making them an ideal sample for our science goals. Utilizing the G395H/F290LP disperser-filter combination, we aim to obtain spatially-resolved maps of rest-frame optical emission lines, especially Hbeta, [OIII]4960,5008, Halpha, and [NII]. A central goal is to investigate the peculiar velocity of each clump and determine the dynamical properties of these systems. Specifically, we will verify whether these clumps are gravitationally bound, i.e., whether they are in the process of accreting into a single object. Further, we will map star formation activity using the Halpha emission line, verify the presence of outflows from emission-line profiles, and assess the recently reported nitrogen enhancement using the [NII] emission line as one of our pivotal tasks. These analyses will provide new insights into the very early stages of galaxy formation and evolution.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 8520
Program Title: Balmer Breaks in Little Red Dots: Stellar Populations or Dense Neutral Gas?

Principal Investigator: Taylor, Anthony

PI Institution: University of Texas at Austin

JWST's discovery of a population of red compact galaxies at redshifts z>3 has challenged our understanding of galaxy and AGN evolution in the early universe. This population, referred to as Little Red Dots (LRDs), consists of objects with blue rest-frame-UV slopes and red rest-frame-optical slopes, resulting in a unique spectral-energy-distribution (SED). A large fraction (~80%) of the LRDs show broad Balmer lines, indicating that they may host broad-line AGN that dominate their SEDs. However, some of these LRDs also show strong Balmer breaks, which instead suggest that post-starburst stellar populations dominate their SEDs. However, a recent theory has proposed that these Balmer breaks may instead be produced by clumpy dense gas near the AGN without the need for an evolved stellar population. We propose to test this theory directly by obtaining deep (4-8 hour) NIRSpec fixed slit medium resolution spectra of the Balmer breaks of three bright LRDs (and MSA spectra of other field targets to maximize the legacy value of this program). We will robustly detect the continuum emission red of the Balmer break and search for Balmer and Ca II H and K absorption features. If Ca II lines are clearly detected, the Balmer breaks in these objects result from post-starburst stellar populations. However, if the Ca II lines are missing and the Balmer absorption lines show a velocity offset relative to strong metal emission features, the Balmer breaks result from an outflow of dense, neutral gas near the AGN. Through these observations, this program will distinguish between these competing models and directly determine the physical origins of Balmer breaks in AGN-hosting LRDs.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 8525
Program Title: Evolutionary Snapshots of Massive Star Formation in NGC 6822

Principal Investigator: Hirschauer, Alec

PI Institution: Morgan State University

We propose to image the massive Hubble star-forming (SF) regions (Hubble I/III, Hubble IV, Hubble V, and Hubble X) in the nearby dwarf irregular galaxy NGC 6822. With high-quality photometric data utilizing NIRCam and MIRI in near- and mid-IR, we will separate, identify, and categorize the young embedded and dusty evolved stars with color-magnitude diagram (CMD) and spectral energy distribution (SED) analyses. This will allow for the characterization of star formation and dust evolution in metal-poor environments analogous to conditions at higher redshift. We will detect massive young stellar objects (YSOs) emerging from obscuration in these HII regions, providing insight into the formation of massive stars at low metallicities. In addition, we will conduct a census of asymptotic giant branch (AGB) stars, and differentiate their chemistries in effort to quantify their dust producing capabilities and characteristics. At this early epoch, however, the dust-producing mechanisms of slowly evolving AGB star progenitors are not well understood. With high-quality observational data of four massive SF regions at different stages in their evolution inhabiting the same metal-poor galaxy, combined with existing JWST observations of equivalent quality made of the massive, young, embedded SF region Spitzer I, we will tremendously improve our understanding of massive star formation and the life cycle of dust.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 8527
Program Title: The 3D Interstellar Medium at Milliparsec Scales: Pathbreaking Observations of Cas A Thermal Light Echoes

Principal Investigator: Peek, Joshua

PI Institution: Space Telescope Science Institute

On August 19th, 2024, JWST made an observation of a thermal light echo from the Cas A supernova that has started a new era in the study of the ISM. The sub-structures, most clearly detected in the longest wavelength filters of NIRCam, show never-before seen structures down to 500 AU scales that we believe probe the typical cold neutral medium (CNM) and fundamental ISM processes. We propose here a program that will (A) measure the morphological diversity of these sub-structures (B) provide enough photometric depth to probe an intriguing density-complexity relationship (C) reconstruct the true 3D sub-structure of the CNM at <0.01 pc resolution.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Gas, Dust and the ISM
ID: 8539
Program Title: Probing the distant universe through GRB afterglow spectroscopy

Principal Investigator: Tanvir, Nial

PI Institution: University of Leicester

Gamma-ray bursts are bright enough to be seen to very great distances and their afterglows can provide redshifts and positions for their host galaxies, as well as detailed characterisation of the host ISM and surrounding IGM, even for very faint hosts that are otherwise undetectable. Thus GRBs, despite their small numbers, offer a unique and powerful tracer of early star formation and the whole galaxy population through the era of reionization. Efforts to identify high-z GRBs have been rewarded with the discoveries of several with spectroscopic redshifts z=6.5-8.5. However, it remains the case that some good candidate high-z GRBs cannot be followed up quickly or deeply enough with ground-based IR spectroscopy, and indeed for others the Ly-alpha break may fall in regions of the IR spectrum difficult to access from the ground. GRB 090429B is an example, which had a photo-z of 9.4, but for which spectroscopy was curtailed due to bad weather. We propose target of opportunity spectroscopy of the afterglow of a GRB with good photometric or low-S/N spectroscopic evidence of z>6.5. The sensitivity of JWST is such that it can constrain host HI column, IGM neutral fraction, metal abundances, and dust in the high-z host galaxy, even several days post-burst. The recent launch of the EP and SVOM satellites will enhance the rate of discovery of high-z events, making this program urgent and timely. Thus we will obtain unique information about a typical high-z galaxy and contribute to building samples which will constrain population properties of primordial galaxies across the luminosity function, the average escape fraction of ionizing radiation, and the evolution of the IGM.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 8544
Program Title: Rest-Frame Optical Nebular Emission Lines at Cosmic Dawn: MIRI/LRS Follow-Up for JADES-GS-z14-0

Principal Investigator: Helton, Jakob

PI Institution: University of Arizona

The recent spectroscopic confirmation of JADES-GS-z14-0 at z = 14.179 (Carniani et al. 2024a, Carniani et al. 2024b, Schouws etal. 2024) challenges our understanding of the early Universe. This galaxy is remarkably luminous (M_UV = -20.81) and reddened (beta_UV = -2.20). It is clearly spatially resolved in the rest-frame ultraviolet (R_UV = 260 parsecs) and therefore dominated by stellar light at those wavelengths. Most notably, it has been detected at 7.7 microns with JWST/MIRI, and the measured flux density in MIRI/F770W (74.4 nJy, S/N = 13) is in excess above the measured flux density with JWST/NIRCam (Helton et al. 2024). At this redshift, less than 300 million years after the Big Bang, the measured flux excess is likely caused by nebular emission from hydrogen and ionized oxygen. We propose for ultra-deep spectroscopic follow-up observations with the MIRI/LRS to cover the brightest rest-frame optical nebular emission lines ([OII]3727+3729, Hbeta, [OIII]4959+5007, and Halpha) in addition to the stellar continuum. These observations will unveil important insights into this extreme galaxy: (1) gas-phase metallicity, electron density, and ionization parameter; (2) recent star-formation rate, ionizing photon production efficiency, and diffuse dust attenuation; and (3) properties of the stellar populations, including stellar mass, stellar age, and shape of the star-formation history. JADES-GS-z14-0 represents the current archetype of early galaxy formation, and the proposed observations represent a rare opportunity to study the formation of some of the first stars and heavy elements in the Universe.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 8559
Program Title: SPAM: Star-formation from Photometry through the Addition of Medium-bands

Principal Investigator: Davis, Kelcey

PI Institution: University of Connecticut

We propose SPAM (Star-formation from Photometry through the Addition of Medium-bands), a NIRCam imaging program to add ten new filters - nine medium band (MB) filters and one wide band (WB) filter (F070W, F140M, F162M F182M, F210M, F300M, F335M, F360M, F430M, and F480M) - to the CEERS Early-Release Science (ERS #1345) legacy dataset. SPAM is an efficient medium program which will have a large impact as it can simultaneously 1) measure the extent and occupation of two overdensities that may be powering the earliest-known reionized bubbles at z=7.7 and 8.7 by tracing strong [OIII] emission improving the photometric-redshift precision by 5-10X over CEERS alone, 2) provide necessary filters to break photometric redshift degeneracies and reliably map galaxy evolution at z>2, and 3) constrain star-formation histories of massive galaxies at z>4 by observing five short-wavelength MBs bracketing the Balmer break. Here, we propose 62.9 hours of non-proprietary NIRCam imaging adding to the public CEERS legacy data and enabling an even broader range of science for the entire community.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 8564
Program Title: Staring at the Void: Supernova-Driven Star Formation and Supression in the Largest Local Superbubble

Principal Investigator: Chandar, Rupali

PI Institution: University of Toledo

The Phantom Void is one of the most visually striking features in JWST images of nearby spiral galaxies. It is a uniquely large (more than 1 kpc in diameter), circular hole in the ISM of the nearby galaxy NGC 628 (the Phantom Galaxy), created by the extreme feedback from thousands of supernovae. Gas and dust have been concentrated on the perimeter of the Phantom Void, leading to new generations of stars forming along its rim. And yet, much of this gas is not currently forming stars, highlighting the contrasting role that feedback plays, and the fine balance between processes that concentrate gas and those that disperse it. We propose 3-27 micron NIRSPEC and MIRI IFU spectroscopy along 1/4 the perimeter of the Phantom Void to understand the role that supernovae-driven bubbles play on the gas-stars-feedback cycle in star-forming galaxies. When combined with ultra high resolution CO (2-1) maps of the Void, we will create temporal and spatial maps of star formation, warm molecular gas, PAH strengths and ratios, and identify regions where the gas has been shocked vs. radiatively heated. We will use the observations to address key questions: How does supernova feedback alter conditions for star formation in the cold ISM? Why is star formation not occurring simultaneously along the entire Void perimeter? How do supernova-driven shocks affect the survival and state of PAH grains?

Proposal Category: SNAP
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 8581
Program Title: The HOTH Survey: Hot On The Hunt for frigid exoplanets in the solar neighborhood

Principal Investigator: Bowens-Rubin, Rachel

PI Institution: Eureka Scientific Inc.

The current exoplanet population includes few frigid planets (< 200K) discovered beyond the snow line (> 2 AU). However, microlensing surveys suggest that small giant planets near the snow line are abundant. We propose the Hot On The Hunt for frigid exoplanets (HOTH) Survey to explore this largely uncharted population of cold giant planets using direct imaging. Our target list consists of 125 nearby FGKM stars (< 8 pc) where MIRI F2100W imaging can detect small giant planets colder than 200K. This survey will uncover a benchmark set of exoplanets suitable for atmospheric characterization, serving as temperature analogs to the Solar System's ice and gas giants. By using JWST MIRI, the survey can detect exoplanets with both cloudy and clear atmospheres and high metallicity ensuring that the occurrence rates from the JWST NIRCam direct imaging surveys are not underreported. Our detection results will be linked to the known inner-planetary architecture of these exoplanetary systems to advance our understanding of both exoplanet formation and the evolution of our own Solar System.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 8582
Program Title: Towards a complete NIR/MIR view of the circumgalactic medium of a brightest cluster galaxy at z=0.4

Principal Investigator: Man, Allison

PI Institution: University of British Columbia

Brightest cluster galaxies (BCGs) of cool-core clusters are uniquely suited for AGN feedback studies. Cycle 2 JWST observations toward one such cool-core BCG have revealed intriguing results: the circumgalactic medium (CGM) has warmer H2 than in the BCG, suggestive of jet-induced shock heating. Polycyclic aromatic hydrocarbon (PAH) 11.3um emission appears in clumps embedded in the CGM, hinting at an origin in clumpy, dense clouds to survive the destructive environment. We request NIRSpec+MIRI/MRS IFU observations to complement the Cycle 2 data of this source. While the detections obtained with only 1 of the 3 MRS gratings are promising, full MRS spectral coverage is needed to properly model the continuum and cover the missing spectra features (H2 S(3), S(7), PAH 6.3, 7.7, 12.6um) to model the gas temperature, excitation and ionization conditions. NIRSpec will detect the PAH 3.3um band and ro-vibrational H2 lines. The full dataset will allow us to, for the first time, obtain a spatially resolved, contiguous NIRSpec+MRS spectrum over 2-28 micron of a BCG and its surrounding cold CGM, covering ~6000 sq kpc. The proposed JWST data will add to a rich ancillary dataset (ALMA, VLT/MUSE, VLA, MeerKAT, Chandra), enabling us to map out the baryon cycle (multiphase gas inflows and outflows), and address fundamental questions on the triggering and quenching of star formation in such environments. We will assess the role of shocks and turbulence in heating the CGM, and understand how molecular gas and PAH survive in harsh conditions in a cluster core. The program will set a new benchmark for the use of PAH as star formation rate indicators, and H2 lines as molecular gas tracers.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 8587
Program Title: Star Formation in a High-Mass IRDC: Suppressed or Veiled?

Principal Investigator: Pillai, Thushara

PI Institution: MIT Haystack Observatory

Most star formation in the universe takes place in high-mass clusters. Their formation and evolution are thus fundamental to understanding how galaxies evolve. High-mass infrared dark clouds (IRDCs), extremely massive and dense filaments at the heart of some giant molecular clouds, are progenitors of high-mass clusters. Large distances and enormous extinction in the infrared have hindered any meaningful census of young stellar objects (YSOs) in IRDCs using infrared techniques, which provide the only means to directly sense the young stars. Here, we propose to use JWST to provide a complete characterization of YSOs down to 0.1 Lsun in one of the most well-studied IRDCs: G28.34+0.06, the “Dragon”. This JWST program enables several experiments crucial for our understanding of high-mass cluster formation (HMCF) and extragalactic star formation relations. It will provide the first direct census of YSOs and star formation rate in a high-mass IRDC. We can study the emergence and evolution of stellar populations in a cloud that has not yet been substantially perturbed by star formation, and is thus representative of the initial conditions. Since all known evolutionary phases of HMCF are embedded in the Dragon, we can place stringent constraints on the main models of HMCF. Further, star formation (SF) rate predictions from different model SF relations differ by an order of magnitude. This permits using the Dragon to decisively differentiate between different star formation relations, thus critically advancing our understanding of the processes governing galactic and extragalactic star formation.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 8597
Program Title: Measuring the Bulk Properties of a 3 Myr Transiting Exoplanet and its Original Protoplanetary Disk

Principal Investigator: Feinstein, Adina

PI Institution: Michigan State University

The usage of exoplanetary atmospheric abundances as chemical tracers of their disk formation and migration is complicated by the fact that planets are typically discovered after their progenitor disk has dissipated. For example, the atmospheric carbon-to-oxygen (C/O) ratio of an exoplanet is typically used to infer its initial formation location However, this method of identification of formation location is inherently not self-consistent without a clear understanding of (i) the volatile inventory of the original protoplanetary disk and (ii) atmospheric compositional evolution. The gold standard for testing where, when, and how a planet forms would be to measure its volatile composition in conjunction with that of its parent disk. The recently discovered target of this proposal presents the first opportunity to perform such an experiment. We propose to fully characterize the IRAS 04125+2902 system with JWST and ALMA. IRAS 04125+2902 is a 3 Myr 0.7 MSun pre-main sequence star in the Taurus Molecular Cloud which hosts a transiting 0.96 RJup planet. IRAS 04125+2902 also hosts a transitional disk that is misaligned with the planetary orbital plane. With this small program, we will use (i) NIRISS/SOSS and NIRSpec/G395M to measure the bulk C/O and metallicity of IRAS 04125+2902 b's atmosphere, (ii) MIRI/MRS to determine the C/O and water-enrichment in the the inner disk, and (iii) ALMA to determine the C/O/N/H ratios in the outer disk. Our joint interdisciplinary program will measure the formation location and migration history of an exoplanet for first time. The results of this study will make IRAS 04125+2902 the gold standard for understanding planet formation.

Proposal Category: AR
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 8604
Program Title: Debris Disks as the Origin of High Altitude Clouds in Exoplanet Atmospheres

Principal Investigator: Arras, Phil

PI Institution: The University of Virginia

Near-infrared interferometric observations have found that it is common for other solar systems to have large quantities of dust orbiting near the star. Transiting planets that are prime targets for JWST also orbit close to their star, are hence are interacting with these dust disks. Recent estimates have found that close-in planets may accrete this interplanetary dust at such high rates as to significantly change the opacity of the upper atmosphere, possibly giving rise to the ubiquitous high altitude aerosols invoked to explain featureless transmission spectra. Such high altitude clouds due to accretion of dust are well known on Earth, and the close-in exoplanets may accrete at vastly higher rates than Earth, leading to correspondingly higher cloud optical depths. The goal of this project is twofold: (a) to carry out orbital dynamics simulations of the star-planet-dust system to estimate accretion rates for a broad range of planet, star, and dust parameters, and (b) to implement a dust growth scheme to estimate the particle density and size distribution in the upper atmosphere. The resulting models will be compared to JWST observations of a range of planets, from giants orbiting solar-type stars like HD 209458b and HD 198733b, to sub-Neptunes orbiting low-mass stars like GJ 1214b.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 8607
Program Title: Studying cosmic noon at 200 parsec scales: resolved spectroscopy of a magnified dusty quiescent galaxy

Principal Investigator: Siegel, Jared

PI Institution: Princeton University

We propose medium resolution NIRSpec IFU spectroscopy of A2744-33295, a gravitationally lensed galaxy at z=2.4. NIRCam photometry suggests A2744-33295 is a member of the growing population of reddened quiescent galaxies at cosmic noon. However, the nature of these galaxies, i.e., whether they are truly quenched, is shrouded by the dust-age degeneracy. With mu=18, this source is the only known dusty galaxy at cosmic noon where spatially resolved spectroscopy is feasible on scales of hundreds of parsecs. Using spatially resolved star formation, reddening, and kinematics measurements, we will determine whether the claimed dust reddening is due to embedded star formation or is instead a sign that dust lingers in the wake of quenching and is then removed by some other channel (e.g., outflows). With A2744-33295, we will study cosmic noon at five times higher resolution than is typically achieved for local galaxies (e.g., 1 kpc for MaNGA).

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8633
Program Title: Back from the dead or the final nail in the coffin: is SN2008S still alive?

Principal Investigator: Ransome, Conor

PI Institution: Harvard and Smithsonian Center for Astrophysics

SN2008S is the prototype for a class of underluminous, dusty transients whos true origins are unclear. 08S-like transients are often regarded as supernova impostors, non-terminal mass loss eruptions of massive stars. However this may not be the case, pre-explosion imaging of SN2008S show that it may have a low mass progenitor and Spitzer follow-up found that SN2008S had faded below the luminosity of its progenitor, perhaps indicating a terminal explosion. However, a surviving progenitor may exist and be dust-enshrouded. This proposal aims to finally solve the mystery of this common class of underluminous (if true supernovae) transient. Using NIRcam and MIRI over a range of filters, we aim to see if the transient is still detectable, construct spectral energy distributions in order to fit models of dust enshrouded progenitors in order to determine if dust could feasibly still be obscuring a survivng progenitor. Furthermore, SEDs of the stars local to SN2008S can be used to estimate the mass, informing us on the mass of the progenitor of SN2008S. The timing of this proposal is perfect as we are on the cusp of an explosion in transient discoveries with LSST at the Vera C. Rubin Observatory coming online in the next year or so. LSST will discover enormous numbers of transients and this investigation will provide a vital case-study for these mysterious objects.

Proposal Category: AR
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 8655
Program Title: Dynamic modeling of the shocking dust physics in WR 140

Principal Investigator: Russell, Christopher

PI Institution: University of Delaware

Carbon-rich Wolf-Rayet star (WC) plus O-star binaries are copious dust producers, with the binary WR 140 being the canonical example of episodic dust-generators. Early Release Science observations using JWST/MIRI/MRS of WR 140 have provided unprecedented spatial and spectral resolution of not only the dust structure surrounding the binary, but also the gaseous wind structures whose collisions form the dust. This system is therefore ripe for a dynamic modeling effort to use both the dust and gas diagnostics to constrain how the collision of the stellar winds produces dust. We will undertake hydrodynamic simulations of the colliding winds of WR 140 and then produce radiative transfer calculations on the output in order to directly compare the models with the MRS observables, all while iterating on the model parameters in order to improve the model-to-observation agreement. We will also synthesize the X-ray emission from the hydrodynamic simulations to compare against the many observations with NASA's X-ray fleet, thereby constraining WR 140's full shock structure -- from the apex of the wind-wind collision region directly between the stars to the much larger dust-enriched region -- simultaneously. The end result will be improved constraints on how this important class of objects generates dust, such as grain size, nucleation radius, temperature, and composition.

Proposal Category: AR (GO-Archival)
Scientific Category: Stars and Stellar Populations
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 8657
Program Title: How does Rotation Impact Y Dwarf Atmospheres?

Principal Investigator: Lacy, Brianna

PI Institution: University of California - Santa Cruz

1D radiative-convective equilibrium models systematically disagree with observations of brown dwarfs and exoplanets cooler than 700 K. These model shortcomings hinder efforts to interpret JWST data and suggest a gap in our current understanding of cold H2-He dominated atmospheres, one of JWST's premiere discovery spaces. We propose to investigate a promising cause of the disagreement-- rotational modulation of temperature structures, circulation patterns, chemistry, clouds, and emergent spectra. Our project will determine whether accounting for rotation can resolve data-model discrepancies and whether rotation induces observable latitude-dependent changes to atmospheric properties in three phases: (1) Run convection-resolving circulation models with chemical tracers near the inferred properties of the two coldest objects with known rotation periods (W0359, W1405), and test corresponding synthetic spectra against their archival data. (2) Run a small grid of these simulations varying temperature, surface gravity, rotation rate, and clear vs cloudy in order to map out how effects scale more generally. (3) Construct a large grid of adjusted RCE models with latitude and rotation rate included along with the usual axes of temperature, surface gravity and composition. Build tools to combine them into spectra for pseudo-2D models at different viewing angles. Test these on the GO2302 dataset (panchromatic spectra for 18 objects cooler than 700 K), then make them publicly available, enabling JWST-users to quickly adopt our findings into their own analyses.

Proposal Category: GO (GO-Archival)
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 8660
Program Title: Touched by Fire: Resolving the AGN Impact on PAH Emission in Galaxies

Principal Investigator: Donnelly, Grant

PI Institution: University of Toledo

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous dust grains in the interstellar mediums of galaxies. Their strong MIR emission bands are widely used as tracers of star formation, and play a crucial role in studies of the co-evolution of galaxies and supermassive black holes. Galaxies with an AGN exhibit spectra with anomalous PAH band ratios, hinting that smaller grains may be destroyed by the hard radiation from the nucleus, and raising questions about how PAH emission can be used for diagnostic purposes in active galaxies. At the same time, the interstellar radiation field (ISRF) impacts these same PAH band ratios, and AGN galaxies have a different ISRF composition compared with normal star-forming galaxies. Previous JWST-based studies of PAHs in AGN galaxies have not simultaneously incorporated the ISRF and changes to the PAH grain size distribution (GSD) when interpreting the physical implications of these anomalous PAH band ratios. We propose to utilize archival JWST NIRSpec+MIRI IFU spectroscopy to analyze PAH spectra for a set of nearby AGN galaxies, within a self-consistent modeling framework that incorporates both potential changes to the PAH GSD from an AGN as well as the impacts from spatial variations in the ISRF. Additionally, we propose for one new NIRSpec IFU observation in the nucleus of NGC 4151 to complete a uniform set of data. This new observation totals just 3 hours of charged time. With this data set and novel modeling framework, we can identify and quantify the impact of an AGN on PAH emission.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8663
Program Title: Is the Moon an Active Source of Near-Earth Asteroids? Testing the Origins of Earth Quasi-Satellite Kamo`oalewa

Principal Investigator: Sharkey, Benjamin

PI Institution: University of Maryland

We propose NIRSpec IFU observations of (469219) Kamoʻoalewa, a unique Earth quasi-satellite asteroid discovered in 2016. This is the first quasi-satellite to have its physical properties studied to assess its composition and origins. Analysis of previous observations with 8m-class ground observatories produced the hypothesis that it may represent the first known asteroid to have formed from lunar collisional ejecta. However, Kamoʻoalewa's faintness limits any stricter tests of its material composition from ground-based observatories. Such tests require knowledge of its silicate mineralogy, the presence or absence of organic or hydrated material(s), and measurements of its size/albedo. By observing Kamoʻoalewa with NIRSpec, we will comprehensively characterize the presence of these materials and provide the first measurements of its size and albedo. This program will enable strict tests of the possible lunar origin for this object, testing whether the moon acts as an entirely unpredicted source of near-Earth asteroids in conflict with fundamental population models.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8683
Program Title: MIRI spectroscopy of high ionisation stellar wind emission lines: Solving the weak wind problem in late O-type stars

Principal Investigator: Hawcroft, Calum

PI Institution: Space Telescope Science Institute

One of the biggest unsolved mysteries in the study of massive stars is the sudden weakening of spectroscopic wind emission signatures below a luminosity of log(L/Lsol) = 5.2. This phenomenon was first identified 20 years ago, and has been labeled the 'weak-wind' problem as hydrodynamical simulations of O-type star atmospheres (which match observations above log(L/Lsol) = 5.2) predict mass-loss rates two orders of magnitude higher than those required to reproduce the observed optical and UV spectra. A breakthrough moment is now happening with the detection of highly ionised fine structure emission lines (of [Ne VI], [Ne V] and [O IV]) formed in the stellar wind of late O-type stars with JWST/MIRI. These lines provide strong, independent constraints on the stellar mass-loss rate and terminal wind speed of the 'weak-wind' O9V star 10 Lac. Here we propose a MIRI spectroscopic survey of 16 late O-type stars covering a range of luminosities (log(L/Lsol) = 4.7 - 5.2) which will allow us to constrain the true mass-loss rates and terminal wind speeds in the domain of the 'weak-wind' problem. We will gain new insights into the strength and structure of the winds of low-luminosity O-type stars with broad implications in our understanding of stellar evolution, feedback, CCSN progenitors and UCHII regions.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 8696
Program Title: Ammonia and methane on a temperate giant planet orbiting a late M dwarf

Principal Investigator: Zhang, Michael

PI Institution: University of Chicago

TOI 6894 is the smallest star known to host a transiting giant planet. The Jupiter-sized TOI 6894b has an enormous 17% transit depth and a temperature of Teq=410 K. We propose to measure its transmission spectrum with NIRSpec/PRISM (0.7--5.2 microns). With just a single transit, we can get a high S/N spectrum that shows prominent absorption features from NH3, CH4, and H2O, which should be independently observable on each limb. Its temperature is low enough for nitrogen to be predominantly in NH3, but not so low that NH3 condenses. This fact, combined with the low gravity and large transit depth, makes TOI 6894b by far the best opportunity to probe the nitrogen chemistry of a giant exoplanet. The methane features will reveal whether methane depletion--frequently observed on hotter planets--applies in this colder regime. The precise metallicity, C/O, and N/O ratios we obtain will also constrain the planet's formation: is it a Y dwarf analog, or--as improbable as it may seem--a metallicity-enriched product of core accretion? Finally, the long ingress and egress makes TOI 6894b an ideal planet for measuring limb asymmetry--that is, obtaining the temperature and composition of each limb separately, which has never been achieved for a planet this cold.

Proposal Category: AR
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Stars and Stellar Populations
ID: 8709
Program Title: Confronting Lyman-alpha Radiation Pressure Feedback in the JWST Era

Principal Investigator: Smith, Aaron

PI Institution: University of Texas at Dallas

Recent JWST observations have unveiled an unexpected abundance of UV-bright galaxies and dense star clusters at redshifts $z > 10$, challenging current models of galaxy formation during Cosmic Dawn. However, Lyman-alpha (Lya) radiation pressure is a strong feedback mechanism in these metal-poor environments, capable of regulating early star formation and black hole growth. Despite its potential importance, Lya feedback is not widely included in galaxy formation simulations due to computational challenges associated with on-the-fly Lya radiative transfer. We propose to confront Lya radiation pressure feedback by developing Lya radiation-hydrodynamic simulations and novel analytical solutions. Our objectives are to (i) develop numerical models to understand time-dependent outcomes, and (ii) design improved sub-grid models for cosmological simulations. We will manage computational challenges by pursuing both Monte Carlo Radiative Transfer and diffusion approximation solvers. Our systematic exploration across parameter spaces focuses on suppression mechanisms, critical column densities, velocity gradients, and delivery timescales. These efforts are crucial for interpreting JWST observations, given the high detection rate of Lya-emitting galaxies at $z > 7$, including spectroscopic confirmations at $z > 13$. By accurately accounting for Lya feedback, we will improve galaxy formation models with informed sub-grid recipes and feedback prescriptions, constrain star formation efficiencies, and enhance our understanding of the early universe during Cosmic Dawn.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8712
Program Title: Unlocking the Secrets of NGC 2808's Multiple Populations

Principal Investigator: Griggio, Massimo

PI Institution: Space Telescope Science Institute

This proposal aims to investigate the internal kinematics of multiple stellar populations within the Galactic globular cluster NGC 2808, focusing on two strategically selected outer fields to observe main-sequence stars down to the very low mass regime. The presence of multiple populations in globular clusters still poses significant questions about their formation and evolution, which can be addressed by comparing present-day kinematics with predictions from formation models. Looking at the internal kinematics of a globular cluster as a whole, ignoring its stellar populations, is a naive and too-simplistic approach. The kinematic and dynamical histories of a globular cluster are intertwined with those of their populations and only a complete modeling of the population internal motions can let us understand these stellar fossils. By leveraging the advanced astrometric capabilities of the James Webb Space Telescope, we will measure kinematic properties of the different stellar populations, which contain key information reagarding the formation scenarios.
High-precision proper motions of stars across a broad mass range and various radial distances will allow us to measure the degree of energy equipartition and mass segregation among the subpopulations. Our observations will complement existing photometric and spectroscopic studies, providing critical insights into the dynamics and formation processes of NGC 2808, and thereby advancing our understanding of the phenomenon of multiple populations.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 8714
Program Title: Combining isotopic and elemental abundances to unveil the formation and accretion history of a cold Jupiter

Principal Investigator: Xuan, Jerry

PI Institution: California Institute of Technology

eps Indi Ab is the first mature (~2-6 Gyr) cold Jupiter (~275 K) to be directly imaged. Orbiting a mid-K star with a semi-major axis of 21 ± 4 AU, the planet has a dynamical mass of 9.2 ± 0.8 MJup from an updated orbital analysis. So far, the planet has only been detected in two filters with MIRI imaging (10.65 and 15.5 microns), resulting in very limited information about its atmosphere. We propose to comprehensively characterize eps Indi Ab's atmosphere with NIRSpec and MIRI medium-resolution spectroscopy (3-20 micron) along with near-infrared photometry (3.9-4.4 micron). These observations will provide the first measurements of deuterium (D, from CH3D) and a nitrogen isotopologue (15N, from 15NH3) in any exoplanet to date, allowing us to test whether its D/H and 15N/14N are enriched, like Uranus or Neptune, or whether it follows the protostellar values. We will complement these isotopic ratios with precise measurements of N/H, S/H, C/H, O/H, and 13C/12C to test major uncertainties in planet formation models. These include 1) whether late-stage solid accretion significantly enriches the atmospheres of giant planets, 2) the relative role of pebble v.s. planetesimal accretion in forming wide-separation (>10 AU) giant planets, and 3) the degree to which these planets subsequently undergo migration. Most of the stellar abundances used for comparison with the planet values will be measured from planned Cycle 3 observations (GO 5765) of eps Indi BC, the T dwarf binary in the same system.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Gas, Dust and the ISM
ID: 8726
Program Title: A Resolved Infrared Census of Star Formation and AGN Activity in Rapidly Quenched Galaxies

Principal Investigator: Smercina, Adam

PI Institution: Space Telescope Science Institute

We propose a combined MIRI/MRS and NIRCam survey of 5 low-redshift rapidly quenched galaxies. Understanding the `quenching' of star formation in galaxies is a premier frontier of galaxy evolution, and these apparently rapidly quenched systems are prototypes of this fundamental process. These low-z galaxies are essentially identical in their properties to analogous systems at cosmic noon. They therefore have outsized constraining power for models and observations of strong feedback and star formation quenching across cosmic time. Despite predictions that these galaxies should be ISM-poor, many host large reservoirs of warm dust and molecular gas, which has triggered an active controversy: are these galaxies truly `quenched', or simply a unique class of embedded starbursts, whose outer disks experienced a burst that has since faded? In this representative sample of 5 galaxies, uniquely accessible to JWST, we will unambiguously address this question, with fundamental implications for understanding galaxy quenching. We will: accurately measure and spatially resolve current star formation activity using dust-penetrating nebular emission lines; image the large-scale ISM at high-resolution; probe low-level and obscured AGN in rapidly quenched galaxies to the deepest-ever levels; spatially map the dusty, turbulent ISM in H2 and PAH emission; and resolve the complete star cluster populations in each galaxy, directly constraining its recent star formation history. Combined, these observations will provide spatially-matched star formation and ISM diagnostics, providing an unprecedentedly detailed view of ISM evolution in galaxies whose star formation was rapidly quenched.

Proposal Category: AR
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: None
ID: 8735
Program Title: Measuring sizes of star clusters in nearby galaxies using PHANGS

Principal Investigator: Gnedin, Oleg

PI Institution: University of Michigan

We propose to measure the radii of 36,000 compact star clusters in 38 nearby galaxies, the largest such sample to-date, using new JWST NIRCam imaging. The study outlined in this AR proposal will increase the number of clusters with published radii by a factor of four, and double the number of galaxies with such measurements. Compared to previous best radius measurements with HST, JWST imaging offers higher spatial resolution, less extinction, and better SED coverage. We will adapt a publicly-available custom pipeline that has been demonstrated to accurately and robustly measure the radii of star clusters in HST imaging. With this uniformly measured sample we will obtain the distribution of cluster radii and internal densities, determine the cluster mass-radius relation, and investigate the variation of cluster properties with age across diverse galactic environments. These measurements will enable an unprecedented examination of the formation and long-term evolution of star clusters.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 8739
Program Title: Precise Direct Interior Composition Measurements of a New Disintegrating Terrestrial Planet

Principal Investigator: Hon, Marc Teng Yen

PI Institution: Massachusetts Institute of Technology

BD+05 4868 b is a recently discovered short-period exoplanet with a comet-like dust tail. At an apparent magnitude of V~10, the star is the brightest known host to an evaporating low-mass planet candidate. We propose to measure transmission spectra along the phase curve of the transiting dust tail from BD+05 4868 b using MIRI LRS slitless spectroscopy. Comparing the transit transmission spectra to extinction and scattering models will probe the mineralogical and gaseous content of the dust tail, which will determine the elementary composition of the disintegrating planet's interior. The composition of the dust tail will reveal the evaporating planetary layer producing the dust grains while the dust's temperature and the tail's spatial extent -- which are measured with the phase curve data -- will yield further constraints on grain composition through grain size and the dynamics of the gas outflow producing such grains. The high signal-to-noise offered by these observations offers the best opportunity to precisely infer the composition of a rocky planet, providing insights into the formation background of terrestrial planets and their habitability.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8762
Program Title: Late-Time Near/Mid-Infrared Nebular Spectroscopy of a Kilonova with JWST

Principal Investigator: Brethauer, Daniel

PI Institution: University of California - Berkeley

This proposal seeks to obtain the first observational evidence that compact object mergers involving a neutron star are capable of producing the third-peak r-process elements as well as characterize the diversity of kilonova elemental abundances to constrain kilonova modeling. The kilonova will be detected and identified by an optical or infrared sky survey, and spectroscopically confirmed. The observations consist of three epochs from approxiamtely 25 to 70 days post-merger: (1) NIRSPEC + MIRI spectroscopy, (2) NIRSPEC + MIRI spectroscopy, and (3) NIRSPEC spectroscopy + MIRI imaging. These observations will: (i) obtain spectroscopy with high SNR for a broad wavelength range to detect and identify as many spectral features as possible, (ii) precisely measure the full infrared spectral energy distribution to inform theoretical ejecta models, identify ejecta mechanisms, and produce the first MIR spectroscopy of a kilonova, and (iii) measure the change in bolometric luminosity between epochs to reveal dominant radioactive isotopes in the ejecta and constrain the presence of the heaviest elements on the periodic table. We waive our proprietary rights to enable the whole community to benefit from these data.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8782
Program Title: Nominally anhydrous asteroids as reservoirs of water in the inner solar system

Principal Investigator: de Kleer, Katherine

PI Institution: California Institute of Technology

The origin of Earth's water remains a central question in planetary science, with current models often emphasizing delivery from carbonaceous (C) chondrite-like bodies from the outer solar system. However, isotopic studies suggest that non-C materials may have played a significant role in delivering water to Earth, highlighting the need to better understand water distribution in these bodies. This study aims to assess the abundance and distribution of water in non-C complex asteroids using near-infrared spectra obtained by the James Webb Space Telescope (JWST). We propose to observe the 2.5–3.5 μm region with the NIRSpec/IFU; in this spectral range, diagnostic OH and H2O absorption features reveal key details about the mineralogy and speciation of hydrated phases. Critically, ground-based observations cannot access this region due to telluric absorptions, making JWST uniquely capable of capturing these diagnostic features. By studying these features, we aim to determine whether nominally anhydrous asteroids exhibit evidence of hydration and if OH/H2O abundance correlates with heliocentric distance. These observations will provide new insights into the diversity of water sources in the solar system, ultimately advancing our understanding of whether the early inner solar system contained sufficient water to contribute significantly to Earth's water supply.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 8789
Program Title: Disentangle the puzzling jets/outflows in a young protobinary system

Principal Investigator: Cheng, Yu

PI Institution: National Astronomical Observatory of Japan (NAOJ)

Jets and outflows facilitate the mass accretion during protostellar evolution and offer a valuable probe for the mass growth of protostars. We have identified a unique young protobinary system (IRS3) that is in a very early stage of disk fragmentation, with both components still actively acquiring mass from spiral arms and streamers. Both protostars are associated with a spatially resolved jet on 100au scale, seen in radio continuum and molecular SiO, respectively. However, neither jet could account for the CO outflow on a few 1000au scale, unless strong recollimation or bending occurs shortly after jet launch. We propose JWST NIRSpec IFU observations to better characterize the jet material in different phases, thereby disentangle the puzzling relationship of the jets/outflows. Given that the system is a textbook example with gas streamers, spiral arms, and binary jets coexisting at a favorable inclination, IRS3 also offers a rare chance to trace the interplay of gas infall, flow, and ejection across different scales and elucidate the evolution of a protobinary system right after disk fragmentation.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Stars and Stellar Populations
ID: 8792
Program Title: Unlocking the massive stars behind the most spectacular fireworks displays in the early Universe

Principal Investigator: Senchyna, Peter

PI Institution: Carnegie Institution of Washington

Many of the most persistent mysteries about the early Universe are wrapped-up in the debate about how globular cluster abundance patterns were imprinted with the signatures of massive star ejecta. The discovery of a population of galaxies powering extremely prominent emission in highly-ionized, nitrogen-enriched gas at z>6 promises to open an entirely new window onto this puzzle and onto the detailed physics of densely-clustered star formation at Cosmic Dawn; yet conclusions thus far are severely limited by the quality of data available for these objects. Here we propose to construct an extraordinarily deep view onto the FUV spectrum of an exemplary nitrogen-rich burst caught in the reionization era, fortuitously quintuply-lensed by the Abell-S1063 cluster. With a 65 hour stare in G140H, we will capture the first high-fidelity snapshot of the massive stars underlying this emission, testing models for this enrichment by providing constraints on stellar abundances and the presence of very/super-massive stars or stellar populations heavily modified by dense cluster interactions. Simultaneously, we will leverage the rich photometric data for this cluster to fill the MSA with new fainter high-redshift targets, for which we will provide stringent constraints on UV nebular emission and the incidence of these peculiar features to much fainter magnitudes. This lensed galaxy bright enough to be accessible to nebular detections from the ground now represents a singular opportunity for JWST to directly constrain the highly-uncertain primordial massive star populations that underly and confound attempts to model faint nebular emission out to the frontier of Cosmic Dawn.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: Stars and Stellar Populations
ID: 8799
Program Title: SN Requiem and its Encore: Leveraging the first strongly lensed SN-Ia siblings for precision cosmology

Principal Investigator: Suyu, Sherry

PI Institution: Technical University of Munich

We propose to obtain NIRCam imaging of the galaxy cluster that strongly lensed Supernova (SN) Requiem and SN Encore, enabling independent measurements of the Hubble constant (H0) that are crucial given the current Hubble tension. The time delays between the appearances of the multiple images of a strongly lensed SN provide a direct measure of the time-delay distance and thus H0. SN Encore was discovered serendipitously in 2023 in a previous JWST program and is located close to the center of its bright host galaxy, making the photometry and time delay of SN Encore uncertain. SN Requiem was discovered in the same host galaxy in archival HST imaging taken in 2016, which showed three multiple images, and a fourth image of SN Requiem is expected to reappear in ~2026 based on our new cluster mass model. Our proposed NIRCam imaging has two goals: (1) Obtain straightforward template imaging for SN Encore, improving its photometry and thus the time-delay measurement of SN Encore by ~50%, and (2) possibly detect the reappearance of SN Requiem with up to ~18% probability, enabling a <1% precision measurement of its time delay. For only 2.5 hours, this program will make a competitve measurement of H0 with SN Encore, and has the potential to measure H0 from SN Encore and SN Requiem with <5% uncertainty, an unprecedented precision from lensed SNe that paves the way for lensed SN cosmology.

Proposal Category: AR
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8812
Program Title: Distribution of water in the solar system from crossover region spectroscopy of asteroids

Principal Investigator: Arredondo, Anicia

PI Institution: Southwest Research Institute

For small bodies, spectral flux is dominated by reflected sunlight in the near-infrared and by thermal emission in the mid-infrared. The crossover region (4-8 μm) has contributions from both and their relative contribution to total flux varies based on the asteroid's distance from the Sun. The crossover region is often excluded from analysis of asteroid spectra, likely because the signal to noise at short wavelengths is lower than the rest of the spectrum. Despite this exclusion, the crossover region is home to spectral features indicative of olivine, pyroxene, and molecular water. We propose to use archival MIRI MRS data of 32 small bodies to explore the crossover region. The targets span a range of semimajor axes, inclinations, geometric albedos, rotational periods, and taxonomies, making it a representative sample to understand the distribution of hydration in the solar system. The study of the distribution and evolution of hydrated small bodies has direct implications for how water was delivered to Earth and how water could be delivered to other extrasolar planets.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: High-redshift Galaxies and the Distant Universe
ID: 8824
Program Title: Challenging Conventional Galaxy Formation: A Possible 500 km/s Velocity Dispersion at z=2

Principal Investigator: van Dokkum, Pieter

PI Institution: Yale University

In 2009, a deep spectrum obtained with the Gemini telescope revealed that a compact galaxy at z=2.2 (1256-0) had a stellar velocity dispersion of 500 km/s, far exceeding any values found in local galaxies. This extraordinary result has faced skepticism due to the low signal-to-noise ratio of the original spectrum, significant formal uncertainties, and challenges reconciling such a high dispersion with the standard inside-out growth paradigm of massive galaxy evolution. However, recent JWST observations have begun to challenge traditional views, providing indirect evidence for an unexpected population of ultra-dense massive galaxies at z=4–7. If these early, ultra-dense galaxies indeed existed, 1256-0 could represent a direct descendant. We propose using the NIRSpec IFU to acquire a high S/N spectrum of 1256-0 to determine the stellar velocity dispersion with a precision of 7–8%. Confirmation of its extreme velocity dispersion would unambiguously demonstrate the existence of ultra-dense galaxies with exceptionally deep potential wells in the early universe. Additionally, we aim to measure the galaxy's stellar age and metallicity through population synthesis, investigate spatial variations in kinematics or stellar populations, and characterize the spatial extent and kinematics of its (weak) emission lines. This small program has the potential to redefine our understanding of galaxy formation and the nature of massive galaxies at high redshift, providing new insights into the early universe's most extreme objects.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 8826
Program Title: The Turning Tide: Discovering Unprecedented Exoplanets and Disks Around Fast-Rotating M Dwarfs

Principal Investigator: Lawson, Kellen

PI Institution: NASA Goddard Space Flight Center

We propose a NIRCam coronagraphic program to discover wide-separation exoplanets and faint debris disks around an unexplored sample of 22 very nearby (d < 10pc) M-dwarf stars with fast stellar rotation rates indicative of youth (ages < 1 Gyr). To date, the outskirts of M dwarf planetary systems remain poorly understood, with only 5 resolved debris disk detections and sparse constraints on the presence of sub-Jovian planets. Early JWST results illustrated NIRCam's unique niche for studying these systems. However, prior and ongoing JWST imaging surveys have focused on targets in young moving groups, which have typical distances of 30 pc of more. At these distances, compact M dwarf planetary systems fall largely within the noisier speckle-dominated regime — inhibiting access to any faint circumstellar sources at Solar system scales. By targeting particularly nearby stars, our program will maximize sensitivity at the expected separations of M dwarf planetesimal belts (~25 au), providing access to sub-Jovian planets and debris disks exactly where we expect them to be. Moreover, with our discoveries likely falling at wide angular separations, they will be particularly amenable to follow-up with JWST spectroscopy — promising a rich legacy of value for our understanding of both M dwarf systems and planetary systems at large.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Stars and Stellar Populations
ID: 8846
Program Title: The Polar Expedition: Extracting Spectra of Polar Regions in Planetary-mass Objects and Brown Dwarfs

Principal Investigator: Fuda, Nguyen

PI Institution: University of Arizona

We propose a unique, time-resolved, multi-epoch program for three L-T transition ultracool dwarfs and planetary-mass objects, viewed from pole-on to equator-on orientations to test the polar-vortex hypothesis. The polar vortex hypothesis explains observed color--inclination and spectrophotometric trends by assuming that polar regions are dynamically and spectrally distinct from the equatorial and mid-latitude regions. If the polar vortex hypothesis is correct, we will isolate two distinct sets of spectra: one from the polar and one from the equatorial regions. With our JWST program, we will be able to test the existence of polar vortices outside the Solar System for the first time, and tackle an outstanding question: Are there spectrally distinct polar regions of different color, cloud properties, and dynamical timescales in brown dwarfs and planetary-mass objects — like in Jupiter?

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8851
Program Title: Warm matter around long-period pulsars

Principal Investigator: Posselt, Bettina

PI Institution: University of Oxford

Disks formed around neutron stars after supernova explosions are of great astrophysical interest. Their occurrence rate and properties are essential to establish the evolutionary links between different neutron star populations, verify predictions of supernova explosion models, and enable studies of planet formation in extreme environments. According to theoretical models, such disks should be numerous around slowly rotating isolated neutron stars. X-ray irradiation from the neutron stars is expected to heat the disks which become (N)IR emitters. JWST NIRCam provides the necessary superb sensitivity and angular resolution to finally find and spatially resolve such warm circumpulsar matter. The proposed distance-limited (<500 pc) sample of most-promising disk hosts provides the best opportunity to study circumpulsar disks in detail or obtain important stringent limits on their occurrence rate.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8857
Program Title: Io's Auroral Emissions as a Tool to Investigate Atmosphere-Plasma Torus Interactions

Principal Investigator: Milby, Zachariah

PI Institution: California Institute of Technology

JWST ERS data of Io in eclipse have demonstrated NIRSpec's remarkable ability to spatially resolve emissions from both S and SO. This first look showed an unexpected co-location between the atomic and molecular emissions, suggesting they may be excited by the same processes. If the SO emissions are electron excited, we will have discovered a new type of aurora which would represent a fundamental shift in our understanding of Io's atmosphere. Observationally, if the SO emissions excited by torus electrons like the S emissions, they will show systematic north-south variation with Jupiter's magnetic field geometry. Consequently, we propose to observe Io in eclipse on four occasions, sampling across the range of magnetic latitudes Io experiences to determine the excitation mechanism of the SO emissions. Additionally, we propose to use the spatially-resolved S emissions to map for the first time the precipitation of the torus into Io's atmosphere and determine how it varies with Io's position within Jupiter's magnetosphere.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 8864
Program Title: Surveying Hellish Worlds: Lava Planets as Time Capsules of Thermal Evolution

Principal Investigator: Dang, Lisa

PI Institution: Universite de Montreal

Stripped of their primordial atmospheres and heated to extremes that expose a molten surface, lava planets offer a rare and unparalleled opportunity to directly probe the interior of rocky exoplanets. We propose a comparative study of thermal phase curves for five lava worlds, spanning a wide range of ages, to move beyond the typical snapshot view of exoplanets. Our proposed MIRI LRS phase curves will map the atmosphere and surface thermal emission of the planet which uniquely their nightside temperatures and constrain total energy budgets to infer whether their interior is fully molten or has solidified. Moreover, our observations will measure emission spectra of their dayside –predicted to harbor a tenuous atmosphere outgassed from the dayside magma ocean– to unveil its composition which is influenced by its interior state. Volcanic activity driven by a molten interior beneath the planet's crust—much like what occurs on Io– could release sulfur into the atmosphere. Together, the energy budgets and atmospheric compositions will allow us to connect atmospheric properties to the interior thermal states of lava planets, offering a first step toward answering key questions about the formation and evolution of rocky planets. Since all terrestrial planets start as molten bodies, permanent lava planets provide a unique window into the geophysics of early stages of rocky bodies in and beyond the Solar System.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 8872
Program Title: The Dark Side of the Force: Unraveling Protostellar Jet Asymmetry by Probing TMC1A's Fainter Red-shifted Outflow with JWST

Principal Investigator: Assani, Korash

PI Institution: The University of Virginia

We propose to observe the red-shifted atomic jet and molecular outflow of Class I protostar TMC1A using JWST's NIRSpec and MIRI MRS. Archival programs (PID: 1290,2104) have mapped the blue-shifted outflow, revealing a collimated red-shifted [Fe II] jet and wide-angle H2 wind with a unique asymmetry: both [Fe II] and H2 outflows are fainter on the red-shifted side, but the H2 outflow is over 3 times brighter than the [Fe II] jet relative to their blue-shifted counterparts. This could suggest that the relative strength of H2 outflow and [Fe II] jet could be different between the red- and blue-shifted side, indicating that the outflow and jet are driven independently from different parts of the disk. As the red-shifted emission is at the edge of the archival data's FOV, we propose observations centered on this component. By obtaining a complete map of the red-shifted jet/outflow, we aim to study differences in bipolar jet+outflow morphology and physical properties (e.g., density, temperature, mass outflow rates) between the red- and blue-shifted sides. This will help distinguish between intrinsic (e.g., differential mass loss) and extrinsic (e.g., ambient medium interactions, extinction) explanations for the observed bipolar asymmetries. Leveraging JWST's sensitivity to probe this deeply embedded system, our study will offer insights into protostellar outflow asymmetries and help constrain launching mechanisms. These findings have implications beyond star formation, as the same launching mechanisms and similar asymmetries in jets/outflows are observed around a wide range of astrophysical systems.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 8877
Program Title: The Core of the Matter: Constraining the Formation History of a Super-Jupiter

Principal Investigator: Wallack, Nicole

PI Institution: Carnegie Institution of Washington

We propose to observe the ultra-hot super-Jupiter TOI-2109b over its full orbit in order to study its core mass fraction and its atmospheric composition. A phase curve using NIRSpec G395H will provide the first constraint on the core mass fraction of a super-Jupiter, allowing for unprecedented insights into the otherwise ambiguous formation mechanism of these giant planets. This planet is the most promising target for such an investigation, meaning that it may be the only chance that we have to understand the formation of super-Jupiters. Constraints on the core mass fraction coupled with a careful investigation of its atmospheric composition with the same data will allow for the best understanding of a super-Jupiter to date.

Proposal Category: SNAP
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8878
Program Title: Filling the Gap: A JWST Survey Program to Track Dust Growth in Supernovae

Principal Investigator: Fox, Ori

PI Institution: Space Telescope Science Institute

A longstanding question about the SN contribution to the Universal dust budget remains ambiguous. The Spitzer Warm Mission spent over a decade building an impressive sample of dusty SNe at 3.6/4.5 micron, but these wavelengths were limited to only the warmest dust and put little constraint on the total dust yields. Only JWST offers the necessary sensitivity and wavelength coverage to characterize the expected cooler dust, particularly at late-times when the IR emission is quite faint. Two recent JWST papers on SNe 2004et and 2005ip have already revealed surprisingly large cold dust reservoirs, reigniting efforts to investigate dust formation trends in SNe. Several recent JWST proposals targeted a select, small number of SNe with this scientific goal in mind, but these programs all have multiple limitations. They are unpredictable in the sense that without recent mid-IR imaging, there is little guarantee that any single event will still be bright. They are also limited in scope, particularly when it comes to sample size and diversity in both supernova age and subclass. A Cycle 2 program (PID 3921) showed the possibility of using the Survey Mode to obtain a uniform MIRI imaging data set of a larger, more diverse sample of SNe. That program was successful, but still only a pathfinder, yielding twelve new observations with eight detections. Here we propose a larger Survey to build on that program with a minimum of 30 new observations (assuming 30% of our targets are observed). The results will enable a variety of new science and lay the foundation for important follow-up in future cycles. The data will be made public immediately to ensure it benefits the entire SN community.

Proposal Category: AR
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8883
Program Title: Overlooked Discoveries: An Archival Exploration of Dusty Supernovae from Cycles 2 & 3

Principal Investigator: Fox, Ori

PI Institution: Space Telescope Science Institute

Late-time infrared (IR) observations of supernovae (SNe) with JWST have garnered significant interest in the astronomical community. Spitzer showed that many SN subclasses show IR plateaus lasting for years, or even decades, but the origin and heating mechanism of the dust remained largely unconstrained. Finding the source of the IR plateaus could unlock insights into the Universal dust budget and mass-loss in evolved stars. Only JWST offers the necessary sensitivity and wavelength coverage to characterize the expected cool dust reservoirs in a diverse sample of SNe, particularly at late-times when the IR emission is quite faint. Two recent JWST-enabled papers on SNe 2004et and 2005ip have already revealed surprisingly large cold dust reservoirs, reigniting efforts to investigate dust formation trends in SNe. Several recent JWST proposals target specific SNe with such science in mind, but a larger sample is necessary to explore trends in both time and SN subclass. While dedicated surveys could help build a uniform sample, hundreds of serendipitous observations of nearby SNe (within 200 Mpc) are already archived and set to be made public at the start of Cycle 4, representing low-hanging fruit for this research. Our preliminary work shows that bright SNe have been overlooked, and they are ready to be analyzed. Here, we propose an Archival Research (AR) program to explore these archival observations for surviving dusty SNe or measure upper limits. Although the dataset may not be uniform, it offers a relatively low-risk and cost-effective approach to enhancing the JWST SNe dust sample and lays a crucial foundation for future monitoring and follow-up studies.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 8887
Program Title: Bridge the gas and ice of complex organic molecules in high-mass protostars

Principal Investigator: Chen, Yuan

PI Institution: Leiden Observatory

Where and how habitable planets can be formed is a long-standing 'big question' in astronomy. To answer it, one of the keys is to study the chemical evolution during star formation processes. In recent decades, complex organic molecules (COMs) have attracted great interest as they are the first step from simple species toward the building blocks of life. So far, around 100 COMs have been detected in the gas phase using radio telescopes such as ALMA, and most of the detections were made toward protostars. However, increasing evidence suggests that their formation starts in the solid phase on grain surfaces during early pre-stellar stages, and the observed gas is sublimated from the icy mantles. Very recently, the existence of COM ices is verified by the secure detection in three protostars using JWST/MIRI-MRS. Now, with the feasibility of observing COMs in both phases, a significant follow-up is to probe their chemical evolution by comparing their abundances between ice and gas. In previous cycles, this idea has been successfully proposed for a decent sample of low- and intermediate-mass sources, while similar observations for high-mass sources are still limited. We therefore propose MIRI/MRS observations for 15 high-mass protostars that are carefully selected from public ALMA surveys. All of these sources have shown to harbor rich gas-phase COMs and in the meantime are suitable for MIRI-MRS observations (i.e. not saturated, not too faint and time-consuming). If accepted, we will obtain an invaluable treasure of mid-IR spectra for a large sample of high-mass protostars and greatly boost our understanding about the chemical evolution of COMs and other simple molecules.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 8915
Program Title: In Search of Siblings: Spectroscopic Follow-Up of a Candidate Massive Quiescent Galaxy at z ~ 7

Principal Investigator: Weibel, Andrea

PI Institution: University of Geneva, Department of Astronomy

The emergence of the first quiescent galaxies in the Universe is a key question of modern astrophysics, which can now finally be tackled thanks to JWST's unprecedented near-IR spectroscopy. The recent confirmation of the massive quiescent galaxy (MQG) RUBIES-UDS-QG-z7 at z=7.29 has been an enormous surprise, pushing the record for the most distant known such galaxy ~500 Myr closer to the Big Bang. The mere existence of RUBIES-UDS-QG-z7 suggests a number density of MQGs as early as z~7 that is ~100x higher than found in *any* modern galaxy simulation. However, inferring a number density from a single source is notoriously difficult and uncertain due to Poisson noise and cosmic variance. It is therefore essential to thoroughly search for more objects like these. Here we exploit the full archive of extragalactic legacy imaging data available to date with at least 6 NIRCam wide filters spanning over 0.28 sqdeg on the sky. Only one single, reliable quiescent galaxy candidate like RUBIES-UDS-QG-z7 is found. The source has a well-measured photometric redshift z=7.30+/-0.14 and shows evidence of a strong Balmer break and an extended star-formation history with a rapid decline in the SFR in the last ~70 Myr prior to the time of observation. However, we cannot rule out that the red colors are not driven by extreme line emission of an extremely young star-burst at z=5.5. We therefore propose to observe this source with a 2hr deep NIRSpec/PRISM spectrum to confirm (or refute) its post-starburst nature at z~7. This program has the promise to identify a second MQG just 700 million years after the Big Bang which would further challenge current models of galaxy formation.

Proposal Category: GO
Scientific Category: Nearby Galaxies to Cosmic Noon
Alternate Category: Stars and Stellar Populations
ID: 8921
Program Title: Learning From Your Failures: Are these Ultra-Diffuse Galaxies the Massive Failures of Galaxy Evolution?

Principal Investigator: Peng, Eric

PI Institution: NOIRLab - (AZ)

Ultra-diffuse galaxies (UDGs) show a puzzling diversity in their properties, from their globular cluster (GC) content to their dark matter content. Only 27 UDGs to date have measured kinematics (mostly from spectroscopy of GCs), and these data have shown that UDGs have velocity dispersions that span a remarkable range, ~10 -100 km/s, in a narrow range of stellar mass. While several formation mechanisms exist to explain the formation of UDGs in dwarf-mass halos with velocity dispersions < 30 km/s, UDGs with dispersions > 50 km/s may only be explained by a dark matter distribution consistent with Milky-Way like halos. Such 'failed galaxies' are missing in all current cosmological simulations. A recent study has identified three UDGs in the Virgo cluster that are extreme outliers, with GC velocity dispersions suggesting virial masses of ~10^12 Msun. These estimates are based on 3-6 GCs per galaxy and need confirmation with larger numbers of GCs that only JWST can provide. We propose to use the NIRSpec MSA to go 1.5 mag deeper than is possible from the ground, tripling the number of GC velocities in these UDGs, and determining whether they are indeed the most massive failures in the Local Universe.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 8960
Program Title: A survey of low mass stars in globular clusters: Probing the Origin of Multiple Stellar Populations with JWST

Principal Investigator: Milone, Antonino

PI Institution: Universita degli Studi di Padova

Despite extensive observations, the existence of multiple stellar populations in globular clusters (GCs) remains an enigma in stellar astrophysics. Their formation may conceal exotic mechanisms of star formation occurring in the early Universe and may impact on the cosmic reionization. This proposal advocates for an extensive exploration of multiple populations with the JWST, considering it a step as natural as urgent for piecing together the intricate puzzle of their formation. Specifically, JWST observations have been successful in detecting multiple stellar populations in the low-mass regime of M dwarfs, difficult to be accessed by previous telescope facilities. The comparison of multiple stellar populations in these stars with those already observed at higher masses, is a crucial ingredient to constrain different scenarios. We propose a survey of GCs which deeply explores the variegate zoo of multiple stellar populations in the low-mass stars. The comparison of the multiple populations at different masses and in clusters displaying different numbers of stellar populations, possibly experiencing distinct paths in their development and evolution, will represent a crucial piece of knowledge to finally understand the phenomenon, will provide the community with uniform observations of low mass stars in star clusters, and last but not least, promises a unique opportunity to leverage the recent JWST observations of first stellar systems at high redshifts, offering unprecedented insights into the nature of ancient stellar systems.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 8961
Program Title: Probing the cosmic ray ionization rate with H2 rovibrational line emission - the Taurus survey

Principal Investigator: Bialy, Shmuel

PI Institution: Technion-Israel Institute of Technology

Cosmic rays (CRs) significantly shape the thermal and chemical state of dense molecular gas, yet measuring the CR ionization rate (CRIR)—a key parameter in astrochemical models—remains challenging. Traditional methods rely on rare ion absorption measurements toward bright background sources or complex model fitting to emission lines. Recently, the “H2 direct method” was developed, utilizing CR-induced H2 rovibrational emission to measure the CRIR without the need for background stars or model fitting. In a pioneering JWST observation of Barnard 68 (GO 5064), CR-induced H2 lines were detected for the first time, enabling a direct measurement of the CRIR in the cloud, providing strong proof-of-concept for this method. Building on this success, we propose a survey to measure the CRIR in three dense, starless cores within the Taurus molecular cloud complex. We will also observe the envelope of one core to investigate CRIR variations on sub-parsec scales (<0.1 pc). This will yield CRIR measurements across a range of scales, from cloud core scales to ~10 pc and up to ~300 pc (when complemented with Barnard 68 observations), allowing us to study CR propagation in the interstellar medium and dense cloud cores. The CRIR is a significant uncertainty in understanding CR interactions with molecular clouds. This proposal will deliver robust CRIR measurements across a well-characterized star-forming region and be the first to probe sub-parsec scale CRIR variations within a molecular cloud, offering new insights into the CRIR distribution, the sources of low-energy CRs, and their propagation.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 8976
Program Title: Testing Outer Solar System Surface Evolution with Retrograde Centaurs

Principal Investigator: Belyakov, Matthew

PI Institution: California Institute of Technology

Results on Kuiper belt, Centaur, and Jupiter Trojan spectroscopy with JWST have shown evidence for a compositional link between the KBOs and Trojans via the thermal evolution of Centaur surfaces. However, the pathway through which these surfaces evolve remains unclear. We propose a test of outer Solar System surface evolution with the high-inclination and retrograde Centaurs. These objects with inclinations above 60 degrees are a dynamically anomalous population injected from a yet undetermined source population past 30 au, and with significantly longer average dynamical lifetimes in the planetary region as compared to their lower inclination counterparts. Thus far, JWST has not observed a single Centaur or KBO with i>60 and 5<a<100, a large missing chunk of Kuiper belt dynamical space. By observing six of these targets and determining whether their significantly longer lifespans result in diminished O-H and CO2 features, we will obtain a critically important sample for testing pathways of surface evolution on Centaur surfaces.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: None
ID: 9012
Program Title: The missing link for understanding multiple populations in star clusters

Principal Investigator: Milone, Antonino

PI Institution: Universita degli Studi di Padova

All massive Globular Clusters (GCs) older than ~2 Gyr host multiple populations (MPs) of stars with different chemical compositions. Understanding the origin of this phenomenon is a challenge in modern astrophysics. One scenario is that GCs were substantially more massive at formation, had several episodes of star formation, and the subsequent mass loss provided a significant contribution to the early assembly of the Galaxy. Alternatively, GCs consist of only one stellar generation, and the MPs are the result of mass accretion onto pre-existing stars. MPs have never been observed in LMC clusters younger than 2 Gyr, where stars heavier than 1.5 solar masses (the only ones that can be studied without JWST) are chemically homogeneous. Nevertheless, these clusters host groups of stars with different rotation rates and masses larger than ~1.5 solar masses. The fact that the age boundary at which MPs are present is also the boundary at which the effects of rotation disappear (i.e. where stars are magnetically braked) suggests that MPs do not correspond to multiple generations but are instead caused by a non-standard stellar evolutionary effect linked to rotation. We propose deep NIRCam imaging of the massive ~1.6 Gyr-old GC NGC1846, which does not host MPs among stars havier than ~1.5 solar masses, and explore for the first time its lowest-mass stars (M-dwarfs). Will they show the MPs expected if the low-mass stars have different chemical compositions as in the old GCs? Or will their low MS remain narrow as expected for a simple generation? The outcome will provide us with the link for understanding the formation of massive clusters in the present day and in the distant past.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 9016
Program Title: Galaxy Formation at The Redshift Frontier: Ultra-Deep NIRSpec Observations of z>13 galaxies

Principal Investigator: Stark, Daniel

PI Institution: University of Arizona

Over the last two years, JWST has discovered an unexpected population of bright galaxies at z>10. The first look at the spectra of this population (GNz11, GHZ2) was surprising, revealing extreme lines that point to gas properties and ionizing sources not seen at lower redshift. These extreme spectra are thought to be powered by strong bursts of star formation or AGN, both of which may explain the large luminosities. The newly-discovered galaxy GS-z14-0 at z=14.2 presents a departure from these systems. It is extremely bright, but it is mostly featureless in the NIRSpec discovery spectrum, with only a single CIII] detection. How GS-z14-0 can appear so luminous at z=14.2 without exhibiting the extreme spectra seen in similarly bright z>10 galaxies is not known. It is plausible it is a strong burst (similar to GNz11 and GHZ2), but with a slightly less extreme population of ionizing agents. Unfortunately current data do not place strong constraints on the specific star formation rate or metallicity of GS-z14-0. Here we propose to obtain the spectroscopy necessary to characterize the ionizing sources and gas conditions in GS-z14-0. With 45.3 hours of R=1000 G235M spectroscopy with the NIRSpec MSA, we will place the first robust constraints on a wide range of physical properties. These observations will provide first window on galaxy formation at z=14, while also providing one of our only spectroscopic benchmarks against which theories of why z>10 galaxies are so luminous can be compared. We will simultaneously observe 39 galaxies at z>5, including two additional z>13 sources, providing the deepest view to-date of the gas and ionizing sources at very high redshift.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 9025
Program Title: The Warm Jupiter Opportunity for Understanding Giant Exoplanet Evolution

Principal Investigator: Gao, Peter

PI Institution: Carnegie Institution of Washington

The formation and inward migration of short-period giant exoplanets have remained mysterious. Two migration pathways have been proposed: disk migration and high-eccentricity (high-e) migration. Disk migration is predicted to yield planets in spin-orbit alignment with their host stars, while high-e migration should lead to more diverse inclinations. At the same time, the two migration pathways should also impact atmospheric compositions in different ways, with disk migrated planets being able to accrete inner disk material while high-e migrated planets cannot, leading to significantly different metallicities and C/O ratios. Both migration pathways are likely important given the diversity in spin-orbit alignments of Hot Jupiters around hot stars above the Kraft Break and the existence of Hot Jupiters in compact multi-planet systems. Recent observations have shown that Warm Jupiters, unlike Hot Jupiters, are all spin-orbit aligned no matter their host star effective temperature, suggesting that they all migrated via the disk. We propose to observe 5 spin-orbit aligned Warm Jupiters with JWST NIRSpec/G395H and combine the data with those of a 6th, previously observed Warm Jupiter, WASP-80 b, to constrain the population level metallicity and C/O ratio. We will then compare our results to those of the Cycle 2 BOWIE-ALIGN program, which observed spin-orbit aligned and misaligned Hot Jupiters orbiting hot stars, and additional JWST programs that targeted aligned, cool star Hot Jupiters, to uncover the link between migration and atmospheric composition of giant exoplanets.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 9026
Program Title: An extraordinary z=4.4 starburst as a detailed astrophysical laboratory to solve Cosmic Dawn mysteries

Principal Investigator: Sanders, Ryan

PI Institution: University of Kentucky

NIRSpec observations of z=6-12 galaxies have revealed many unexpected properties of Cosmic Dawn sources that are unseen in the local Universe, including anomalous chemical abundance patterns (high N/O and He/H at low O/H) and high gas densities. The physical interpretation of these properties has not reached a consensus, and debate is ongoing about their ionizing sources, formation histories, and enrichment pathways. A difficulty in unambiguously interpreting such spectra is that they typically do not detect extremely faint features or long-wavelength lines that can break degeneracies. We propose to obtain MIRI medium resolution spectroscopy of a starburst galaxy at z=4.4, GOODSN-17940, that shares many features with z>6 sources, including high emission line equivalent widths, intense star formation, a lack of a 2175 Angstrom bump in the dust curve, and notably high He/H and super-solar N/O at sub-solar O/H and C/O. This target has an exquisitely detailed rest-UV+optical NIRSpec spectrum with over 70 detected emission and absorption lines from the Cycle 1 AURORA program, with which we can study the physical drivers of these properties in much greater detail than is possible at z>6. Adding the rest-frame near-infrared HeI, Paschen-series HI, [FeII], and PAH 3.3-micron lines covered by MIRI MRS will solve many mysteries in the physical interpretation of 17940's line emission, conclusively identifying the cause of its chemical abundance pattern, identifying the nature of its ionizing source, providing new constraints on its gas density, and revealing its dust composition. These results will enhance our ability to robustly interpret the spectra of Cosmic Dawn galaxies.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 9033
Program Title: By the Ashes of Stars: A Chemical Census of a White Dwarf Planet

Principal Investigator: MacDonald, Ryan

PI Institution: University of Michigan

We propose to obtain a detailed chemical inventory for the only known transiting planet orbiting a white dwarf: WD 1856b. Cycle 1 observations in the near-infrared have revealed the planet is far hotter than its equilibrium temperature (450 K vs. 160 K), implying WD 1856b should have substantial thermal emission in the mid-infrared. We propose to observe 2 transits with MIRI LRS to detect multiple molecular species in the mid-infrared beyond 5 um that are not accessible to the existing Cycle 1 observations. We also propose to observe 2 additional NIRSpec PRISM transits to enable precise chemical abundance constraints. Our 4-transit program will yield the first precise measurements of the main carbon-, nitrogen-, and phosphorus-bearing molecules in a post-main-sequence giant planet atmosphere. The short transit duration of this white dwarf planet renders these observations very time efficient, requiring only a total charged time of 13.7 hours. Finally, our out-of-transit MIRI LRS observations will also allow a direct test of planetary thermal excess spectroscopy, providing a new technique to characterize the atmospheres of non-transiting exoplanets.

Proposal Category: AR
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 9042
Program Title: For the Love of Exoplanets: Characterization of the Internal Structure of Hot-Jupiters

Principal Investigator: Kipping, David

PI Institution: Columbia University in the City of New York

Although we have learned much about the atmospheres of hot-Jupiters over the past two decades, we are still largely ignorant of the structure and composition of their interiors. This is because these highly-irradiated worlds experience radius inflation, and consequently their position on a mass-radius diagram is not purely a function of their structure. If we could overcome this challenge, however, constraints on their core mass fractions would be extremely valuable and might inform an unresolved tension. Although planetary formation theories suggest gas giants should contain cores of about 15 Earth masses, recent work suggests that less-irradiated giant planets may possess cores of up to 100 Earth masses. New measurements of a poorly-sampled sub-population, hot-Jupiters, could help determine whether heavy cores are in fact common beyond the solar system. We propose produce six of these measurements through a re-analysis of archival JWST transit data with a focus on fitting their deformations from spherical symmetry.

Proposal Category: AR
Scientific Category: Gas, Dust and the ISM
Alternate Category: None
ID: 9051
Program Title: EXploring the WIM with JWST MIRI

Principal Investigator: Kulkarni, Shrinivas

PI Institution: California Institute of Technology

The Warm Ionized Medium (WIM) is a major phase of the Galactic diffuse interstellar medium. Mid-IR fine structure emission lines, [NeII] 12.81 micron, [SIII] 18.71 micron and possibly [SIV] 10.51 micron, from the WIM were detected in the MIRI-MRS commissioning data. Compared to the traditional optical nebular lines the mid-IR fine structure lines are insensitive to extinction and the temperature of the WIM. Here we propose to analyze archival datasets (``background", faint targets, whether Galactic or extra-galactic) and using ionization ratios infer the spectrum of the diffuse Lyman-continuum radiation field as well as probe the field as a function of vertical height -- topics of considerable interest to the study of the halo and circumgalactic medium of the Milky Way.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 9056
Program Title: Imaging the Coldest Planets Around the Nearest Accelerating Stars

Principal Investigator: Franson, Kyle

PI Institution: University of Texas at Austin

JWST/MIRI is the first instrument that can directly image planets with ages similar to our own Solar System. This was recently demonstrated in the discovery of Epsilon Indi b, the first mature imaged planet. At a distance of 3.5 pc, angular separation of 4 arcsec, and with a dynamical mass of 6 Jupiter masses, Epsilon Indi b will be a key spectroscopic benchmark for models of the coldest atmospheres. However, to explore to diversity of cold planet atmospheres, we need a sample of mature gas giants like Eps Indi b at close enough distances (<10 pc) and wide enough angular separations (>1 arcsec) to be feasibly accessible to mid-infrared spectroscopic characterization. Here, we propose to image the next five most promising nearby accelerating stars with the goal of increasing the sample of cold giant planet benchmarks. By focusing on astrometric accelerations between Hipparcos and Gaia, this program is able to prioritize the stars with the highest probability for delivering planets with similar temperatures, distances, and angular separations to Eps Indi b. Planets discovered through this survey will sample the diversity of cold giant planet atmospheres, benchmark the models used for cold free-floating planets, and will enable the first ensemble tests of substellar evolutionary models at old ages through their dynamical masses.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 9065
Program Title: Characterizing environmental effects on the formation and evolution of water in star-forming regions: Orion as a case study

Principal Investigator: Slavicinska, Katerina

PI Institution: Universiteit Leiden

Water is essential to many of the physical processes that drive star and planet formation as well as to the existence of life on Earth. However, how local environmental conditions affect the formation and evolution of water in young star-forming regions remains poorly understood. Deducing these effects is vital to characterizing water's chemical evolution in protostellar objects and, subsequently, how it is accreted from protoplanetary disks by icy outer solar system bodies like comets and habitable rocky worlds like Earth. To that end, we propose to measure the HDO/H2O ratios in the ice envelopes of 6 isolated young protostars in the Orion molecular cloud complex, suggested to be analogous to the star-forming region where our solar system formed. The source sample was selected to complement other JWST programs measuring ice HDO/H2O ratios in clustered Orion protostars, ALMA programs measuring HDO/H2O in warm protostellar gas, and cometary HDO/H2O measurements. In synergy with these works, the proposed observations will elucidate how local environmental parameters like proximity to other stellar objects affect the formation and chemical processing of water during the pre- and protostellar stages and, ultimately, clarify the veracity of the tentative link between the water in our solar system and the water ice from these most primitive epochs of star formation.

Proposal Category: SNAP
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Stars and Stellar Populations
ID: 9067
Program Title: The Jovians Around White Dwarfs with Metals (JAWZ) Survey: The Highest Resolution Direct Constraints on Giant Planets Orbiting Polluted White Dwarfs

Principal Investigator: Sallum, Steph

PI Institution: University of California - Irvine

JWST has recently enabled new progress in the study of post-main-sequence (post-MS) solar system evolution. MIRI observations have revealed indirect evidence for debris and planetary mass companions around nearby white dwarfs, and the first directly-imaged post-MS giant planets at ~11AU and ~34 AU from their white dwarf hosts. While exciting, these direct images are only probing the tip of the exoplanet iceberg. Direct population studies require novel imaging strategies to access tighter orbits where giant planets are known to be more abundant. We propose to use NIRISS to execute the Jovians Around White Dwarfs with Metals (JAWZ) Survey, the highest orbital resolution direct imaging search for post-main-sequence exoplanets orbiting metal-polluted white dwarfs. We select 100 nearby polluted white dwarfs from the Gaia DR3 40pc catalog as potential targets. Execution of 20 JAWZ Survey targets will have a high likelihood of multiple direct giant planet detections down to ~4 AU, significantly outperforming past MIRI direct imaging and accessing parameter space inaccessible to Gaia astrometry. JWST/NIRISS is the only instrument capable of making these observations, which are possible with relatively short total duration visits to a subset of a spatially-well-distributed target list. These factors, combined with the potential for new, high-impact science, make JAWZ an excellent option for Survey observations.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Stars and Stellar Populations
ID: 9077
Program Title: The iconic debris disk surrounding the white dwarf G29-38

Principal Investigator: Cunningham, Tim

PI Institution: Harvard University

This proposal seeks to leverage the capabilities of the James Webb Space Telescope to explore and characterize the debris disk surrounding the white dwarf star, G29-38. Our target is the prototypical metal-polluted white dwarf hosting a dusty debris disk, and by far the brightest in the infrared. We propose to obtain time-resolved NIRSpec and MIRI spectroscopy and imaging to measure the disk composition and probe the geometry of the disk. We aim to measure the precise dust mineralogy composition, including contributions from shock-heated and thermally-transformed crystalline grains, and detect the coldest emitting dust which will bring new constraints on the location of the outer edge of the disk. This observation will serve as a cornerstone spectrum for a large sample of white dwarfs with debris disks. Additionally, our observations will focus on probing the short-term (sub-hour) variability in the mid-infrared wavelengths within the debris disk, a phenomenon not previously explored.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 9078
Program Title: Probing the origin and interiors of Jupiter Trojans through the study of collisional fragments

Principal Investigator: Wong, Ian

PI Institution: Space Telescope Science Institute

Jupiter Trojans have been a persistent enigma for planetary science. Current models of solar system evolution predict that they must have formed beyond the primordial orbits of the ice giants alongside the present-day Kuiper belt objects. Therefore, detailed study of the surface properties of Trojans should, in principle, reveal the telltale signs of an outer solar system origin. Collisions offer a unique perspective on the question of Trojan composition. The resurfaced material on collisional fragments provide a window into the bulk composition of these objects and may retain some chemical signatures that are otherwise obscured or degraded on the uncollided objects. The collisional fragment Eurybates was observed by NIRSpec as part of a Cycle 1 JWST program. The spectrum reveals an exceptionally deep 3 micron absorption band, as well as a never-before-seen 4.25 micron feature that suggests the ubiquitous presence of carbon dioxide in the interior of Trojans. Motivated by this result, we propose to collect spectroscopic observations of additional Trojan collisional fragments. We plan to observe 3 smaller members of the Eurybates family to assess whether the 4.25 micron feature on Eurybates is representative of the entire parent body. We will also target 2 members of the Ennomos collisional family to probe whether there are systematic differences in bulk composition among the Trojan population. Rotationally resolved spectra of Ennomos will explore the surface variability apparent in previous ground-based observations.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: None
ID: 9079
Program Title: JWST/NIRCam multi-color monitoring of a rare catastrophic collision directly imaged in a nearby planetary system

Principal Investigator: Kalas, Paul

PI Institution: University of California - Berkeley

A fundamental process in the evolution of planetary systems involves constructive and destructive collisions. These are rarely observed in real time except in the solar system. For extrasolar planetary systems, debris disks represent destructive collisions among planetesimals. In the Fomalhaut system, the HST-detected source known as Fomalhaut b has been interpreted as a direct imaging observation of a fresh dust cloud produced in 2004 by a rare catastrophic planetesimal collision. Various studies examined its dimming over time, changes in morphology, and radial acceleration. Here we show that a new source similar to Fomalhaut b has appeared near the dust belt in recent HST/STIS data. If the catastrophic collision model is correct, Fomalhaut “b2” is predicted to expand in size due to radiation pressure and Keplerian shear, become fainter, and follow a trajectory that initially appears Keplerian and evolves to radial. It is unknown if b2 represents a collision between refractory asteroids or icy bodies. Here we propose a multi-cycle NIRCam campaign to measure changes in b2's brightness, color, position, and morphology over the next three years. Since b2 is very faint and HST/STIS does not have filters, JWST is the only observatory capable of tracking the evolution of b2 in real time with a suite of filters that are diagnostic of spectral features seen in asteroids and icy Kuiper Belt objects. The findings will provide exceptionally rare empirical data to inform the theory of collisional processes. Studying b2 will also serve as invaluable preparation for the HWO mission that will need to distinguish between compact transient dust clouds and authentic planetary signals.

Proposal Category: GO
Scientific Category: Exoplanet System Formation and Dynamics
Alternate Category: Exoplanet Atmospheres and Habitability
ID: 9091
Program Title: Imaging a Hidden Super-Jupiter Accelerating its Metal-rich M-dwarf Host

Principal Investigator: Morgan, Marvin

PI Institution: University of Texas at Austin

JWST’s MIRI is the only instrument capable of imaging mature Jovian-mass planets around nearby stars, as demonstrated by the recent discovery of a massive, temperate Jupiter orbiting Eps Ind. We aim to image a new cold benchmark super-Jupiter similar to a mature beta Pic b identified from the astrometric and radial acceleration of its host star, HIP79431. The M3V dwarf star hosts an inner warm Jupiter and an outer companion which we seek to recover. The long-term RV trend and astrometric acceleration (significant at the 18-sigma level) suggests that the stellar reflex motion must originate from an outer giant planet (~11 MJup) or low-mass brown dwarf at a separation of ~ 5–12 AU. This would be the second direct imaging planet discovery by JWST, and its dynamical mass will immediately enable tests of atmospheric and evolutionary models at low temperatures and old ages.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: Exoplanet System Formation and Dynamics
ID: 9095
Program Title: Combining Emission and Transmission Spectroscopy to reveal Exo-Neptune Aerosols, Chemistry, and Formation

Principal Investigator: Piaulet Ghorayeb, Caroline

PI Institution: University of Chicago

Exo-Neptunes are a key exoplanet demographic: although less abundant than the smaller sub-Neptunes, they are much more numerous than the larger well-studied hot Jupiters, and can provide context to the formation of Uranus and Neptune in the solar system. However, most exo-Neptunes can only be characterized in transmission, which is plagued by aerosols especially between 550-700K. Observational constraints on cloud and haze properties are therefore direly needed to orient and interpret future observations. We propose to conduct the comprehensive panchromatic atmospheric characterization of the 640K TOI-674 b in transmission (0.6-12 μm) and emission (3-5.2 μm) within a Small JWST program, which wil serve as a community benchmark. TOI-674 b is the only warm Neptune where this search can be conducted as it is uniquely amenable for characterization in both geometries and has detected planetary features in transmission. We will combine the strengths of transmission and emission spectroscopy to achieve our three main aims. (1) We will constrain the presence and properties of aerosols by breaking the clouds-metallicity degeneracy, probing a potential haze slope (in transmission), and constraining the temperature profile and energy budget (in emission) which dictate cloud compositions. (2) We will probe atmospheric chemistry at the CH4/CO transition, where both emission and transmission spectra are sensitive to a potentially high internal temperature indicative of tidal heating. (3) We will constrain the formation and migration of TOI-674 b through a precise eccentricity measurement and via our sensitivity to the atmospheric metallicity, C/O, C/S, and S/O ratios.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 9101
Program Title: Unveiling the Nature of Super-Puffs: A Panchromatic Transmission Spectroscopy Survey

Principal Investigator: Radica, Michael

PI Institution: University of Chicago

With Neptune-like masses but Saturn-like radii, super-puffs present a fantastic opportunity for spectroscopic characterization. These planets challenge conventional formation models, with their abnormally large radii suggesting that they are inflated by high internal temperatures or aerosols. To unravel the origins of super-puffs, we propose a comprehensive panchromatic survey of the atmospheres of the four most observable super-puffs: WASP-107b, WASP-127b, WASP-193b, and TOI-1420b using JWST NIRISS, NIRSpec, and MIRI. By acquiring transmission spectra across a wide wavelength range (0.6-12 μm), we will (1) precisely characterize the chemical inventories of these super-puffs, with measurements of their metallicities and elemental ratios, (2) interpret these measurements in terms of the processes shaping the atmospheres, including internal heating, photochemistry and vertical mixing, and (3) assess the role of aerosols on their inflated radii. Primarily, this program aims to address whether the inflated radii of super-puffs are driven by high internal temperatures or the presence of photochemically-produced hazes. In addition, by observing optimal targets with a wide range of planet masses and equilibrium temperatures, we will also probe temperature- and mass-dependent trends in elemental ratios, aerosol production and coverage, as well as the importance of photochemistry, which will all impact our understanding of giant planets more generally. With our proposed observations, we will double the current sample of super-puffs with high-precision JWST observations and provide a pristine set of panchromatic transmission spectra that will serve as benchmarks for the community.

Proposal Category: GO
Scientific Category: Gas, Dust and the ISM
Alternate Category: Stars and Stellar Populations
ID: 9105
Program Title: Pioneering Supernova Dust Studies with JWST: Detection of Dust Precursors in SN 2024ahv

Principal Investigator: Shahbandeh, Melissa

PI Institution: Space Telescope Science Institute

The rarity of nearby stripped-envelope supernovae (SESNe) presents an exceptional opportunity to study dust formation and evolution in the early Universe. SN 2024ahv, a rare Type Ib SESN (SN Ib) just 20 Mpc away, presents an unparalleled opportunity to study dust formation and evolution. As the closest SN Ib likely to explode during JWST's lifespan, it offers a unique chance to build a multi-wavelength legacy dataset, providing insights into massive star deaths and cosmic dust formation. JWST has already delivered remarkable early detections of CO and SiO in SN 2024ahv, making this supernova a critical probe for dust formation processes. While dust production in hydrogen-rich SNe II has been the primary focus until now, SESNe, born from short-lived, massive stars, are likely key contributors to early dust in the cosmos. Monitoring SN 2024ahv across NIR and MIR wavelengths will allow us to trace molecular evolution, dust formation, and composition in exquisite detail, offering insights never before captured for an SESN.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 9111
Program Title: An Infrared View of the Type Iax Supernova Remnant Pa 30

Principal Investigator: Caiazzo, Ilaria

PI Institution: Institute of Science and Technology Austria

Pa 30 is an extraordinary and unique supernova remnant. A surviving hot star is at its center and shows strong outflows with extreme velocities in excess of 15,000 km/s. Optical spectra of the central star and the nebula lack any indication of hydrogen or helium, while an X-ray spectrum reveals carbon-burning ashes. But the most striking feature is the morphology of the nebula, unlike any previously seen in a supernova remnant: the optical emission is structured in almost radial filaments distributed in a spherically symmetric fashion around the central star. Because of the surviving stellar remnant and the lack of hydrogen and helium, it has been suggested that Pa 30 is the product of a thermonuclear explosion in a near- or super-Chandrasekhar white dwarf that failed to explode the entire star and created a sub-luminous transient. These failed explosions have been observed in other galaxies and are considered a sub-class of type Ia supernovae called type Iax. The discovery of Pa 30 gives us the unique opportunity to study the physics and evolution of the remnant of such an event in our own Galaxy. We here propose to observe 6 sections of the nebula with MIRI/MRS, and the entire nebula with MIRI imaging to 1) reveal if the IR emission is diffuse or filamentary in nature, 2) constrain the contribution of thermal dust and line-emission in the IR, and 3) characterize the physical properties (composition, density, temperature) of the nebula by comparing lines in the IR and in the optical. With its unprecedented angular resolution and sensitivity in the mid-IR, JWST is uniquely suited for this study, which will be key to understand the origin and evolution of this unique SNR.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Nearby Galaxies to Cosmic Noon
ID: 9138
Program Title: Investigating the Cumulative Feedback of High-Redshift Restarted Radio AGN on Massive Galaxy Quenching

Principal Investigator: Kukreti, Pranav

PI Institution: Astronomisches Rechen-Institut Heidelberg

Quenching of massive galaxies is a significant challenge for cosmological models attempting to reproduce the observable Universe. A variety of quenching timescales are found in massive galaxies, with ~25% of them quenching in a duration of 500 Myr. AGN feedback is an important quenching mechanism, however, the small duration of an AGN phase (10-100 Myr) compared to the galaxy lifetime, makes it hard to connect these two. In this regard, restarted radio-AGN are unique, since they can be used to trace multiple epochs of AGN activity over hundreds of Myr. Restarted sources with sustained jet activity over 300-400 Myr, can suppress star formation, and quench massive galaxies over a short timescale. We propose NIRSpec fixed-slit mode observations of 4 restarted radio AGN at z~1 with massive quiescent host galaxies, to find evidence for the cumulative impact of AGN feedback. We plan to perform a stellar population modelling using spectrophotometric data, and determine the abundances of different stellar populations and the star formation history (SFH) of the galaxies. We will compare the young stellar population and recent SFH (<500 Myr) with the radio-AGN timescales, to find for the first time, evidence of cumulative AGN feedback. These observations, located at the cosmic midpoint of the Universe, will help constrain the quenching mechanisms in massive galaxies.

Proposal Category: GO
Scientific Category: Exoplanet Atmospheres and Habitability
Alternate Category: None
ID: 9157
Program Title: Probing the Dynamical History of a White Dwarf Planet

Principal Investigator: Jenkins, Sydney

PI Institution: Massachusetts Institute of Technology

Most known exoplanets orbit stars that will eventually evolve into white dwarfs. However, little is known about the fate of these post-main-sequence worlds. One of the few known white dwarf planets is WD 1856+534 b, which orbits at just 0.02 au from its host star—close enough that it should have been engulfed during the star's transition of the main sequence. Two main dynamical pathways have been proposed to explain this: high-eccentricity migration and common envelope evolution. We propose observations to constrain WD 1856 b's dynamical history by searching for signatures of common envelope evolution in the planet's atmosphere. If it did undergo common envelope evolution, it will be the first known planet to have survived engulfment by its star. Regardless of its dynamical history, our program will also probe the atmospheric physics of one of the coldest known planets. These results will provide critical insight into the dynamics of post-main-sequence systems and the atmospheres of cold worlds.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 9165
Program Title: Does Bursty Star Formation Explain the Astonishing Abundance of Bright z>10 Galaxies?

Principal Investigator: Endsley, Ryan

PI Institution: University of Texas at Austin

Over the past two years, several independent studies have reported an astonishingly high number of bright z>10 galaxy candidates identified from deep JWST/NIRCam imaging. A growing collection of NIRSpec confirmations have solidified the picture that bright z~12-14 galaxies are >10 times more abundant than predicted by nearly every pre-JWST model. While relatively exotic solutions have been proposed to resolve this tension, new JWST data at slightly lower redshifts is hinting at a simpler explanation. Galaxies at z~6-8 are found to be experiencing much more bursty star formation histories (SFHs) relative to their lower-redshift counterparts, and these strong bursts make low-mass galaxies temporarily appear much brighter due to the sudden formation of many O stars. Several models have now demonstrated that a strong evolution in burstiness at z>10 can explain the high abundance of z=10-14 systems. Here, we propose to quantify the evolution in burstiness at z>10 by completing MIRI follow-up of the eight brightest spec-confirmed z=10-14 galaxies. Past work at z~0-8 have demonstrated that the optical [OIII] and H-alpha equivalent widths (EWs) and the Halpha-to-UV luminosity ratio (LHa/Luv) are excellent tracers of galaxy burstiness. With our proposed data, we will measure the median EWs and LHa/Luv of bright z=10-14 systems and compare to published findings at z~6-8. If we find that all of these properties increase substantially at z>10, it would firmly imply that very strong bursts of star formation are a key contributor to the stunning abundance of z>10 systems. Our data will also enable tests of other proposed explanations for the high z>10 galaxy counts measured with JWST.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 9177
Program Title: Unmasking a Potential Recoiling Black Hole or Hyperluminous Blue Variable

Principal Investigator: Koss, Michael

PI Institution: Eureka Scientific Inc.

The coalescence of SMBHs during galaxy mergers produces strong gravitational waves, which can cause a merged black hole to recoil with velocities up to 5000 km/s. Such recoiling black holes, if displaced from the center of their host galaxy, may retain an active accretion disk and broad emission lines, creating a spatially or kinematically offset AGN. Despite their theoretical importance in black hole-galaxy coevolution models, confirmed cases of recoiling black holes are exceedingly rare. We propose JWST/NIRSPEC observations of SDSS1133, an enigmatic persistent broad line object offset 800 pc a nearby (30 Mpc) dwarf galaxy. SDSS1133 has displayed AGN-like broad emission lines and significant variability 63 years, yet also shows rare P Cygni absorption and narrow Fe II and [Ca II] emission which have led to interpretations as a hyperluminous massive) blue variable undergoing eruptions. However, further, AO imaging has failed to reveal star forming regions around SDSS1133, challenging the idea of a massive LBV (M>100 Msun) in a quiescent dwarf galaxy. SDSS1133's X-ray emission is also 4 orders of magnitude brighter than typical LBVs. We propose JWST/NIRSPEC to search for extended emission or star-forming regions around SDSS1133, associated with a massive LBV star. Alternatively, a lack of extended features would favor the interpretation of SDSS1133 as a recoiling black hole. Either scenario would be groundbreaking and likely common given the small volume SDSS 11133 was found. SDSS1133 could represent a extreme LBV, or a previously undetected population of recoiling SMBHs in dwarf galaxies, with profound implications for future gravitational wave detectors like eLISA.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 9180
Program Title: Ushering in the JWST Era of Precision Constraints on Reionization: A Survey of Faint Quasar IGM Damping Wings at 6.5 < z < 7.4

Principal Investigator: Hennawi, Joseph

PI Institution: University of California - Santa Barbara

The Ly-alpha damping wing signature imprinted on the spectra of high-z QSOs by the foreground neutral IGM provides the most mature and credible method for measuring the Universe's reionization history. We applied a state-of-the-art analysis pipeline to the spectra of 41 bright QSO spectra (37 ground-based, 4 JWST), which accounts for the patchiness of reionization, the unknown QSO lifetime, continuum reconstruction error, and spectral noise, allowing us to disentangle the IGM damping wing from the QSO's unknown intrinsic spectrum. After marginalizing out nuisance parameters associated with the QSO continuum and lifetime, we find that reionization occurred gradually, is highly patchy, and ends late, quantitatively confirming past qualitative claims based on the Ly-a forest and reionization simulations. A battery of tests performed on hundreds of mocks demonstrates the reliability of this methodology. These tantalizing results exhaust existing bright QSOs observable from the ground, representing 500+ hours of 8m-class time. A fundamental prediction of the IGM models is that fainter QSOs (J_AB > 22) exhibit far stronger damping wings than bright QSOs because of the reduced impact of ionization by the QSO itself. We propose a NIRSpec spectroscopic survey (G140H, G235H, G395M) of 27 QSOs at z>6.5, which, combined with existing spectra, will yield a sample of 68, enabling measurement of the cosmic reionization history to 5% . The jointly inferred QSO lifetimes will further enable reconstruction of their distribution, to be compared to SMBH masses and Eddington ratios (determined from the same spectra). This experiment is only achievable with the exquisite sensitivity of JWST.

Proposal Category: GO
Scientific Category: High-redshift Galaxies and the Distant Universe
Alternate Category: None
ID: 9214
Program Title: Unlocking the nature of the first galaxies with ultra-deep rest-UV spectroscopy

Principal Investigator: Mason, Charlotte

PI Institution: University of Copenhagen, Niels Bohr Institute

JWST is transforming our view of star formation and supermassive black hole growth in the first billion years. NIRCam imaging has revealed an unexpected abundance of bright z>9 galaxy candidates. NIRSpec prism spectroscopy has shown several of the brightest sources show extremely high ionization emission lines and peculiar abundance patterns, implying the presence of very massive stars and/or AGN, and detections of Lyman-alpha emission at z>10 suggest these hard ionizing sources may drive an earlier start to reionization than we had expected. However, our understanding has been limited to sources with the brightest rest-frame UV emission lines The critical next step is ultra-deep high resolution rest-frame UV spectroscopy of galaxies at our redshift frontier to: confidently distinguish between massive stars and AGN powering galaxies' ionizing spectra, reveal direct emission from very massive stars, uncover the growth mode of high-redshift AGN, measure the physical conditions which facilitate early star formation and black hole growth, and constrain the onset of reionization. We propose SPUDS: The SPectroscopic UV Deep Survey - 160 hrs of R~1000 NIRSpec spectroscopy of >150 z~5-14 galaxies, selected primarily from the deepest public spectroscopic surveys, including the majority of spectroscopically confirmed z>9 galaxies, with 30 hr depths in G140M. SPUDS will provide the community with a vital legacy dataset for understanding the properties of the first galaxies and AGN, and what drove the reionization process.

Proposal Category: GO
Scientific Category: Stars and Stellar Populations
Alternate Category: Gas, Dust and the ISM
ID: 9218
Program Title: Tracking Dust Formation and Destruction from the Moment Before a Star Explodes to Four Years After

Principal Investigator: Foley, Ryan

PI Institution: University of California - Santa Cruz

Type Ibn supernovae (SN Ibn) are rare explosions of highly stripped stars that interact with helium-rich circumstellar material. SN 2023fyq, the closest Ibn (18.2 Mpc), was imaged by JWST/MIRI three weeks before its explosion, revealing a significant reservoir of cold (120 K) dust. Following the explosion, an extensive observational campaign commenced, including a public DDT program 312 days post-explosion. These JWST data revealed the first definitive detection of warm amorphous silicate dust during this early phase. We propose to leverage this rare opportunity for continued monitoring of SN 2023fyq with JWST from 2.5 to 4 years after the explosion. These new JWST observations will determine how much pre-existing dust was destroyed, how much new dust formed 312 days after the explosion, determine the dust growth rate and any compositional changes in dust formation over time. We request 15.6 hours of NIRSpec and MIRI observations split across Cycles 4 and 5 (7.8 hours in each cycle). This data will establish a comprehensive legacy archive of SN 2023fyq's evolution. This unique dataset will be crucial for understanding dust formation, binary interactions, late-stage stellar evolution, and rapid mass loss during the final phases of a stripped star's life.