Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18001
Program Title: Completing Panchromatic Spectra for High Priority HWO Target Stars

Principal Investigator: Peacock, Sarah

PI Institution: University of Maryland Baltimore County

The Habitable Worlds Observatory (HWO) will enable the first direct imaging and spectral characterization of terrestrial exoplanets in the habitable zones of nearby stars. However, interpreting these spectra and assessing planetary habitability requires a complete understanding of the high-energy stellar radiation that drives atmospheric chemistry and photochemistry. While some HWO target stars have existing X-ray or UV observations, most lack high-quality data across the full high-energy spectrum. Only 1/3 have either FUV or NUV HST spectra and 1/5 have both. Likewise, only a fraction have X-ray measurements, limiting our ability to construct comprehensive stellar SEDs. We propose FUV and NUV spectroscopy of 10 key stars that currently lack full UV coverage but have existing X-ray data, enabling self-consistent panchromatic SEDs for a subset of HWO's most promising targets. These observations will provide critical missing constraints on stellar radiation environments, allowing for improved exoplanet atmosphere modeling, photochemical studies, and biosignature detectability assessments. Specifically, this dataset will: (1) establish a high-energy spectral library for a representative sample of HWO-relevant stars, (2) refine stellar atmosphere models to improve planetary atmospheric retrievals, (3) constrain interstellar medium attenuation for Lyman alpha and EUV reconstructions, and (4) lay the groundwork for future studies on stellar activity, atmospheric escape, and exoplanet habitability. By securing these data now, we ensure that HWO operates with the most complete empirical understanding of its target stars, maximizing its scientific return.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18002
Program Title: Probing the Interior of the Dwarf Planet Haumea

Principal Investigator: Proudfoot, Benjamin

PI Institution: University of Central Florida Board of Trustees

In the region beyond Neptune, a diverse population of small, icy bodies exists. These transneptunian objects (TNOs) are some of the most enigmatic bodies in our solar system. The most mysterious of these bodies is Haumea, a large (~1500 km diameter), rapidly rotating body (3.9 hours) hosting two moons (Hi'iaka and Namaka). Haumea, like most of the other large TNOs, is thought to be differentiated, with a dense, rocky core surrounded by a water-ice mantle. Between these layers, a thin subsurface ocean may have once existed, with significant astrobiological potential. Although indirect evidence indicates Haumea may be differentiated, no direct probe of Haumea's interior has yet to be made. In this program, we use astrometric tracking of Haumea's moons to infer the interior structure of Haumea. We require 3, well-timed single-orbit visits using WFC3/UVIS, which will enable detection of Haumea's differentiated core at a significance of ~3 sigma. This low-risk, high-reward program will provide the first direct probe into the interior of a TNO, acting as a touchstone for understanding the interiors of the icy transneptunian population.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: Stellar Physics and Stellar Types
ID: 18003
Program Title: A Spectacularly Polluted White Dwarf with Transits

Principal Investigator: Farihi, Jay

PI Institution: University College London

Planetary systems orbiting white dwarfs offer not only a glimpse into the future solar system, but also a test of long-term dynamical processes spanning major stellar evolutionary transitions. These dynamical changes are epitomized by ubiquitous dust variability in the infrared, and via rapidly evolving transits detected now in at least 14 systems. Critically, the polluted stellar atmospheres distill entire exoplanetary bodies into their bulk chemical compositions, a phenomenon that is unavailable for main-sequence stars, and currently the only means to acquire empirical insight into exoplanetary surfaces and interiors. Here, we propose to study an unprecedented source with long-term transits, extreme pollution, gaseous disk emission, and a color term in multi-band light curves. The near record-breaking abundances determined from low-resolution spectroscopy imply that myriad lines of many metal species will be detected in the ultraviolet. These include but are not limited to C, N, O, Al, Si, P, S, Cr, Mn, Fe, and Ni. Multiple lines of oxygen and carbon will be detected with high confidence, and possibly nitrogen if present in sufficient quantities. These abundances directly constrain the volatile content of the parent body, and to some degree, its birthplace in this exoplanetary system, in turn constraining its origin and nature. The observed, several year transit duration suggests the parent body was initially in a relatively distant orbit where water and other ices may persist. Volatile-rich debris pollution has only been observed previously in a single case, and requires the ultraviolet capacity of Hubble for an assessment of the bulk chemical composition.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18004
Program Title: The HyperDeep Ultraviolet Field

Principal Investigator: Hayes, Matthew

PI Institution: Stockholm University

JWST has prompted tremendous expansion in our understanding of the first galaxies. However, the renewed interest in the reionization era has once more exposed our ignorance of the ionizing emissivity of galaxies, particularly the escape fraction, fesc(LyC). Numerous major campaigns, both with HST and from the ground, have sought to measure and calibrate fesc(LyC), using two main redshift windows at z~0 and z~3. We show herein that the main high- and low-z LyC calibrations are mutually inconsistent. Surprisingly, the high-z methods violate constraints set by existing HST imaging, while z~0 data are more consistent with observation: data from LzLCS+ exactly predict the number of LyC detections in the UVUDF, which is just two galaxies! Critical LyC calibrations, robustly folding in the redshift evolution of galaxies, remain elusive. We show there must be a sea of LyC-leaking galaxies lurking just below current observational limits, and propose to obtain a 'hyperdeep' image (124 orbits) of the UDF in a single filter: WFC3/F336W. The unprecedented depth will blow open the current data-imposed limits when combined with exquisite spectroscopy from VLT+JWST. Targeting ~1500 galaxies and AGN, the survey will provide the definitive test of LyC emission just 1Gyr post-reionization. We will match detection statistics from low-z, constrain fesc(LyC) to the cosmologically relevant 5% for ~100 galaxies and measure fesc(LyC) in a sample of low-luminosity AGN that are optimized for LyC detection. Ultimately, we will harmonise fesc calibrations across ~12 Gyr of cosmic time, while alleviating the dominant uncertainties that arise due to evolution of the galaxy population.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18005
Program Title: 2014 WC510: A second trans-Neptunian triple?

Principal Investigator: Proudfoot, Benjamin

PI Institution: University of Central Florida Board of Trustees

Small planetesimals in the trans-Neptunian region are thought to be formed as the result of gravitational collapse triggered by the streaming instability mechanism. Simulations of such gravitational collapses commonly produce hierarchical triple systems (and other higher multiples), suggesting that they may be common in the trans-Neptunian region. However, to date, only one hierarchical triple has been found, suggesting that either triples are rare or telescopes have not yet reached the necessary resolution to resolve them. Recent HST observations have revealed that 2014 WC510, previously seen to be a closely separated binary, could have a more distant third companion. Alternatively, the system may be a wide binary that happens to be in an edge-on orbit. To determine if WC510 is the Solar System's second confirmed hierarchical triple, we propose a simple 6 orbit program to recover the orbit of the newly discovered distant companion. This provides a sensitive test of the streaming instability formation of planetesimals. Even if not a triple system, our program will precisely measure WC510's mass, providing one of the most precisely known densities in its size range. There is also potential to predict mutual events, which can provide a powerful tool to study WC510 in exquisite detail.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18006
Program Title: Geophysical Characterization of the Distant Ocean World Makemake

Principal Investigator: Proudfoot, Benjamin

PI Institution: University of Central Florida Board of Trustees

Recent JWST observations have revealed that the trans-Neptunian object (TNO) Makemake has a prominant IR excess indicating the existence of Enceladus-style hotspots on its surface. This makes Makemake possibly one of the Solar System's most distant ocean worlds. Unfortunately, little is known about many of the basic properties of Makemake, making high-fidelity geophysical investigations almost impossible. To solve this, we propose an investigation to measure the mass, density, and pole-axis orientation of Makemake via astrometric tracking of its small satellite, nicknamed MK2. Measuring mass and density will help to constrain the ongoing radiogenic heating of Makemake and provide firm footing for models of Makemake's interior structure. Determining Makemake's pole-axis orientation will provide critical context for interpreting the JWST thermal measurements and could help to constrain the geographical extent of any hotspots. Leveraging over a dozen orbits from past HST programs, we require just 4 well-timed HST orbits to complete our investigation, which will revolutionize our knowledge of Makemake and enable high-fidelity geophysical modeling of this distant ocean world.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18007
Program Title: Spectroscopy of the complex core of VY Canis Majoris

Principal Investigator: Smith, Nathan

PI Institution: University of Arizona

VY Canis Majoris (VY CMa) is the most luminous, largest, and presumably the initially most massive red supergiant (RSG) known. It is surrounded by a spectacular asymmetric nebula that was imaged by HST over 20 years ago, and shows a complex array of knots, arcs, and large-scale axisymmetric structure. It is a key object for understanding the extreme mass loss of the most massive RSGs and a benchmark for progenitors of SNe that interact with dense circumstellar material. Spectra reveal a range of outflow velocities in these structures that are faster than typical RSG winds, suggesting blasts of uneven mass-loss episodes over the past 1000 yr. The origin of this instability is not known, but it is usually attributed to either magnetic/convective instability near the Eddington limit, or to binary interaction with an unseen companion star. Although the central source in the nebula appeared unresolved in the earlier HST/WFPC2 imaging, a recent ground-based extreme-AO image has revealed that the central core of the nebula is not a point source. Instead, the core seems to be bisected by a dark obscuring lane (a disk?), and a fainter point source (a companion star?) is resolved at about 120 mas from the core. These features would have been just at the edge of the resolution limit in dithered WFPC2 images. We propose to obtain STIS spectra of the core of VY CMa in order to (1) record the spectrum of the fainter companion candidate, to see if it is reflected RSG light or a companion star, and (2) obtain the spectrum across the central obscuring lane to determine if it is molecular/dust obscuration and estimate its column density.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18008
Program Title: Using HST to Find Supernova Progenitor Stars in JWST, HST, and Euclid Imaging

Principal Investigator: Kilpatrick, Charles

PI Institution: Northwestern University

Supernovae and other luminous transients at <40 Mpc often have deep, high-resolution pre-explosion imaging in which a single progenitor system can be isolated. The vast archives of multi-band, multi-epoch HST imaging have revolutionized this field over the past 25 years, but as new missions such as JWST and Euclid come online, more such examples will be found. Each new event is extremely valuable for studying the correlation between supernova properties and the mass, metallicity, and local environments of the specific stars that explode. However, the fields where these occur are crowded, and often multiple candidate counterparts are found to the limits of natural seeing in pre-explosion imaging. A follow-up, high-resolution image is typically needed, and this is often impossible to obtain from the ground with adaptive optics due to the lack of proper bright guide stars that are needed within ~30 arcseconds. In these cases, we will trigger a non-disruptive HST target-of-opportunity observation to obtain the necessary high-resolution imaging and isolate the individual star that exploded. With 2 such triggers during Cycle 33, we can catch supernovae and isolate their progenitor systems in pre-explosion imaging, catching these rare and valuable events as they occur in the nearby Universe.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Intergalactic Medium and the Circumgalactic Medium
ID: 18009
Program Title: Final Chance to Map the Spatial Distributions of Lyman-Continuum and Lyman-Alpha Emission of Strong Lyman Continuum Emitters

Principal Investigator: Marques-Chaves, Rui

PI Institution: University of Geneva, Department of Astronomy

We request high-resolution (~0.1") narrow-band Lyman-alpha (LyA) imaging with HST/ACS ramp filters for a sample of nine strong Lyman continuum Emitters (LCEs, fesc[LyC] > 40% - 80%). A pilot study on the UV-brightest galaxy and strongest leaker known (fesc[LyC] ~ 90%), J1316+2614 at z~3.6, revealed an extended filamentary Lyman-alpha emission around -and a hole on top of- the extremely compact stellar core. We now propose LyA imaging of all other known z ~ 2-3 LCEs with fesc[LyC] > 40%, including seven UV-luminous galaxies and two strongly lensed systems, all with existing high-resolution LyC detections and rest-frame optical nebular emission line maps (JWST/NIRSpec IFU). These observations will enable high-SNR, spatially resolved studies of LyA and LyC emission in and around the stellar cores of faint to extremely UV-luminous leakers (-18 < MUV < -24). In addition, the proposed data will allow us to search for extended filamentary LyA structures- potential gas inflows fueling these powerful starbursts. Combined with existing LyC imaging (HST) and ultra-deep JWST spectroscopic maps (e.g., Halpha, Hbeta, [O III]/[O II], dust maps, etc.), the proposed LyA data will offer the most comprehensive spatial view to date of extreme LyC escape mechanisms, potentially uncovering a new mode of star formation and ionizing photon leakage in the early universe. Acquiring these data is time-sensitive, as ACS/WFC (including ramp filters) may no longer be available in future cycles.

Proposal Category: SNAP
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18010
Program Title: A Search For The Moons of Mid-Sized TNOs

Principal Investigator: Proudfoot, Benjamin

PI Institution: University of Central Florida Board of Trustees

Mid-sized trans-Neptunian objects (TNOs) are the perfect probe for understanding the collisional process that creates terrestrial planets and giant planet cores. Interestingly, although the largest TNOs have a high binary fraction--likely due to collisions--mid-sized TNOs have few known collisional moons (binary fraction ~ 15%), even though they were likely subject to a similar collisional environment as the large TNOs. This may be due to observational bias, where the moons of mid-sized TNOs are too small to have been seen in large numbers in past surveys. To explore this dichotomy, we propose a 98 target SNAP survey of mid-sized TNOs with a goal of discovering moons around mid-sized TNOs and precisely measuring the binary fraction of this interesting population. Our program will push upper limits on moons to one mag fainter than past programs and will use detailed PSF analysis to recover (or place upper limits on) close-in moons. We expect to discover at least ~3-5 new companions, with potential to discover more than 20, if the mid-sized TNO binary fraction is large. Our target list is made up of all TNOs with H magnitude < 5.5 that have yet to be surveyed for moons in detail, and have sufficient ephemeris quality for observations with WFC3. Discovering moons around our targets hold great scientific value in determining the importance of collisions in the earliest moments of our solar system, with broad application to (exo)planet formation, protoplanetary disks, and debris disks. Our program enables a variety of interesting and high-impact investigations into the origins of mid-sized TNOs.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18011
Program Title: White dwarfs with inconsistent ages in young open clusters

Principal Investigator: Hallakoun, Na'ama

PI Institution: Weizmann Institute of Science

The third data realse of Gaia has unveiled a large population of white dwarfs with main-sequence companions at orbital separations of ~1AU, indicating a history of mass transfer between the two companions. Recently, a subsample of these systems that are located in open clusters was used in order to estimate the mass of the white dwarf's progenitor, and to constrain its evolutionary history. A few of these systems that are located in young open clusters displayed inconsistencies between the cluster and the white dwarf ages, where the estimated white dwarf cooling age appeared older than the cluster. The UV excess and age measurements relied on single-band GALEX photometry alone (mostly NUV), as the optical and infrared are dominated by the main-sequence companion. Here we request ACS/SBC FUV photometry for six of these systems, in order to get a more reliable measurement of the flux of the white dwarf, that will confirm/refute the age inconsistency. The SBC filters will allow us to construct the spectral enetry distribution of the targets in the FUV, constraining their effective temperatures and revealing broad absorption features that could contribute to the age estimate inconsistency. If the system is confirmed to be older than the cluster, it would represent the first evidence of a star captured from the field into an open cluster.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18012
Program Title: Cosmology with the first gravitationally-lensed supernovae discovered by LSST within Euclid galaxy-galaxy lenses

Principal Investigator: Ryczanowski, Daniel

PI Institution: University of Portsmouth

Local and early Universe measurements of the cosmic expansion rate disagree by 8% if the concordance cosmological model is correct. Before we claim new physics, additional high precision measurements of the expansion rate (H0) are desperately needed to rule out systematic errors. Strong gravitationally lensed supernovae (SNe) are perfect for such a measurement, but rates have historically been too low to build a cosmologically useful sample. With the advent of the Rubin Observatory's Legacy Survey of Space and Time we can now discover enough lensed SNe to make a precise constraint on H0, leveraging the standardisable nature of Type-Ia SNe to ensure that systematics are well controlled. The most exciting lensed SNe will occur in already known galaxy-galaxy lenses since they guarantee long time delays, large image separations and a multiply imaged host -- all of which are critical for precision cosmology. With the rapidly growing galaxy-galaxy lens sample of Euclid we can expect two doubly imaged SN-Ia to occur in a Euclid-discovered galaxy-galaxy lens during Cycle 33. We propose to use HST to 1) obtain astrometry of these SN images to milliarcsecond precision, and 2) obtain high resolution imaging of the lensed host galaxy after the SN has faded. This data will immediately allow us to measure the Hubble constant with 6% precision and build the foundation for a 2% measurement within 5 years.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18013
Program Title: Searching for Strong Lensing Signatures in a Possible Lensed GRB.

Principal Investigator: O'Neill, David

PI Institution: University of Birmingham

Gamma-ray bursts (GRBs) are among the most energetic phenomena in the universe, capable of being detected at high redshifts with sub-second timing precision. This makes them compelling candidates for probing cosmological parameters through gravitational lensing. However, despite nearly 20 years of observations, no strong lensing candidate has been conclusively identified, largely due to uncertainties in the prompt emission and localisation of GRBs. Recently, we have identified a potential lensed GRB pair. We now aim to leverage the excellent depth and resolution capabilities of the HST to search for a potential host galaxy, determine image multiplicity, and identify any intervening lensing object(s) along the line of sight. A confirmed detection of gravitational lensing in a GRB would be a historic first and return an immediate, high-impact scientific result.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18014
Program Title: An Extraordinary Strongly-Lensed Ly-C Leaker at z=4.059

Principal Investigator: Gladders, Michael

PI Institution: University of Chicago

We propose HST imaging observations to measure the ionizing photons leaking from a remarkable z=4.059 strongly lensed galaxy. This galaxy, the highest redshift system yet identified to be spewing ionizing photons into the broader cosmos, and only the third strongly-lensed instance of a Ly-C leaker ever found, offers an opportunity to isolate and study the region(s) within the galaxy that are producing ionizing photons that are escaping. In addition to the direct measurement of the leaking ionizing photons we will also gather multi-band imaging, with both HST and JWST, to measure the continuum spectral energy distribitions of all structures within the galaxy. We also propose for initial exploratory JWST spectroscopy to measure restframes emission lines in the nebular gas. All of this imaging and spectroscopy will inform an analysis of the physical conditions within and properties of the leaking components, which be correlated with the leaking Ly-C photons known to be emerging from this galaxy.

Proposal Category: GO
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: Galaxies
ID: 18015
Program Title: Feedback by the Many or the Few? Surveying Star Cluster Outflows in NGC 4449

Principal Investigator: Boettcher, Erin

PI Institution: University of Maryland

Star clusters are the primary purveyors of stellar feedback in starforming galaxies. Supernovae and stellar winds that are correlated in space and time thermalize their energy to produce hot, expanding bubbles of T ~ 10^7 K gas. When these bubbles merge with others, they can break out of the disk, powering galactic fountains and winds. In starburst galaxies, the star cluster population collaborates to drive kiloparsec-scale outflows. However, how this collaboration occurs remains unclear. It is not known whether galactic winds are driven predominantly by a small number of high-mass clusters (log(M/M_sun) >= 4.5) or by the combined contributions of many lower mass clusters (3 < log(M/M_sun) < 4.5). We propose to answer this question in the nearby dwarf starburst galaxy NGC 4449 (d = 4 Mpc), where we will survey the warm ionized outflows associated with 12 star clusters (11 new and one archival) with 3.4 =< log(M/M_sun) =< 5.4 using "down-the-barrel" COS/G130M spectroscopy. We will measure the metal column densities, traced by N(Si) = N(SiII) + N(SiIII) + N(SiIV), as a function of velocity to constrain the energy and metal mass engaged in galactic fountains (v < v_esc) and winds (v > v_esc) as a function of cluster mass. By quantifying the role of lower mass clusters in driving starburst winds, we will determine the dominant drivers of the large-scale outflows that heat and chemically enrich the circumgalactic and intergalactic medium.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18016
Program Title: Revealing new regimes in terminal mass loss from massive stars with HST and NEOWISE

Principal Investigator: De, Kishalay

PI Institution: Columbia University in the City of New York

Massive stars are known to undergo intense terminal mass loss episodes which remain poorly understood. The energetics and mass budget of this mass loss have wide implications in astrophysics ranging from chemical enrichment to Galactic-scale feedback. While mass loss in the months to decades prior to the core-collapse supernova (CCSN) has been systematically probed through optical spectroscopic interaction signatures with nearby (< 10^16 cm) dense circumstellar material (CSM), the demographics of mass lost at earlier times that produce CSM enhancements at >10^17 cm remain unknown. Not only does such distant CSM produce signatures at phases (more than thousand days after explosion) where it is very difficult to follow-up CCSNe, their very existence (as inferred from scarce X-ray, radio and optical/UV observations) challenges models of massive stellar evolution. Recently, the use of systematic search techniques on data from the NEOWISE MIR sky survey has been demonstrated to be a powerful probe of late-time CSM interaction via signatures of the heated dust that accompany these episodes. We request HST/WFC3 UVIS observations of 28 recent CCSNe from synoptic surveys that i) do not show spectroscopic signatures of interaction near peak light and ii) exhibit luminous MIR emission at > 1000 days after explosion. Unlike previous blind HST UV snapshot surveys, this curated sample offers a method to measure the mass, energetics and geometry of distant CSM in a sample of CCSNe that are confirmed to be undergoing delayed interaction. Utilizing the unique UV sensitivity and spatial resolution of HST, this program will open new frontiers in understanding massive stellar death.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 18017
Program Title: Investigating AGN Feedback in a z=0.8 Brightest Cluster Galaxy with a Remarkable 30 Kiloparsec Extended Dust Tail

Principal Investigator: Noble, Allison

PI Institution: Arizona State University

We have discovered a remarkable star-forming Brightest Cluster Galaxy (BCG) at spectroscopic redshift of z=0.81 that has asymmetric and extended dust emission over 30 kiloparsecs, embedded with a powerful radio source. BCGs are the most massive galaxies in the Universe, at any epoch, and reside at the centers of galaxy clusters. Besides their inherent interest as extreme systems, BCGs undergo an astrophysical balancing act between gas cooling and energy feedback within the dense intracluster medium. They thus offer a unique opportunity to study the physics of AGN feedback, as the energy imparted by the AGN leaves unique imprints on the surrounding gaseous medium. We propose joint HST UV and JVLA imaging to map out recent star formation and search for jetted AGN emission. We will complement this with high-resolution archival ALMA dust continuum and optical Euclid observations for a premiere case study of a star-forming and radio-bright BCG. The full suite of observations will allow us to connect the origin of the dust tail to the radio source and investigate the role of feedback in this cluster core at z=0.81.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18018
Program Title: Phoenix from the Ashes: Searching for Surviving Companions to SN~2023bee with early excess

Principal Investigator: Wang, Qinan

PI Institution: Massachusetts Institute of Technology

Despite their important role in modern cosmology, the exact progenitor system of Type Ia supernovae (SNe Ia) remains elusive. The community has been trying to resolve this question in many indirect ways, but HST offers a unique opportunity to do so directly by observing a nearby SN Ia, SN 2023bee. This supernova has an early excess flux that could be due to the interaction between the SN ejecta and a non-degenerate companion. If observed, this would be the first direct detection of the single-degenerate SN Ia progenitor channel. According to theoretical models, the surviving non-degenerate companion will be heated by SN ejecta and inflate, resulting in a significant increase in its luminosity. The late-time bolometric light curves of SNe Ia are also indicative of their isotope composition, and thus of their progenitor systems. HST, with its exquisite depth, resolution, and multi-band coverage from UV to NIR, is the only resource suitable for discovering these heated surviving companions and constraining the progenitor channels of SNe Ia. Using HST to observe SN 2023bee over three cycles, we will be able to confirm or exclude the existence of a non-degenerate companion in this system, and provide strong constraints on the progenitor system.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18019
Program Title: Gravitational lensing by a luminous satellite: a test of dark matter and galaxy formation models

Principal Investigator: Despali, Giulia

PI Institution: Universita di Bologna

Strong gravitational lensing enables precise measurements of galaxy mass distributions, including both dark matter and baryonic components. In some systems, small satellites perturb the lensed arcs, allowing us to measure their masses independently. Recent lensing detections of low-mass satellites show anomalously high concentrations, inconsistent with predictions from the Cold Dark Matter (CDM) model. These outliers cannot be explained by baryonic effects alone, as simulations that reproduce the observed densities require stellar masses exceeding luminosity constraints. This tension motivates the exploration of alternative dark matter models such as Self-Interacting Dark Matter (SIDM), which can alter central densities through particle interactions. To test these scenarios, we propose deep HST observations of a newly discovered lens system with a luminous satellite visibly perturbing the arc. This rare configuration allows us to disentangle stellar and dark components of the satellite, measuring its mass, light, and dark matter density profile. Preliminary Keck-AO modeling indicates a steep satellite mass profile (gamma~2), deviating from NFW expectations. Multi-band HST imaging will enable accurate stellar mass and luminosity estimates for both the lens and satellite, allowing us to precisely constrain the density profile. These data are critical to determine whether the high concentrations observed are a general feature of lensing satellites or indicate new dark matter physics. This system, part of a growing sample our team is compiling, offers a timely and high-impact opportunity to address fundamental questions about dark matter on galactic scales.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: None
ID: 18020
Program Title: The Extended Clusters of Andromeda - dwarf galaxies or globular clusters?

Principal Investigator: Collins, Michelle

PI Institution: University of Surrey

New survey data continues to blur the boundary between Globular Clusters (GCs), thought to be single stellar populations devoid of dark matter, and dwarf galaxies. The extended clusters (ECs) of Andromeda were first discovered in 2005 and sit right in the gap between these two populations. Given their sizes (half light radii of ~30pc) and brightnesses (Mv ~ -6), it was unclear whether these were puffed up globular star clusters, or faint dwarf galaxies. In the nearly two decades since, we are still unsure of their nature. Spectroscopic data have shown they could be either dark matter dominated or dark matter free, while shallow HST imaging to their horizontal branches have shown them to have stellar populations consistent with either population. One clear method to break this frustrating degeneracy is to measure their star formation histories. GCs form their stars essentially in a single burst, while even the faintest dSphs have star formation that extends over a Gyr or more. By measuring their star formation histories we can determine which class ECs belong to for the first time, offering a unique opportunity to refine our definition of GCs and dwarfs, test GC formation models and refine using galaxy counts of the faintest dwarfs as a cosmological probe. To achieve our goals, we request 33 orbits of WFC3 observations to image three bright ECs down to their oldest main sequence turn-offs.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18021
Program Title: FUV imaging of massive Magellanic Clouds clusters

Principal Investigator: Sana, Hugues

PI Institution: Institute of Astronomy, KU Leuven

Stripped stars are one of the most exciting types of massive binary interaction products. They are the hot, helium-rich cores of intermediate and high-mass stars that have lost their envelope through mass transfer or common-envelope evolution. Stripped stars dramatically enhance the ionization radiation budget of massive stars and are excellent candidate progenitors of hydrogen-poor core-collapse supernovae. Given their temperature and small sizes, stripped stars are hard to detect in the optical. Using NUV SWIFT photometry, a newly proposed method, based on NUV-optical color-indexes, has recently been successful in identifying a dozen such stripped stars in the Magellanic Clouds (MCs). However, the quality of the PSF and its photometric precision have limited these studies to low-density field regions, and to more massive stripped stars with no or optically-faint companions. Here we propose to take the detection of stripped stars to the next level, by testing and validating the use of HST FUV photometry in two 25-40 Myr massive MC clusters. As FUV photometry is challenging given Brightness Object Protection constraints, we used archival WFC3/F225W photometry and VLT/MUSE integral field spectroscopy to avoid problematic objects in the clusters targeted here. Characterizing the full stripped-star population is crucial to constrain binary evolution models and can only be achieved with FUV imaging. Our pilot project will open the possibility to detect stripped stars in their native clusters (hence assign them an age!), particularly stripped stars with optically bright companions (unidentifiable in the NUV or optical) and lower-mass stripped stars than possible so far.

Proposal Category: SNAP
Scientific Category: Galaxies
Alternate Category: None
ID: 18022
Program Title: Unlocking the full potential of JWST spectroscopic fields with SHIP^3: Snapshot HST Imaging of Pure-Parallel Programs

Principal Investigator: Nedkova, Kalina

PI Institution: The Johns Hopkins University

To unlock the full potential of JWST spectroscopic fields, we propose Snapshot HST Imaging of Pure-Parallel Programs (SHIP^3) to target 123 fields from the two largest wide field slitless spectroscopy surveys with JWST/NIRISS. Both of these programs are based on pure-parallel observations thereby providing detailed spectroscopic diagnostics of thousands of galaxies down to unprecedented stellar masses of $< 10^8$ Msun over $0.6 < z < 3.4$ in an uncorrelated and unbiased fashion. These large surveys are poised to answer key outstanding questions in galaxy evolution but often lack ancillary photometric data necessary to reliably constrain galaxies' physical properties, such as stellar mass. Using HST's unique, high spatial resolution imaging, we will (1) enable reliable stellar mass estimates allowing us to (1A) measure the star formation rate-stellar mass relation down to $\sim 10^7$ Msun, reaching ~10x less massive galaxies than currently measured at $0.6 < z < 2.4$, (1B) extend the gas-phase mass-metallicity relation over $1.7 < z < 3.4$ to low masses, expanding the low-mass samples by over an order of magnitude, and (1C) examine the relation between nebular attenuation and stellar mass to low stellar masses. The SHIP^3 program will also (2) allow spatially resolved rest-frame UV measurements with which we will characterize the properties of star-forming clumpy galaxies, including identification of clump and interclump regions within galaxies.

Proposal Category: GO
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: None
ID: 18023
Program Title: Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

Principal Investigator: McDonald, Michael

PI Institution: Massachusetts Institute of Technology

In low-redshift clusters, such as Perseus and Abell 1795, the warm (10^4K), ionized phase is of critical importance to understanding thermal instabilities in the hot intracluster gas. Maps of Halpha and [O II] have been used for decades to understand how (and how not) cooling proceeds in the intracluster medium. This intermediate-temperature gas, which we think condenses out of the hot phase in areas that are locally out of thermodynamic equilibrium, retains a kinematic imprint of the hot gas, allowing us to probe the turbulence and bulk motion of the 10^8K gas by observing the "fluttering" of cool filaments in the same way that the motion of a flag provides insights into the wind speed and direction. To date there are only a small number (~4) of clusters in which we detect cool multi-phase gas on large enough scales (>50 kpc) that it can be used to provide insights into the details of cooling/feedback physics in the intracluster medium. We have recently discovered what may be the most extreme such system, MS1455.0+2232, which has a network of cool filaments that may extend on scales of ~100kpc, a factor of ~2 larger than the archetype system: the central galaxy in the Perseus cluster. Using a conveniently-located narrow band filter on WFC3-UVIS, we propose to obtain deep narrow-band imagine centered on the [O II] emission line, to make the first deep map of cool 10^4K gas in this system. This system will immediately join a small number of ~4 other clusters with extended emission line nebulae which each have proved critical in understanding cooling, feedback, turbulence in the intracluster medium.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18024
Program Title: Untangling the stellar content of the NGC 6822 Hubble regions with the unique WFC3/IR filters

Principal Investigator: Jones, Olivia

PI Institution: United Kingdom Astronomy Technology Centre

With the unique WFC3/IR medium band filters we will image massive star-formation regions (Hubble I/III, IV, V, X) in the low-metallicity dwarf galaxy NGC 6822. These regions, spanning various evolutionary stages, provide a temporal sequence of star formation under conditions analogous to the early Universe. This high-resolution HST data will be combined with existing JWST and ALMA observations to study star formation, stellar feedback, and dust evolution in this system. A central challenge is distinguishing young stellar objects in the Hubble regions from the significant population of evolved stars in the NGC 6822 field, which overlap in colour space. The unique WFC3/IR filters, sensitive to H2O absorption in M-type AGB stars and the CN+C2 features in Carbon stars, break this degeneracy. It will even determine AGB star chemistries from which we can quantify their dust production. Given the significant roles of evolved stars in the chemical enrichment of the interstellar medium (ISM) and young massive stars in shaping their environments through intense radiative feedback, jets and winds, detailed observations of the interplay of these populations in nearby systems where CO cores and atomic gas have also been resolved on 1--3 pc scales is essential. By characterizing the stars physical properties via SED modeling and their effects on the HII regions in NGC 6822, we can refine our understanding of massive star formation and the dust lifecycle in chemically unenriched environments.

Proposal Category: GO (GO-Archival)
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18025
Program Title: Last but not least: 13 globular clusters to complete the HST legacy

Principal Investigator: Massari, Davide

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

We propose to target 13 unexplored Galactic globular clusters (GCs) with HST WFC3/UVIS. These systems are the only ones out of the 156 Milky Way GCs observable in optical bands that still lack observations to build a deep colour-magnitude diagram in the F606W and F814W bands. They have only been imaged at high-resolution in two bands by Gaia or HST with the Wide-Field Planetary Camera 2 (WFPC2), whose resolution and depth can barely reach the main-sequence turn-off. This hampers their investigation on a plethora of science cases, and leaves them out of the HST monumental legacy on globular clusters. Our proposed observations will fill this gap, thus completing the sample of known Milky Way GCs imaged by HST down to low-mass stars in the HST F606W and F814W filters, and providing the last brushstroke to complete one of HST masterpieces. In fact, having the entire system of Galactic GCs observed i) in the same stable photometric system, ii) from the red giant branch to the faint main sequence, and iii) over wide field-of-views (covering several half-light radii) enables the full investigation of two fundamental science cases. These are: 1) reconstructing the timeline of the MW assembly history by means of the GC age-metallicity relation (the target GCs are likely accreted by still unknown mergers hidden in th distant Halo); 2) testing the universality of the GCs stellar mass function. This is one of the last chances we have to achieve these paramount goals.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: Stellar Physics and Stellar Types
ID: 18026
Program Title: Testing Volatile Transportation in the Epoch of Terrestrial Planet Formation

Principal Investigator: Lu, Cicero

PI Institution: NOIRLab - Gemini North (HI)

Debris disks offer a unique laboratory to test theories of volatile transport in the epoch of terrestrial planet formation. The leading hypothesis posits that exocomets can deliver water-ice stored in exo-Kuiper belts and the inner regions of a young planetary system in the form of water vapor via sublimation. However, liquid water remains elusive in debris disks to date. We propose to observe OH fluorescence emission as a tracer for H2O in liquid and vapor phases with HST STIS/NUV E230H and definitively to decipher whether water vapor exists in the inner regions in three young planetary systems (HD 131488, beta Pictoris, and HD 181327). These targets are most suitable because they contain water-rich exo-Kuiper belts newly discovered with JWST/NIRSpec observations and have also been identified with exocometary activities from past multi-wavelength studies. We aim to constrain the OH gas temperature, emission mechanism, and radial velocity for any detected OH line velocity to examine whether the OH gas origin is consistent with exocometary. While JWST provides new clues to the composition of planetesimal reservoirs, our proposed HST observation will provide the most direct and definitive clue for the existence of liquid H2O in debris disks. A non-detection will allow us to place the first constraints on OH dissociation rates based on observed H2O-ice column densities, providing a new benchmark for comparison with younger, gas-rich protoplanetary disks. Our proposed observation across our sample of early A to mid-F type stars will benchmark our understanding of the volatile transportation in these exoplanetary systems.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18027
Program Title: Securing the HST Surface Brightness Fluctuation Legacy with a Robust JWST Calibration

Principal Investigator: Jensen, Joseph

PI Institution: Utah Valley University

Addressing the "Hubble tension" is a top priority for JWST, and several programs have been awarded time to construct a completely independent distance ladder based on old populations in elliptical galaxies instead of Cepheid variable stars in spiral galaxies. In particular, tip of the red giant branch (TRGB) stars have been measured in 14 early-type galaxies with JWST for the purpose of calibrating the surface brightness fluctuation (SBF) method. However, thus far only 8 of these galaxies have SBF measurements with HST WFC3/IR. We propose to complete the calibration linkage between HST and JWST by using HST WFC3/IR to observe the remaining 6 galaxies with established JWST TRGB distances. The result will be a higher precision zero point for the HST SBF sample, expanding the calibration from 8 to 14 galaxies. The TRGB calibration of SBF decouples the large archival sample of over 230 HST IR SBF measurements from the Cepheid-SN Ia ladder. The HST SBF sample, spanning the sky and extending to 100 Mpc, provides an independent estimate of the Hubble constant based solely on old stellar populations.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18028
Program Title: On Cloud 9 - The Effects of Reionization on Low-Mass Dark Matter Haloes

Principal Investigator: Bennet, Paul

PI Institution: Space Telescope Science Institute

We request 2 orbits of imaging with ACS to search for the stellar counterpart to M94 Cloud 9 (M94-CL9), a recently discovered RELHIC (REionization-Limited HI Cloud) candidate near the nearby galaxy M94. Constraining the properties of low-mass subhaloes are critical given the hierarchical nature of galaxy formation and evolution within the Lambda-CDM paradigm. The lowest mass halos are also the most numerous. RELHICs are posited to make up 50% of the halo population below M_halo <10^9 M_sun. They host few stars due to the rapid ionization of their HI reservoirs during reionization. Studying these systems will provide us with an opportunity to understand the properties of systems whose potential growth was stunted by reionization. M94-CL9 was discovered during an HI survey around M94 using the Five-hundred Meter Aperture Telescope. Its HI properties (M_HI ~1.5e6, W_50~25km/s) and lack of stellar counterpart in extant deep optical imaging are comparable to the properties of RELHICs in simulations. However, the current limits on the stellar mass of M94-CL9, M_* ~1.1e5 M_sun, are not particularly strong and do not suggest that it is a true RELHIC. Deeper imaging is required to probe further into whether any stellar counterpart associated with M94-CL9 is present. With an observing time of 2 orbits we will be able to reach a projected mass limit of M_*~ 1.0e4 M_sun for an old stellar population and less for a young population with recent star formation. The confirmation of a lack of any stellar counterpart would strongly suggest that M94-CL9 is indeed a RELHIC and the detection of a stellar counterpart would make it one of the most gas-rich, low-mass galaxies in the Local Volume

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18029
Program Title: Proper Motions of the M31 Satellites: The missing pieces of the 6D puzzle

Principal Investigator: Bennet, Paul

PI Institution: Space Telescope Science Institute

Precise proper motions (PMs) have transformed our understanding of the Milky Way (MW) and its substructures. However, MW's nearest massive analog M31 remains underexplored in this regard. This proposal requests 48 HST orbits to obtain second-epoch observations to measure PMs for seven bright dwarf satellites of M31: NGC 205, And VI, VII, XIX, XXXI, XXXII, and XXXIII. These are ideal targets due to their stellar density, known distances, and line-of-sight velocities. M31's satellites offer a unique opportunity to study galaxy assembly, orbital history, and dark matter halo mass. Unlike the MW, M31's satellites show strikingly similar star formation histories, suggesting possible coordinated quenching events around ~6 Gyr ago which could indicate a group infall or a shared environmental effect, scenarios only distinguishable through 3D kinematics which can only be accessed by PM measurements. Meanwhile, the existence and stability of the "Great Plane of Andromeda" (GPoA) remain debated. PMs of satellites within and outside the plane, especially of massive members like NGC 205, are crucial to test whether the GPoA is a stable structure or a transient feature. Precise PMs will help constrain M31's halo mass by using distant satellites as tracers, a method proven effective for the MW. Most of these dwarfs have no prior PM measurements and Gaia is not sensitive enough at M31's distance. HST is currently the only observatory capable of achieving the necessary precision. These observations are critical to unlock the orbital histories and assembly of the M31 system within a broader cosmological context.

Proposal Category: GO (GO-Archival)
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: Stellar Physics and Stellar Types
ID: 18030
Program Title: Shoring Up the Cosmic Shoreline: Improving the Cumulative XUV Irradiance Knowledge of Rocky Worlds DDT Targets

Principal Investigator: France, Kevin

PI Institution: University of Colorado at Boulder

The JWST Rocky Worlds Director's Discretionary Time (RW DDT) program is studying whether rocky planets orbiting M dwarf stars can retain their atmospheres. The RW DDT is targeting approximately 10 of the most promising small planets for (1) atmospheric detection observations with JWST and (2) measurements of the far-ultraviolet to infrared stellar spectral energy distributions with HST. The RW program is framed around the concept of the Cosmic Shoreline, where a planet's gravity (escape velocity) is compared with the escape-driving XUV energy input from the star. However, measurements or calculations of the stellar XUV flux, critical to placing systems on the Cosmic Shoreline, are *not* part of the RW DDT stellar characterization effort. We propose to directly support the fundamental goal of the DDT program with a multi-cycle GO+AR program to quantify the stellar XUV environments of the RW target stars and empirically place them on the Cosmic Shoreline. We will do this with (1) new far-ultraviolet + X-ray (Chandra and XMM) observations of the host stars in Cycles 33, 34, and 35 that enable high-quality extreme-ultraviolet calculations and characterization of the full XUV (X-ray + extreme-ultraviolet) irradiance, (2) observation and characterization of stellar flares across the full high-energy spectral band to quantify the contribution of time-variable phenomena to the total ionizing radiation budget, and (3) creation of a high-level stellar data product library to support the community's analysis and interpretation of the terrestrial planet data acquired by the RW DDT program.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18031
Program Title: Be+sdO binaries with visual orbits

Principal Investigator: Gies, Douglas

PI Institution: Georgia State University Research Foundation

Binaries are common among massive stars, and close pairs interact over their lifetime to transform the binary systems by exchanging mass and angular momentum. The mass transfer scenario results in a gainer star spun up to near-critical rotational velocity and a donor star stripped off its outer envelope to reveal a hot and faint helium star. FUV spectroscopy remains the only feasible approach to directly detect these helium companions. The orbital and physical properties of the helium companions are essential to trace the evolutionary state of post-mass transfer binaries. Massive helium stars are the probable progenitors of double neutron stars and black holes in X-ray binaries. Here, we propose obtaining FUV spectroscopic observations for five Be+He binary systems recently angularly resolved through near-IR long baseline interferometry with the CHARA Array and VLTI. The visual orbits combined with distances yield the total system masses, but obtaining individual masses requires spectroscopic orbits from radial velocities. Our goals are to confirm the detection of the stripped helium stars in these Be binaries, determine their orbital elements through measurements of the Doppler shifts, find the individual masses, and refine the physical properties of both components from the reconstruction of individual component spectra using Doppler tomography. We aim to compare the fundamental physical parameters of these systems with evolutionary models to estimate their ages and to trace their formation processes through mass transfer.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18032
Program Title: The Mysterious Death of a Lonely Dwarf: Who Quenched Cetus?

Principal Investigator: Bennet, Paul

PI Institution: Space Telescope Science Institute

Cetus dSph (Cetus) is a classical isolated dwarf galaxy in the LG, separated from the Milky Way (MW) and M31 by ~750 kpc and ~680 kpc, respectively. Despite this apparent isolation, Cetus is a quenched dwarf galaxy with no HI reservoir or recent star formation. This is contrary to the distance-morphology relation where quenched galaxies are typically closer to a massive host and star-forming galaxies are more isolated. Traditionally, the quenched nature of Cetus has been explained by labeling it a backsplash galaxy, i.e. a galaxy, typically a dwarf, that has previously interacted with a massive galaxy but is now significantly outside of its virial radius due to a highly elliptical orbit. Significantly, this explanation is not compatible with recent kinematic studies, which suggest that Cetus may be on first infall with no previous interaction with the MW or M31. If on first infall, Cetus would defy our current understanding of how galaxies quench; there are no analogs of quenched, Cetus-mass galaxies in simulations that have not encountered a more massive companion. However, existing kinematic data for Cetus has significant measurement uncertainty, making its first infall orbit classification highly uncertain. We propose a new epoch of imaging for the Cetus dSph with HST to measure the proper motions (PM) of Cetus to sufficient accuracy to definitively constrain its past orbit and interaction history. Given the clear theoretical challenge of a first infall orbit to galaxy quenching models, it is critical to constrain the orbit of Cetus to advance or verify our understanding of how galaxies quench.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Stellar Physics and Stellar Types
ID: 18033
Program Title: The smoking gun uncovering the origin of the rotational spread in young Magellanic cloud clusters: NGC1866

Principal Investigator: Muratore, Fabrizio

PI Institution: University of Padova

Young stellar clusters in Magellanic Clouds (MCs) do not host simple stellar populations, as could be expected. Features, such as the split main sequence (MS) and the extended main sequence turn-off (eMSTO), are easily visible in all clusters younger than 2 Gyrs. Spectroscopic studies suggest that these features arise from different rotation rates among the stars. However, the occurrence of slow rotators poses a serious challenge to our understanding of stellar evolution. Indeed, pre-MS stars are expected to accelerate, so we do not expect to find slow-rotating stars. What causes some stars to slow down while others retain their spin? So far, three main mechanisms have been proposed, involving tidal interaction in binary systems, disc interaction in the pre-MS phase, and stellar mergers. Binary fraction among fast and slow rotators is the key to constrains the mechanism, indeed, each mechanism predicts different binary content. A new method has been developed to analyze a large sample of binaries, effectively distinguishing between slow and fast rotators using the F275W filter. This method has already been applied to three star clusters that are less than 100 million years old. Unfortunately, due to their young age, it is challenging to validate a single mechanism. We propose to observe NGC 1866, a 200-million-year-old star cluster in the Large Magellanic Cloud, using the F275W filter. Given that the mechanism has been active for a longer period, we expect to find more significant differences in binary content. This makes the cluster the smoking gun uncovering the braking mechanism and the origin of the split MS and the eMSTO.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18034
Program Title: Spatially resolving the conditions for ionizing radiation escape in galaxies

Principal Investigator: Saldana-Lopez, Alberto

PI Institution: Stockholm University

One of the fundamental questions in cosmology is the origin and mechanisms responsible for the reionization of the Universe. However, models and observations struggle to provide a complete picture of the processes driving the escape of ionizing photons from galaxies. Surveys such as the Low Redshift Lyman Continuum Survey (LzLCS) have been able to characterize the properties of sources emitting Lyman continuum (LyC) radiation. But LzLCS only measures the ionizing output along single sightlines, incorporating scatter in the relations between the fraction of escaping ionizing photons (fesc) and physical properties of galaxies. Here we propose 40 orbits with HST ACS/WFC ramp filters to observed a statistical sample of 40 galaxies drawn from the LzLCS -the LaCOS sample- that has archival multi-wavelength imaging with HST. Our program, targeting H-alpha and H-beta emission, will allow us to build spatially resolved maps of dust obscuration and constrain the intrinsic ionizing luminosity of the star-forming regions. We will use this data in concert with publicly available Lyman alpha (Lya) imaging from LaCOS, to characterize the LyC escaping channels and to test the different modes of feedback and LyC escape. This study will yield the observational constraints needed for JWST to elucidate the conditions in which Reionization happened, and will have an unprecedented legacy value for observers and simulations, enabling studies about radiative transfer, star-formation, feedback and the Baryon Cycle in galaxies.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Intergalactic Medium and the Circumgalactic Medium
ID: 18035
Program Title: Direct search for Lyman continuum in a multiply-lensed low-mass high-redshift analog

Principal Investigator: Furtak, Lukas

PI Institution: Ben-Gurion University of the Negev

Early star-forming galaxies at high redshifts have been shown to most likely be the sources that drove the reionizantion of the Universe with deep JWST observations. Direct observation of their ionizing Lyman continuum (LyC) emission however remains impossible due to IGM opacity. Instead, low-redshfit analogs of high-redshift galaxies are studied to constrain their LyC escape and link it to other observables, e.g. Lyman-alpha (Lya), the ultra-violet (UV) continuum slope, or rest-frame optical emission lines and line ratios. We here propose to use the HST's unrivaled UV sensitivity to directly detect the LyC emission of a particularly unique, gravitationally lensed, analog of the faint low-mass galaxy population that reionized the Universe. Situated at z=3, this galaxy has an unusual double-peaked Lya emission profile where the blue peak is much stronger than the red peak which suggests a significant LyC escape fraction. It moreover presents an extremely blue UV continuum slope such as has thus far only been observed in the highest-redshift (z>10) galaxies with JWST. Thanks to the strong lensing, we benefit from a factor ~10 in flux magnification and will be able to stack the multiple images to achieve greater depth and probe LyC escape fractions as low as 0.015, establishing a link between this object's LyC escape fraction, the unique Lya emission profile and other properties. The timing to conduct these observations in cycle 33 is ideal since the cluster will be imaged with JWST in cycle 4, which will add crucial additional constraints to our analysis. Our proposed deep UV observations will in turn ideally complement JWST near-infrared imaging of the lensing cluster.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Intergalactic Medium and the Circumgalactic Medium
ID: 18036
Program Title: Multiwavelength Extinction Curves in Distant Galaxies

Principal Investigator: Aller, Monique

PI Institution: Georgia Southern University Res. & Svc. Foundation, Inc

Interstellar dust grains significantly impact the formation of new stars and the appearance and derived stellar populations of distant galaxies. Dust grain properties, including composition, size, and structure, reflect both the dust progenitors and subsequent interstellar processing. Variations in dust grain properties lead to wavelength-dependent differences in the UV-to-MIR extinction curves of galaxies. Studies of distant galaxies commonly assume extinction curves similar to the Milky Way, Local Group, and starburst galaxies; this assumption has not been confirmed in normal galaxies. Recent studies using quasar absorption systems (QASs) find that there may be more small grains, silicate dust grains may be larger or have more crystallinity, and that there may be differences in the relative build-up of carbonaceous and silicate dust grain populations. However, such UV-to-MIR analyses have only been possible for a small number of sources. We propose to obtain STIS G230L/G430L spectra to determine the shape of the UV extinction curve and strength of the 2175 A bump produced by carbonaceous dust in a sample of 6 QASs with JWST MIRI-MRS and optical data. The proposed data will allow us to break the fitting-degeneracy between the FUV-rise and 2175 A bump, to determine whether these galaxies have a large population of carbonaceous grains or a large population of small grains relative to the Milky Way. It will also allow a comparison of the UV features from carbonaceous grains with MIR silicate features in the same sightline of $z>0.1$ galaxies. These results may impact corrections applied to high-z galaxy studies, as well as models for the formation/evolution of dust grains.

Proposal Category: SNAP
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18037
Program Title: Search for massive sub-kpc dual active galactic nuclei in the most luminous quasars

Principal Investigator: Do, Ha My

PI Institution: University of Southern California

Supermassive black hole binaries (SMBHBs) are expected to dominate the nanohertz gravitational wave background (GWB). The large GWB amplitude measured by pulsar timing arrays (PTAs) suggests that there are more binaries than predicted by major merger models. Merging SMBHBs in the local universe correspond to close-separation massive dual AGN progenitors at z=0.15-0.9. However, we have detected very few sub-kpc dual AGN massive enough to contribute to the GWB in this redshift range. We propose a SNAP with WFC3/UVIS of the 148 most luminous Type-2 AGN selected from SDSS in z=0.1-0.4 to detect the most massive sub-kpc dual AGN predicted by the GWB. Only a WFC3/UVIS SNAP can provide a large enough sample at a high enough resolution for our science goal of characterizing the population of PTA-mass sub-kpc dual AGN. With this data, we can constrain the abundance of sub-kpc duals and test the population of SMBHBs predicted by the measured GWB. Furthermore, this observation would allow us to study the demographics of SMBHBs and their host galaxies to aid future detection efforts.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18038
Program Title: Unravel the Puzzles of Little Red Dots: HST View on Local Analogs

Principal Investigator: Lin, Xiaojing

PI Institution: University of Arizona

One of the most impactful early discoveries from JWST is the ubiquity of "little red dots" (LRDs) at z=2-10. LRDs are characterized by broad hydrogen emission lines and v-shaped SEDs (blue UV and red optical continua), interpreted as low-luminosity AGNs. A significant fraction of LRDs also exhibit Balmer absorption and Balmer breaks, which could be produced by a shell of dense gas surrounding the black hole. However, these models leave many degeneracies, particularly regarding the origin of the UV light. Spatially decomposing AGN and stellar light, as well as LyA observations, is the most direct way to test these LRD models. Yet at high redshift, LRDs are too faint and compact for such decomposition, even with JWST. Local analogs of LRDs provide the best opportunities to unravel the physical nature of this population. We propose HST UVIS imaging and STIS spectroscopy on three LRD analogs at z=0.1-0.3. These analogs, selected from SDSS, exhibit emission line profiles, UV-to-optical SEDs and Balmer absorptions that most closely resemble those of high-redshift LRDs. They establish an effective testbed and benchmark for LRD studies at z>2. By spatially resolving their UV-to-optical continua and mapping their Lya profile, we aim to: (1) unravel the origin of UV light, separate AGN and galaxy contributions and obtain a resolved view of host galaxies, (2) reveal the existence and measure the density and size of the hydrogen gas envelops surrounding the center BH. Fully leveraging the unique UV capabilities of HST in both imaging and spectroscopy, this program will directly test theoretical hypotheses of LRDs and address one of the most debated questions since the launch of JWST.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Galaxies
ID: 18039
Program Title: Confirming and Characterizing a Fast, Cool Inflow Toward a Luminous Quasar at z = 0.78

Principal Investigator: Liu, Will

PI Institution: University of Michigan

We propose HST COS+STIS observations of J0233-0455, a z=0.78 quasar exhibiting redshifted, inflowing Mg II absorption at +800 km/s, to study the elusive process of gas accretion onto supermassive black holes (SMBHs). While AGN outflows are well-documented, direct observations of gas inflows that fuel SMBHs remain extremely rare. Our target was identified through a systematic search for quasars with redshifted absorption, similar to a recent inflow discovered along with a filamentary nebula. As the brightest of the ten quasars found exhibiting the redshifted Mg II absorption, J0233-0455 is singularly suitable as a pilot target for the detailed UV spectroscopy we propose. The proposed UV spectroscopy will target key transitions including Ly-alpha, Ly-beta, the Lyman limit, C II, C IV, and O VI, allowing us to characterize the physical properties, ionization state, and chemical composition of the inflowing gas. The spectral diagnostics will enable measurements of the total mass and inflow rate of the accreting material. This study potentially offers a unique opportunity to quantitatively probe the mechanisms of black hole fueling, addressing a fundamental gap in our understanding of AGN physics and galaxy evolution.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18040
Program Title: First UV Observations of the Negative Extremum of xi1 CMa's Complex Magnetic Field

Principal Investigator: Erba, Christiana

PI Institution: Space Telescope Science Institute

The magnetic pulsating star xi1 CMa has the longest rotation period of any known magnetic B-type star (about 30 yr). It is also the only magnetic hot star for which pulsationally-induced modulations have been observed in both its X-ray light curve and its Halpha emission. Archival spectra from IUE and HST, obtained at different rotation phases, suggest xi1 CMa's UV resonance lines are also modulated on the pulsation period, a phenomenon that has not previously been observed for any magnetic hot star. A decade-long spectropolarimetric monitoring effort has now revealed xi1 CMa's complex magnetic topology; as a result, its asymmetric magnetosphere is expected to produce unique UV line profiles at the positive and negative extrema of the longitudinal field curve. xi1 CMa is currently passing through the negative magnetic extremum, a key phase in its rotation cycle that has never before been observed at UV wavelengths. We propose 4 new HST/STIS observations during Cycle 33 to obtain the first high-resolution UV spectra of xi1 CMa near its negative magnetic extremum and to measure the pulsation-induced modulation in its UV wind lines. This novel dataset will be paired with ancillary ground-based optical spectropolarimetry and X-ray spectroscopy obtained near xi1 CMa's negative magnetic extremum. Ultraviolet spectroscopy is the only way to complete a characterization of the velocity and density structure of xi1 CMa's complex magnetosphere, and HST is the only instrument with which these observations can be obtained. UV spectra are critically needed now, since an observation at this rotation phase will not be available again for at least a generation.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18041
Program Title: Unveiling the Progenitors of Type Ibn Supernovae with Early UV Spectroscopy

Principal Investigator: Dong, Yize

PI Institution: Center for Astrophysics | Harvard & Smithsonian

We propose a disruptive ToO program with HST/STIS to obtain two epochs of UV spectra of a newly discovered Type Ibn supernova (SN) within 250 Mpc. Type Ibn SNe are a rare class of fast-evolving transients that exhibit strong interaction between SN ejecta and dense circumstellar material (CSM), as evidenced by their rapidly evolving light curves and narrow helium lines in their spectra. This dense CSM likely originates from enhanced mass loss during the final years of massive star evolution, but the physical mechanisms driving this remain poorly understood. Studying Type Ibn SNe offers valuable insights into the late stages of massive star evolution and the processes that lead to their explosions--fundamental questions in transient astronomy. UV spectroscopy provides critical diagnostics of the progenitor surface composition, mass, and ejecta geometry. These properties can only be precisely constrained through UV data, enabling a comprehensive exploration of progenitor diversity and offering deeper insight into the nature of Type Ibn explosions.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Intergalactic Medium and the Circumgalactic Medium
ID: 18042
Program Title: Deep UVIS imaging of the Leo II dwarf spheroidal galaxy: deciphering the evolution of a unique Milky Way satellite

Principal Investigator: Savino, Alessandro

PI Institution: University of California - Berkeley

We propose to obtain deep photometric imaging of the Milky Way (MW) satellite galaxy Leo II. Leo II has unique properties within the MW galactic ecosystem and has great potential to deepen our understanding of the Local Group history. Leo II is the only known MW satellite to have quenched at intermediate ages (6 Gyr ago), bridging the gap between the two main groups of early-quenched and late-quenched satellites. Additionaly, Leo II is one of the most distant MW satellites and is in a low-eccentricity orbit, making it a precious tracer of the properties of the outer MW halo. Yet, this is the only long-known Local Group galaxy that lacks deep photometry and it is readily accessible by HST. The exquisite precision of our proposed observations will enable us to derive an updated, high-resolution, star formation history for this galaxy and investigate the presence of multiple episodes of star formation. Characterizing the frequency, amplitude, and timescales of star formation activity in Leo II will help address open questions connected to the formation and evolution of dwarf spheroidal galaxies, assessing the relative importance of ubiquitous (stellar feedback, interaction with the host) versus stochastic (mergers, gas accretion) drivers of star formation. In addition, we will determine a precise quenching epoch for Leo II which, when combined with state-of-the-art orbital calculations, will allow us to constrain the efficiency of ram pressure stripping at large Galactocentric radii, with implications for the density of the Milky Way circum-galactic medium and the total mass contained in the hot corona of our Galaxy.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18043
Program Title: The Metallicity Distribution Functions of M31 Ultra-Faint Dwarf Galaxies

Principal Investigator: Fu, Sal

PI Institution: University of California - Berkeley

We propose to measure the first well-populated stellar metallicity distributions (MDFs) in ultra-faint dwarf galaxies (UFDs) that orbit M31. We will use UVIS F395N (Ca H&K) and F475W imaging to measure precise metallicities (0.1-0.2 dex) of ~400 stars in 7 M31 UFDs, all of which show diverse and extended star formation that is not clearly compatible with quenching due to reionization, at odds with MW UFDs and expectations from cosmological simulations of galaxy formation. These extended SFHs leave unique imprints on each galaxy's MDF, which encode the signature of baryonic processes that shaped their evolution (e.g., inflows, outflows, stripping, SNe enrichment). From our MDFs we will: (i) measure the strength of feedback-induced outflows, via the mass-loading factor. We will compare them to predictions from cosmological simulations, which underestimate the strength and variation in outflows at low-redshifts and are unconstrained over the mass and age range of our sample; (ii) constrain the physical processes (e.g., stripping, gas depletion) that result in these galaxies quenching at intermediate cosmic epochs (z~2-5); (iii) search for metallicity gradients that have been discovered in some MW UFDs, but whose origins are unclear; (iv) catalog extremely metal-poor star ([Fe/H] < -3.5) candidates that will make for efficient community follow-up in the ELT era. This program will increase the number of stellar metallicities in these galaxies by a factor of ~20. Measuring high-fidelity MDFs is only possible due to the excellent blue-sensitivity and angular resolution of HST -- no other ground- or space-based facility can acquire these data.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18044
Program Title: UV spectroscopy of extremely metal-poor dwarf compact star-forming galaxies with exceptionally strong HeII 4686 emission

Principal Investigator: Izotov, Yuri

PI Institution: National Academy of Sciences of Ukraine, BITP

We propose to obtain for the first time the full UV spectra of 6 extremely metal-poor compact star-forming galaxies with the hardest ionizing spectra found at low-redshift. The emission line spectra, covering the range from Lyman-alpha to ~2900 Ang, will allow us to constrain the ionizing radiation field of these galaxies in the Lyman continuum and up to high energies (54 eV and higher) and thus to test different scenarios proposed to explain the hard spectra of these galaxies. The data will also allow abundance studies of Carbon and other elements. Finally, it will provide an important reference sample to study extremely metal-poor galaxies (with 2-10 % solar metallicity) with very hard radiation and also to better understand other objects (e.g. sources hosting intermediate-mass black holes, high-z AGN or other unusual objects). In short, the observations will provide fundamental and unique information on the radiation field, nature of the ionizing sources, and ISM properties of these extreme galaxies. And the observations will have an important impact for our understanding of the most metal-poor and first galaxies in the early Universe

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Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18045
Program Title: Unveiling the energy flow from Jupiter's magnetosphere to aurora

Principal Investigator: Nichols, Jonathan

PI Institution: University of Leicester

Jupiter's auroras are the brightest in the solar system, revealing where charged particles, energized in the magnetosphere, deposit vast quantities of energy into the atmosphere. Jupiter's auroras in particular are the foundation of our understanding of similar emission from more distant astrophysical objects. However, a pilot program of simultaneous HST and JWST observations of Jupiter's auroras has recently revealed fundamental gaps in our understanding of how such emissions are generated, demonstrating the power of joint observations to yield new insights into this system. Together with the evolving Juno mission, Cycle 33 presents a golden opportunity to answer the questions raised and piece together the energy flow from magnetosphere to aurora. These observations will answer the following science questions: 1. Are the brightest H3+ emissions in the solar system driven by low energy electrons? 2. Are the satellite footprint emissions driven by Alfven waves? 3. Are polar auroral flares driven by the solar wind? Only simultaneous observation with HST, JWST and Juno can answer these questions.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18046
Program Title: Testing the Mass Thershold of Reionization-Quenching with Isolated Dwarf Galaxy Hedgehog

Principal Investigator: Li, Jiaxuan

PI Institution: Princeton University

Cosmic reionization has long been thought to quench star formation in low-mass dwarf galaxies. However, no direct observational evidence exists beyond satellites of the Local Group. The mass range where reionization quenching is dominant remains elusive. We request HST WFC3/UVIS imaging in F606W+F814W for Hedgehog, a newly discovered isolated quiescent dwarf galaxy at 2.4 Mpc. Having no neighbors within 1 Mpc, Hedgehog's evolution was very likely unaffected by environmental effects, making it preserve the cleanest possible signature of reionization quenching. Compared with other ultra-faint dwarfs, Hedgehog's relatively high stellar mass (6x10^5 Msun) makes it particularly valuable for understanding the mass threshold of reionization quenching. A deep color-magnitude diagram analysis will reveal its ancient star formation history by resolving the horizontal branch, a key feature of the oldest, most metal-poor stellar populations. Our observations will provide a decisive test of reionization's impact on galaxy evolution at the critical mass threshold (M* ~ 10^5-10^6 Msun). Alternatively, if Hedgehog is a backsplash satellite from the Centaurus~A group, it would be the most distant backsplash galaxy ever confirmed, revealing the dynamical history of the nearby Centaurus A group and offering tests for backsplash models.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18047
Program Title: Disentangling the True Nature of Three Broadline-Offset & VLBA/Gaia-Offset Quasars with HST

Principal Investigator: Breiding, Peter

PI Institution: Binghamton University

In a sample of 15,900 SDSS quasars, Eracleous et al. (2012) found 88 objects exhibiting broad emission lines with >1000 km/s velocity offsets with respect to the host galaxy rest frame. One leading hypothesis for the origin of these velocity-offset broad lines is the dynamics of a binary supermassive black hole (SMBH), with competing hypotheses of recoiling SMBH and a broad line region (BLR) gas outflow due to entrainment by a relativistic jet. Three of these quasars were also shown to have signficiant VLBI/Gaia offsets in follow-up VLBA observations, where recoiling SMBHs, binary SMBHs, and optical synchrotron jets are all potential causes of these offsets. We propose HST observations to test the various competing physical models for both the observed spectroscopic and astrometric offsets, requiring a total of 3 ACS/WFC + F606W orbits to achieve our science goals.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18048
Program Title: Identifying Auroral Currents at Jupiter

Principal Investigator: Clarke, John

PI Institution: Boston University

Prior to the arrival of JUNO at Jupiter, the acceleration of high energy charged particles producing the bright aurora was thought to be well understood. During its close passes, however, the expected magnetic field-aligned potential structures accelerating the electrons into Jupiter's atmosphere have not been found, even when flying through magnetic flux tubes of bright aurora. Things are more complicated than thought, and other processes have to involve the acceleration of ions and electrons below JUNO's altitude in the form of ionospheric currents in auroral regions. Ionospheric current systems strongly heat the neutral atmosphere, and HST can measure the H2 temperature at the emission altitudes by resolving H2 ro-vibrational emissions. High temperatures indicate Joule heating from electric currents, which are carried by ions across magnetic field lines (in the case of Jupiter, mainly protons). The strong heating locations can be identified across the auroral oval using HST/STIS with G140M. In addition, proton-excited auroral emissions can be identified through Doppler-shifted H Lyman-alpha emissions from charge exchange of fast protons with atmospheric neutrals. This is an emission signature that HST can measure, however there are only two prior observations with the spectral resolution and sensitivity to detect it. This proposal is to perform scans across Jupiter's northern auroral region to identify regions of ionospheric heating/currents and proton-excited aurora. The observations will be scheduled close in time to JUNO perijove passes, which will record the charged particle environment in Jupiter's auroral regions.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18049
Program Title: Multi-Epoch UV Spectroscopy of Young Tidal Disruption Events

Principal Investigator: Hammerstein, Erica

PI Institution: University of California - Berkeley

When a star wanders too close to a supermassive black hole (SMBH), it can be torn apart by the tidal forces it experiences. This process can create luminous flares of radiation across the electromagnetic spectrum, and spark a multitude of phenomena such as outflows and jets. Despite predictions that these transients would be primarily X-ray ones, in recent years most tidal disruption events (TDEs) have been discovered in the optical/UV with no consensus on the origin of this emission. These large samples of TDEs can be used to probe the SMBH mass function to great distances and smaller masses, as the timing of the optical/UV light curve can be used to weigh the SMBH and probe its spin. This is only possible if we can understand the origin of the optical/UV emission. With this Cycle 33 program, we propose to observe a sample of young TDEs discovered before peak using STIS to obtain UV spectra. The UV spectra can probe the existence, evolution, and properties of outflows. By observing the evolution of outflows from pre-to-post-peak in TDEs, we can test the models for the optical/UV emission and thereby making great strides toward the goal of using TDEs as indepedent probes of SMBH properties. This goal is especially pressing in the era of upcoming, wide-field surveys and NASA missions which will discover hundreds to thousands of new TDEs.

Proposal Category: GO
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18050
Program Title: Reaping the Whirlwind: Accretion & Outflow in the Inner Milky Way

Principal Investigator: Bish, Hannah

PI Institution: Space Telescope Science Institute

Star formation in spiral galaxies like the Milky Way is powered by accreted gas. However, we have yet to detect the gas flows that must be powering the region of our Galaxy with the most star formation -- the inner disk. Observing the gas that is likely cooling and accreting directly onto the inner disk is key, but extremely challenging because these diffuse inflows must be measured in absorption. In external galaxies sightlines are sparse, which makes the Milky Way the ideal laboratory for detecting this gas because of its abundance of potential sightlines. However, from our vantage point absorption signatures of inflowing and outflowing gas become blended with absorption signatures of rotating gas at the disk-halo interface. Therefore, if we wish to detect and understand these vertical flows we must also understand the expected absorption signature from rotating gas above the disk, which is influenced by Galactocentric radius-dependent effects from lag that have never before been measured directly. To break the degeneracy between the absorption signatures of rotation and inflow/outflow, we propose to observe 8 quasars, paired with 20 stars at small angular separation, to measure the velocities, and, crucially, the distances to the gas in each sightline segment. These sightlines will probe above regions both with and without active star formation and determine the velocities associated with star formation-driven outflows. This program will yield the first measurements of halo gas rotation in the inner Galaxy as a function of distance, and provide insight into the connection between inflows, outflows, and star formation in this region.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18051
Program Title: Evolution of the Newly Discovered Jet in the Symbiotic System HM Sge

Principal Investigator: Hack, Warren

PI Institution: Eureka Scientific Inc.

We propose HST/WFC3 observations of the interacting Symbiotic binary HM Sge to study the evolution of the jet we discovered using the archival April 2021 observations, which was likely ejected during a powerful outburst during 1975-1980. Since 1975, HM Sge has been slowly getting fainter, that is until recently, when a dramatic dimming of the light curve began in late 2021/early 2022, indicating a new powerful mass ejection and dust formation, similar to the outburst and jet producing events in two nearby Symbiotics CH Cyg and R Aqr. Our goal is to carry out a timely high-angular resolution (0.025") multi-wavelength (UV-Optical) line-emission study of the newly discovered jet and the recent ejecta by zooming in on the central 3" radius (300 AU) circumbinary region, reaching as close as 25 AU to the central binary. This will allow us to determine the spatial/spectral evolution of the distribution and the characteristics of the new jet and more recent ejecta, and to gain a unique insight into jet formation and early propagation in symbiotic and other accretion-powered systems.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18052
Program Title: Golden Cepheids in Open Clusters; A Complete HST+Gaia Reference Sample to Optimize the Hubble Constant

Principal Investigator: Riess, Adam

PI Institution: The Johns Hopkins University

The Hubble tension, a 5-sigma discrepancy between the measured and cosmologically predicted value of the Hubble constant (H0) is one of the most compelling developments in cosmology in decades. Having withstood scrutiny and extensive crosschecks, it now demands pursuit with maximum signal-to-noise and a clear path to future improvements. The leading H0 determination is based on photometric observations of 14 Milky Way Cepheids in open clusters whose companion stars provide the opportunity to average-down errors and provide extreme parallax precision with Gaia. These calibrate Cepheids in the hosts of 42 local SN Ia, minimizing zeropoint errors through uniform WFC3 use. The recently released Gaia DR3 has provided the opportunity to discover new open clusters and established the association (through positions and proper motions) with 10 additional "golden" Cepheids. We propose two goals to optimize the current HST-based H0 measurement while supporting JWST calibration: (1) complete the high-leverage MW Cepheid sample by observing the final 10 with WFC3, to produce a 30% reduction in the uncertainty, and (2) obtain WFC3-IR NIR grism spectrophotometry at 0.8-1.7 micron of these stars to synthesize their magnitudes in JWST filters (F090W, F115W, F150W), empirically calibrating JWST's emerging distance ladder. These data will sharpen the current Gaia-based H0 and enable future gains. This effort will lay a cornerstone for a <1% H0 determination and further our understanding of what may be a fundamental shift in the cosmological model.

Proposal Category: GO
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: None
ID: 18053
Program Title: The Size Scale and Baryonic Content of Low Redshift Intergalactic Absorbers

Principal Investigator: Wakker, Bart

PI Institution: Eureka Scientific Inc.

This proposal aims at observationally determining the characteristic size scale of intergalactic absorbers near redshift 0, which make up the 10,000 K photoionized phase of the intergalactic medium (IGM). Such sizes are a key ingredient in the derivation of the fraction of baryons in the photoionized phase of the IGM. By comparing absorber sizes at z>2 with those locally, we will test predictions that suggest significant growth over cosmic time. This growth is responsible for reducing the gas accretion rate and star formation rate of galaxies. We will determine the distribution of characteristic absorber size at z=0 by observing 23 QSOs, which, combined with existing HST STIS/COS data for 13 targets, constitute 18 pairs of sightlines, separated by less than 3 arcmin (40 kpc at cz=3500 km/s). The dual sightline approach will allow us to probe the correlations between Lya absorbers on size scales ranging from 5 to 100 kpc, as a function of HI column density and environment. Our analysis will allow us to compare transverse sizes to sizes derived from photo-ionization modeling, characterize IGM turbulence, compare transverse and line-of-sight correlations, examine large-scale flows, and study structures in galactic halos. }

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Galaxies
ID: 18054
Program Title: Are 3XMM J2150 and EP240222a really off-nuclear tidal disruption events?

Principal Investigator: Patra, Kishore

PI Institution: University of California - Santa Cruz

Galaxy merger simulations predict a substantial population of off-nuclear massive black holes (MBHs). Tidal disruption events (TDEs) occurring around these wandering MBHs provide a rare window into studying these otherwise dormant black holes. Recently, AT 2024tvd was confirmed as the first optically selected off-nuclear TDE. Two other X-ray selected events have also been put forward as off-nuclear TDE candidates: 3XMM J2150 and EP240222a. However, their separation from the purported host galaxy is large (13 and 35 kpc, respectively). It is not clear that the two MBHs are even linked to the larger "host galaxy". Therefore, we request deep HST imaging of these 2 off-nuclear TDE candidates to 1) detect signatures of faint satellite galaxies that might host these TDEs, ii) detect UV emission from the TDe accretion disks. These deep and high spatial resolution images will help answer whether these are indeed off-nuclear MBHs like AT 2024tvd.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18055
Program Title: Simultaneous mapping of ammonia on Jupiter with Juno and HST/WFC3

Principal Investigator: Wong, Michael

PI Institution: University of California - Berkeley

Recent publications have demonstrated that imaging filter ratios at visible wavelengths can measure the spatial variation of ammonia gas on Jupiter. The approach is validated using both small-aperture filtered observations and spectroscopic observations. WFC3/UVIS includes the F645N filter which can enable the same analysis but at state of the art spatial resolution. The method also requires continuum and weak methane-band filters to resolve the degeneracy between ammonia concentration and aerosol screening. Measuring the spatial variation of ammonia has science value in three broad areas: 1. It traces vertical flows, because ammonia is depleted at high altitude by condensation. High-resolution maps reveal the vertical flows associated with discrete storms and vortices, measure sharp meridional gradients that are blurred in ground-based observations, and detect both causes and effects of moist convection. 2. By independently mapping cloud opacity and ammonia concentration, we can test the hypothesis (seemingly contradicted in recent retrievals) that the upper cloud deck is composed of ammonia ice particles. 3. The bulk abundance of ammonia is a key astrochemical constraint on planet formation, but the strong spatial variation of ammonia is a significant source of error. The proposed data would provide an independent constraint from radio (VLA, Juno) retrievals that include a degeneracy with temperature. We propose a long-term study that would overlap with Juno passes, providing additional value as context for thermal profiles from radio occultations.

Proposal Category: GO
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: Galaxies
ID: 18056
Program Title: Growing in the Wind: OVI Spectroscopy of Cool Clouds mixing with a Hot CGM

Principal Investigator: Rupke, David

PI Institution: Rhodes College

Models of the circumgalactic medium (CGM) show that it is fed by outflows from galaxies. These outflows expel cool clouds into a hot medium, where the clouds can grow by turbulent mixing and radiative cooling. Recent deep HST-UV images of the giant, luminous wind surrounding the massive, star-forming Makani galaxy show that T~10^5.5 K gas--as revealed by O VI 1032, 1038 Angstrom emission--has the same morphology as the cooler gas emitting [OII], implicating this mixing process. We propose deep COS spectroscopy to directly detect and spectrally resolve O VI in emission and absorption from the nebula center. This will complete the spatial+spectral picture of O VI in Makani and allow us to calculate the density and mass of the warm-hot phase of the wind-CGM interaction. We can then compare to galaxies of lower mass and star-formation rate. Makani is only the second galaxy imaged in O VI, and thus represents a key benchmark for future UV space missions like HWO. Fully characterizing its O VI nebula will best inform design requirements for such a mission.

Proposal Category: SNAP
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Exoplanets and Exoplanet Formation
ID: 18057
Program Title: Heavy Metal in Your Solar Neighborhood

Principal Investigator: Hasselquist, Sten

PI Institution: Space Telescope Science Institute

We propose a Snapshot proposal to obtain STIS E230H i2713 spectra of dozens of stars that will soon be observed by the Habitable Worlds Observatory, NASA's next UVO flagship. From these spectra as well as the spectra of 22 targets already with STIS E230H spectra, we will derive the abundances of heavy metal elements with transitions only accessible in the UV and at high-resolution for metal-rich, solar-like stars, including Ir, Hf, Pt, Lu, and Os. At present, there are virtually no measurements for these elements for stars in the Solar Neighborhood making it difficult to understand if the patterns in our solar system are typical for the solar neighborhood. Upon completion of this SNAP, we will, for the first time, measure the chemical abundance patterns of these elements, allowing us to answer powerful science questions about the nucleosynthetic sites of these elements as well as put important constraints on the extent to which the abundances of these elements vary for potential solar-like planet hosts. This work will lay the groundwork for NASA's next UVO flagship by providing a more detailed characterization of HWO direct-imaging targets and further developing spectroscopic measurement techniques in the UV. We have 150 targets spread across the sky.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Stellar Physics and Stellar Types
ID: 18058
Program Title: The chemical composition of pristine gas through first-population stars in NGC 121

Principal Investigator: Legnardi, Maria Vittoria

PI Institution: University of Padova

We propose to uncover, for the first time, the original chemical composition of the gas that formed an ancient globular cluster (GC) in the Small Magellanic Cloud (SMC). Our target is NGC 121, the only SMC cluster old enough to trace the properties of primordial star-forming gas. By combining archival and new HST/UVIS WFC3 F275W images, we will analyze stars in this cluster to reconstruct the conditions present in the early Universe. Our focus is on first-population (1P) stars, which preserve the chemical signature of the proto-cluster cloud. In Milky Way GCs, the 1P sequence often shows unexpected features, such as internal metallicity variations up to ~0.3 dex. These findings challenge the long-standing view that 1P stars are chemically homogeneous, suggesting instead that the star-forming gas was either inhomogeneous or later altered by stellar feedback. However, such studies remain limited to Galactic environments. NGC 121 provides a unique opportunity to investigate whether these internal chemical spreads are a universal property of globular clusters or depend on the host galaxy environment. By studying this SMC cluster, we will gain insight into early chemical enrichment processes in low-mass galaxies and explore the broader connection between star cluster formation and galactic evolution.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: None
ID: 18059
Program Title: Investigating Planet Formation in Real Time with the Dynamic Shadows Sweeping Across TW Hya

Principal Investigator: Debes, John

PI Institution: Space Telescope Science Institute - ESA - JWST

In the era of HST, JWST, and ALMA, the initial conditions of planet formation will be laid bare through the direct imaging of planet forming regions around nearby young stars. As more and more disks are observed over multiple epochs, their dynamic and variable natures are revealed, opening new avenues of study. Recent HST/STIS observations of TW Hya have revealed as many as three shadows, originating from ~6au, sweeping across the disk with different periods. We propose to observe TW Hya using HST/STIS coronagraphy with a long term monitoring program to fill in badly needed orbital phase coverage of the shadows' motion and create a homogenous, high quality dataset with archival STIS observations. Our program will elucidate the physical origin of the shadows by measuring the shadow orbital periods, their inclination relative to our line of sight, and the position angles of where each shadow appears/disappears, thus elucidating the orbits of the shadow relative to the properties of the outer disk and constraining future dynamical and hydrodynamical models of planet-disk interactions. Additionally, our observations of the three shadow periods will determine if a singular Jupiter analog is responsible for launching multiple spiral arm shadows, or if the shadows are due to three less massive planets. Disk shadow imaging is a new tool for understanding the initial conditions of planet formation at radii inaccessible by other observations.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18060
Program Title: Opening the crucial ultraviolet window on carbon dredge-up in white dwarfs

Principal Investigator: Bedard, Antoine

PI Institution: University of Warwick

About 30% of white dwarfs have helium-rich envelopes where deep convection occurs, leading to an important but poorly understood phenomenon: the dredge-up of carbon from the core to the otherwise pristine helium surface. This process has far-reaching implications, as the atmospheric carbon content (1) impacts white dwarf age determinations used to probe stellar and Galactic evolution, (2) affects the interpretation of exoplanetary material accreted onto white dwarfs, and (3) provides a rare empirical benchmark for the complex physics of dense plasmas. Yet, observational characterization is severely limited by the insensitivity of the optical window, where the trace carbon often remains spectroscopically invisible and only has a mild effect on the SED. Our understanding of carbon dredge-up thus rests on theoretical models, which depend on uncertain input physics and, crucially, have recently been called into question by Gaia observations. Fortunately, the ultraviolet window, and in particular the far-UV capabilities of HST, offers a clear and unique solution to this problem, as it is expected to reveal many strong carbon features allowing precise abundance determinations. We propose STIS far-UV spectroscopy of 16 bright helium-rich white dwarfs to detect and measure the surface carbon content across a key range of effective temperatures. These observations will enable the first robust test of dredge-up models, in turn providing valuable new constraints for dense matter physics and astrophysical applications of white dwarfs.

Proposal Category: GO (GO-Archival)
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18061
Program Title: Hubble Census of Nearby Satellites

Principal Investigator: Jones, Michael

PI Institution: University of Arizona

Low-mass galaxies provide a crucial means to test the predictions of cosmological models on small scales where they have frequently struggled to match observations. However, the most detailed comparisons have relied almost exclusively on the satellite galaxies in the Local Group (LG) as this was, until recently, the only system with a high level of completeness at low mass and surface brightness. Here we propose a complete census of ALL satellite galaxies ($M_V < -9$) within MW-like systems out to 10 Mpc. We request 149 orbits to image 149 of these satellites, as well as support to incorporate 111 targets with existing HST observations. Together these observations make up a volume-limited sample of 260 satellites around 22 MW-like hosts. This data set will allow an unbiased characterization of the properties of MW-like satellite systems and end our over-reliance on the LG as the one point of detailed comparison with simulations. Among many other science goals, the observations and analysis that we propose will allow: 1) the most robust measurement of the satellite luminosity function to date, 2) the determination of the globular cluster luminosity function in a lower galaxy mass regime than ever before, and 3) measurements of the star formation histories and quenching times of an unprecedented sample of satellites. Only in the past few years has a project of this scope become possible, as previously the target samples did not exist, and it is only possible with space-based observations. The data products of this program will be fundamental to all studies, both theoretical and observational, of low-mass satellites for the next decade or more.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18062
Program Title: Star formation history of the lowest baryonic mass star-forming galaxy known in isolation

Principal Investigator: Jones, Michael

PI Institution: University of Arizona

Pavo was recently discovered via a machine learning search of DECaLS imaging, and has the lowest baryonic mass of any star-forming galaxy known in isolation, sitting just above the mass threshold where cosmic reionization is expected to permanently quench star formation in low-mass galaxies. Very little is known about the impact of reionization on low-mass star-forming galaxies, even though it is a critical time in their lifecycle. Existing HST studies of the ancient star formation histories (SFHs) of extremely low-mass galaxies have almost all targeted quenched satellites in the Local Group (LG), but with deep observations it is possible to target the nearest extremely low mass galaxies in isolation, beyond the confounding influence of the LG environment. Pavo is one of only two galaxies known in this regime, in isolation, and close enough to reach the required depth. Deep HST imaging will sample the stellar population of Pavo down to the sub-giant branch, permitting the accurate modeling of its SFH all the way back to the epoch of reionization. These observations will also provide insight into recent episodic star formation in Pavo, which appears to currenly be in a lull, and identify RR Lyrae stars, allowing a highly accurate distance measurement. The only means to understand the impact of reionization on extremely low-mass star-forming galaxies is to observe the ancient stellar populations of isolated objects, and without observations of Pavo, our entire knowledge of this process will be extrapolated from a single object, the only other galaxy currently known in this regime (Leo P).

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18063
Program Title: UV Spectroscopy of the Stingray Nebula Central Star: Stellar Evolution in Real Time

Principal Investigator: Sahu, Kailash

PI Institution: Eureka Scientific Inc.

V839 Ara, the central star of the Stingray planetary nebula (PN), evolved from a B1-type post-AGB star in the 1970s to become hot enough to ionize the surrounding ejecta and reveal itself as a new PN by the 1990s. It provided the first-ever opportunity to study the transition of a star from the post-AGB to the PN phase, prompting studies with ground- and space-based telescopes. However, several aspects of this very rapid evolution have remained enigmatic. After the initial fast rise in temperature, high-resolution HST UV spectra obtained in 2015 showed a decrease in Teff, suggesting that V839 Ara is already returning toward the AGB (a "born-again AGB star" event). HST images in 2016 showed that the nebular emission had faded precipitously, in keeping with an observed decrease in the central star's Teff. This has led to the speculation that the star is undergoing a late thermal pulse (LTP). However, known LTP stars are hydrogen-poor and rich in He, C and s-process elements, while V839 Ara shows solar abundances. And the current LTP models do not reproduce its observed very rapid evolution. V839 Ara provides a unique opportunity to study the transition of a post-AGB star to a PN, and then apparently back toward the AGB. Since 2015, there have been no further UV spectra of the central star. We will obtain new HST UV spectra, and in conjunction with spectral-synthesis models, make a direct and accurate measurement of its present Teff, log g, and chemical composition. Our measurements will provide important and much-needed constraints on models of post-AGB evolutionary tracks, leading to a better understanding of this brief and fast-evolving phase of stellar evolution.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18064
Program Title: Are Novae Galactic Lithium Factories ?

Principal Investigator: Woodward, Chick

PI Institution: University of Minnesota - Twin Cities

The astrophysical origin of lithium in the Galaxy represents one of the major open questions in modern astrophysics. While lithium is destroyed by stellar evolution, many astrophysical processes and sources actively produce lithium. However, galactic chemical evolution studies suggest that none of these latter sources except novae appears sufficiently efficient to synthesize the total amount of Li. Detection of the 7Be II 313.0 nm resonance doublet transition in novae has finally confirmed theoretical predictions that 7Be is produced during the thermonuclear runaway on the surface of an accreting white dwarf that drives nova explosions. 7Be decays into 7Li with a half-life of 53.2 days, but when 7Be abundances are measured relative to calcium (current technique) the derived abundance of 7Li is 4 to 5 dex higher than the meteoritic value. The Ca result hints novae could be the major factories of 7Li. We propose a synoptic ToO study using the HST UV STIS echelle to set stringent constraints on in situ 7Li production using 7Be and Mg II as novel proxies. The objective is to derive an independent and accurate estimate of the nova 7Be (=7Li) yields, its evolution as it decays, and the dependence of lithium yield on nova type (classical novae or recurrent) using Mg II 280.0 nm as a reference element. The goal is to determine whether novae are the Galactic lithium factories. Two novae targets are proposed to enable comparision of 7Li yields in different nova types which will constrain the tension between theoretical models and observations.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18065
Program Title: Alpha-1 Hercules (M5 Ib-II): Wind Acceleration from an Oxygen-rich AGB star in a Coeval System

Principal Investigator: Harper, Graham

PI Institution: University of Colorado at Boulder

Oxygen-rich AGB stars are at the nexus of mass-loss mechanisms for cool evolved stars. K through mid-M red giants show signatures of rapid wind acceleration and magnetic wave-driven winds (outflows), while carbon-rich AGB stars lose mass through a combination of pulsation and radiation pressure - driving dusty outflows. However, this combined mechanism does not work for low-amplitude oxygen-rich AGB stars. We propose high and medium-spectral resolution, high signal-to-noise ratio, near and far-ultraviolet STIS observations of the oxygen-rich M5 Ib-II AGB star alpha-1 Her. These will be used to measure the wind acceleration and wind turbulence gradient which will help determine whether alpha-1 Her has a magnetic wave-driven, or an unrecognized hybrid radiation pressure-driven outflow. Absorption in the FUV CO Fourth-Positive Electronic bands will enable a sensitive analysis of the properties of the molecular wind component. The coeval alpha Hercules system has well determined stellar masses, radii, effective temperatures, and evolutionary age, making it an excellent system to study the full context of the mass-loss process in this O-rich M-type AGB star. These observations will help constrain where, evolutionarily, magnetic processes transition to pulsational radiation-driven flows - permitting more reliable mass-loss rate and chemical enrichment predictions for galactic evolution models for subsequent generations of stars and their planets. This suite of spectra will be an invaluable addition to the existing Hubble Archive, adding to the very under-represented class of cool evolved M stars.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: None
ID: 18066
Program Title: Discovery of Very Low-Mass Galaxy Candidates within the Local Group

Principal Investigator: McQuinn, Kristen

PI Institution: Space Telescope Science Institute

The discoveries of ultra-faint dwarfs satellites of the Milky Way and M31 were a paradigm shift for our understanding of heirarchical structure formation and helped frame our thinking of how reionization impacts the growth of low-mass structures. That paradigm is now changing again as more ultra-faint dwarfs are detected at farther distances and in different environments. For example, we now have evidence that *isolated* ultra-faint dwarfs are not necessarily quenched by reionization and there are tentative detections of ultra-faint dwarfs that are gas-rich. Despite these advances, interpretations are limited as these types of systems are very faint and hard to find, and therefore sample sizes are still quite small. Here, we report the discovery of 4 ultra-faint dwarf galaxy candidates found via ground-based optical surveys. Each system is visible by-eye in the optical images and the color-magntiude diagrams of the resolved stars suggest they are very low-mass galaxies within the Local Group. These intriguing systems appear to be outside the virial radius of the Milky Way and M31 (i.e., are likely isolated) and are an opportuity to futher probe the regime of ultra-faint dwarfs as a function of different environments. We are requesting 1-orbit of HST WFC3 imaging for each candidate to confirm and characterize these systems. The data will enable robust measurements of distances, structural parameters, integrated magnitudes, and star formation histories.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Exoplanets and Exoplanet Formation
ID: 18067
Program Title: Measuring the Accretion Rate for the Least Massive Known Brown Dwarf with a Circumstellar Disk

Principal Investigator: Luhman, Kevin

PI Institution: The Pennsylvania State University

A Cycle 3 JWST program has searched for free-floating brown dwarfs down to the mass of Jupiter in the nearby star-forming cluster IC 348 (5 Myr, 300 pc). Those observations have discovered a brown dwarf that has an estimated mass of 2 Jupiter masses and that exhibits excess emission at 3-5 um from a circumstellar disk, making it the least massive known brown dwarf with a disk. We propose to use UV imaging with HST to measure the disk's accretion, which is a vital component of any effort to model the disk and constrain its properties. Using the accretion rate measured with HST, we will develop a model that fits the IR excess emission detected by JWST, which will provide an estimate of the inner radius of the disk. The accretion rate will also facilitate the modeling of any other future observations of the disk, such as JWST spectroscopy at 5-15 um and ALMA millimeter continuum measurements. Ultimately, this system represents a unique opportunity to study disk accretion and planet formation in an extreme, unexplored regime of stellar mass.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18068
Program Title: Dynamically Mapping the Satellite Galaxies in the Outer Halo of the Milky Way

Principal Investigator: Kallivayalil, Nitya

PI Institution: The University of Virginia

The satellite galaxies of the Milky Way (MW) constitute the benchmark for studies of faint galaxies, including the effects of cosmic reionization, and testing cold dark matter. We propose to use HST ACS/WFC and WFC3/UVIS for second-epoch imaging of 14 ultra-faint satellite galaxies of the MW that have existing first-epoch imaging from HST, in order to measure high-precision proper motions. We target the most distant satellites, d = 80 to 420 kpc, which uniquely probe 3D dynamics in the outer halo of the MW, and which have large uncertainties from Gaia. Through these precise proper motions, we will match each satellite's stellar mass, distance, and 3D velocity to statistical analogs from cosmological simulations to infer full orbital histories in a cosmological context. We will use these orbits to address diverse science cases, including testing models of patchy reionization, testing the origin and significance of the MW's plane of satellites, and robustly determining the total mass profile of the MW's dark-matter halo out to its virial radius. Ultimately, completing the dynamical catalog of MW satellites at these distances will enable a novel and robust modeling framework that will place the entirety of the MW satellite population in its cosmological context for the first time.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Galaxies
ID: 18069
Program Title: Requiem's Return: Precision cosmology from a decade-delayed, strongly-lensed supernova and its new sibling

Principal Investigator: Pierel, Justin

PI Institution: Space Telescope Science Institute

This program will capture the reappearance of a strongly lensed Type Ia supernova (SN Ia), SN Requiem, a decade after its initial discovery. Lensed by the galaxy cluster MACS J0138-2155, the first three images of SN Requiem at z=1.95 were seen in a 2016 HST visit; the fourth is predicted to appear a decade later. In 2023, this system became even more remarkable with JWST's discovery of a second lensed SN Ia in the same host galaxy, named SN Encore. Detecting SN Requiem's fourth image enables the first joint Hubble constant (H0) measurement from two lensed SNe in one system. Using archival JWST, HST, and MUSE data, we built seven lens mass models of the cluster, incorporating both statistical and systematic uncertainties, to predict SN Requiem's reappearance. If H0 = 73 km/s/Mpc, the fourth image is expected in June-Nov 2026; if H0 = 67.4 km/s/Mpc, then Apr-Sept 2027. We propose two HST cycles to monitor the cluster and catch the reappearance, triggering JWST ToO imaging and spectroscopy upon detection to measure the longest-ever lensing time delay (~10 years). This allows a Requiem+Encore H0 measurement with <3% uncertainty -- the most precise from lensed SNe to date -- and directly addresses the Hubble tension between early- and late-Universe values. Our program leverages HST WFC3/IR as the most efficient tool to monitor the system and detect SN Requiem, and JWST to capture the full UV-NIR photometric and spectroscopic evolution of this rare event.

Proposal Category: SNAP
Scientific Category: Galaxies
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18070
Program Title: SNAP Observations of All Unobserved Galaxies within 10 Mpc

Principal Investigator: Tully, R.

PI Institution: University of Hawaii

With the ability to resolve individual stars in nearby galaxies, HST is acquiring a remarkable legacy. Observations in a single orbit in two filters suffice to resolve stars at least 1.5 mag below the tip of the red giant branch for a galaxy within 10 Mpc, enabling the measurement of a distance accurate to 5%. To date, this information is known for 65% of galaxies beyond the Local Group and within 10 Mpc brighter than M_B=-12. Currently, there are 162 galaxies identified as likely lying within 10 Mpc that have not been observed with HST brighter than M_B = -12. There are numerous reasons to want a complete volume-limited sample. What fraction and what are the differences between galaxies in groups and isolated? What are the luminosities/mass fractions within and between groups? What are the statistics regarding stellar ages and metallicities? What do we learn about large scale structure and kinematics? Will surprising anomalous systems be discovered? A SNAP program will not assure sample completion but it is the most efficient vehicle toward approaching this goal.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18071
Program Title: Confirming distantly-active long period comets on retrograde orbits beyond 20 au

Principal Investigator: Bolin, Bryce

PI Institution: Eureka Scientific Inc.

The vast majority of comets show maximum amounts of activity when they cross the ice sublimation line between 4-5 au. Bodies that show activity beyond the ice sublimation line are thought to be driven by the sublimation of hypervolatiles such as CO2 and CO, which begin to sublimate well beyond 10 au. Recently, a class of objects known as distantly active comets, such as long-period comets C/2017 K2 and C/2014 UN271, and Centaur 95P/Chiron, have shown activity well beyond this distance, strongly supporting the hypervolatile activity hypothesis. However, additional examples of distantly active comets are rare. In this proposal, we have identified two candidate comets located more than ~20 au from the Sun and show evidence of being active by having significant non-gravitational accelerations. We propose to use the exceptional sensitivity and angular resolution of HST/WFC3 to test or set stringent limits on the activity of two distantly active comet candidates,(336756) 2010 NV1 and (523797) 2016 NM56. Our observations will test these candidate comets' activity by using the high sensitivity and resolution of HST to constrain their extendedness relative to point sources and mass loss below the limit implied by their non-gravitational accelerations. By testing these candidates for distant activity, we will dramatically increase the sample of distantly active comets, which will be used to test the predictions of planet formation models used to describe the formation and early evolution of cometary bodies in the solar system.

Proposal Category: GO (GO-Archival)
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18072
Program Title: The Fate of the Leading Arm of the Magellanic Stream

Principal Investigator: Mishra, Sapna

PI Institution: Space Telescope Science Institute

The Leading Arm (LA) is a fragmented, multiphase gaseous region of the Magellanic System resulting from tidal and hydrodynamic interactions between the Large and Small Magellanic Clouds (LMC and SMC). It traces the orbital trajectory of the LMC-SMC system and also serves as a potential reservoir of cold gas accreting onto the MW's disk-- fuel that could sustain ongoing star formation in our Galaxy. Unlike the trailing Magellanic Stream, the LA leads the Magellanic Clouds and is the only Magellanic component currently interacting with the MW disk offering an opportunity to study active gas accretion. However once this gas plunges through the MW disk, how it survives or succumbs to the harsh ionizing environment of the MW remains unclear. We propose studying two regions, LA II and LA III, to investigate the survival of this gas by measuring ionization levels. We request 22 orbits of HST/COS G130M spectroscopy to observe four quasars. Together with three archival sightlines, these observations will map the LA III region over 20 degrees on the sky, sampling a range of distances from the MW disk. Our goals are: (1) calculate the ionized-to-neutral hydrogen ratio, (2) investigate spatial variations in gas properties, and (3) compare our findings with simulations. This study will enhance our understanding of satellite gas accretion, its role in sustaining star formation in the MW, and overall the mechanisms through which galaxies acquire and utilize baryonic matter.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18073
Program Title: Using Early FUV Spectra of Type IIP/L Supernovae to Elucidate Mass Loss in Red Supergiants

Principal Investigator: Bostroem, Kyra

PI Institution: University of Arizona

Red supergiants, the progenitors of Type IIP/L supernovae lose a significant fraction of their initial mass during their lifetimes. However, there is no first-principle description of this mass loss and empirical prescriptions vary by orders of magnitude. On top of this uncertainty, recent optical supernova observations show periods of enhanced mass-loss occur just prior to explosion which are not described by any model. It is not known what fraction of red supergiants experience this kind of eruptive mass loss. While optical light curves and spectroscopy can probe the most extreme mass-loss rates, the UV is significantly more sensitive to interaction between the supernova ejecta and circumstellar material, probing mass-loss rates from nominal red supergiant winds to the strongest outbursts. Additionally, during the first week of evolution, while the optical is relatively featureless, the FUV is full of high-ioniztion and strong resonance lines which provide information about the metalicity of the progenitor star, temperature and density of the supernova ejecta, and the composition of the circumstellar material. These observations are also critical for interpreting the growing number of supernovae discovered at high redshift. However, early FUV observations are challenging: only ~1 infant supernova per year is observable with HST. In this proposal, we request a disruptive ToO observation to study a nearby, infant, Type IIP/L supernova in the FUV and NUV. These observations will map the final phases of red supergiant mass loss, connect them to the properties of the supernova and progenitor star, and shed light on the UV diversity of supernovae.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18074
Program Title: PANCHO: Piloting a Novel Calibration for H2 Observations

Principal Investigator: Polzin, Ava

PI Institution: University of Chicago

Very low metallicity galaxies are a frontier in modern astrophysics. Locally, they represent the exreme low mass end of galaxy formation. At early cosmic time, when the global metallicity is lower, they are the result of some of the earliest galaxy formation in the universe. Despite their importance on a range of scales, understanding the formation and evolution of such galaxies - including the connection between their chemical and physical properties - is a significant challenge due to their generally low masses and/or high redshifts. There is a disparity between observed star formation in low metallicity galaxies and the most common models of star formation inferred from more numerous observations of higher metallicity, often higher mass, galaxies. As a result, the mechanism and medium for star formation in less metal-enriched galaxies is uncertain. A primary constraint can be placed on the nature of star formation using directly measured molecular hydrogen abundance. To date, this has been a challenge since absorption spectroscopy, by necessity, covers only a limited angular extent toward a sometimes ionizing background source. We propose a pilot program that capitalizes on the molecular and atomic lines in the HST COS FUV bands to, in conjunction with archival 21 cm emission maps, obtain spatially resolved molecular hydrogen content along two sightines in IC1613. IC1613 is one of best-studied low metallicity galaxies, providing a unique testbed for star formation models. These observations will: (1) extend UV absorption constraints of H2 to external galaxies and (2) place initial constraints on the nature and regulation of star formation in low metallicity galaxies.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Galaxies
ID: 18075
Program Title: Multiple intermediate-mass black holes in the local dwarf galaxy UGCA320

Principal Investigator: Li, Xin

PI Institution: European Southern Observatory - Chile

Identifying and studying intermediate-mass black holes (IMBHs; BH mass < 10^5 solar mass) in local dwarf galaxies offers crucial insights into the formation and growth of supermassive black holes (SMBHs), as IMBHs are believed to represent an early evolutionary stage. Determining their abundance and accretion properties is key to understanding how SMBHs assemble, and the UV emission is crucial in identifying IMBH and constraining the accretion disk properties. However, only a few IMBHs have been identified so far, and no more than one IMBH has been confirmed in any single dwarf galaxy, leaving their demographics and properties uncertain. In the dwarf galaxy UGCA 320, we identified two off-disk IMBH candidates with multiple evidence, and an off-center candidate in the disk but with inconclusive evidence. Although they have previous UV detection by Galex and Swift, large uncertainties prevent constraining the intrinsic UV slopes of the two off-disk candidates, and the broad PSF prevents resolving the candidate located in the disk. We propose HST observations using SBC/F140LP, UVIS/F225W, and UVIS/F300X to obtain cleaner AGN UV emission and construct high spatial resolution SEDs at three parsecs. These data will allow us to study IMBH accretion disk properties and provide robust evidence for them as IMBHs.

Proposal Category: GO (GO-Archival)
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: Galaxies
ID: 18076
Program Title: Unveiling the Circumgalactic Medium of M33

Principal Investigator: Mishra, Sapna

PI Institution: Space Telescope Science Institute

Satellite galaxies are cosmic storytellers, revealing how galaxies collide, evolve, and grow. Interactions with their hosts through ram-pressure and tidal stripping--can rapidly quench star formation. However, the circumgalactic medium (CGM), which serves as a protective outer envelope, remains largely unexplored for satellite galaxies, with the Large Magellanic Cloud (LMC) being the only well-studied case. We propose to study the CGM of the Triangulum Galaxy (M33), the most massive satellite of Andromeda (M31) and an analog to the LMC. We request 30 orbits of HST/COS G130M spectroscopy to observe five new quasars. Combining with two archival sightlines, we will map M33's inner CGM (within 0.5 Rvir). Our goals are to: (1) determine if M33 hosts its own CGM or it has merged into M31's CGM, (2) compare it with the LMC to assess how environment and infall history shape CGM evolution, and (3) test predictions from simulations of satellite CGM evolution. This research offers a unique opportunity to advance our understanding of how feedback, host mass, and orbit influence satellite CGMs through direct observational constraints beyond the Milky Way.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 18077
Program Title: Ultraviolet Spectroscopy of a Luminous Fast Blue Optical Transient

Principal Investigator: Perley, Daniel

PI Institution: Liverpool John Moores University

Recent surveys have identified a population of rapidly evolving, very luminous extragalactic transients which radiate primarily in the ultraviolet (even out to late times) and are accompanied by powerful X-ray and radio emission. These transients lack any discernable supernova features in optical spectra and ground-based observations have been unable to definitively pin down their origins, although a combination of extreme energetics and low ejecta masses indicate they are probably linked to accretion events involving very massive (but not supermassive) black holes. We propose to obtain a far-ultraviolet spectrum of a newly-identified transient of this nature in Cycle 33 or 34, which would be only the second such spectrum obtained to date. The abundant strong line features in the FUV make it a uniquely powerful spectral regime for testing models for the structure, composition, and velocity of the outflow and allow for a crucial test of competing models: whether these events represent the collapses of massive stars into black holes (and if so, which types of stars), or the disruption and accretion of stars onto supermassive black holes.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: Stellar Physics and Stellar Types
ID: 18078
Program Title: Constraining variability of white dwarf planetary debris accretion

Principal Investigator: Cunningham, Tim

PI Institution: Harvard University

White dwarfs accreting the remnants of evolved planetary systems have recently been confirmed as a new class of X-ray source using Chandra. This is the first direct evidence that these degenerate stars are actively accreting the remains of the planetary systems that orbit them. Metals from accreted planetary remnants have been identified in thousands of white dwarfs but inferring accretion rates and parent body compositions depends on accurate white dwarf atmospheric models. The inferred accretion rate is always averaged over the diffusion timescale which can range from days to millions of years. This hampers any search for variability in the accretion rate. The discovery of X-rays produced from the accretion of planetary debris provides the first independent measurement of the accretion rate of these systems, enabling a measurement of the instantaneous accretion rate. We propose to exploit HST to search for long-term variations in the inferred accretion rate of the only system with a measured X-ray accretion rate detected to date, G29-38. This object is one of the closest metal-polluted white dwarfs, has a diffusion timescale of approximately one year and ongoing X-ray monitoring, which makes it the stand-out target for this study.

Proposal Category: SNAP
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18079
Program Title: An HST Near-UV SNAP + Roman survey of extended star-forming disks in nearby galaxies

Principal Investigator: Sarbadhicary, Sumit

PI Institution: The Johns Hopkins University

Star formation in low-density, low metallicity, atomic-gas-dominated environments is poorly-understood compared to the inner, molecular gas-rich disks of galaxies. The existence of star-formation in such conditions has been confirmed by the discovery of extended-UV (XUV) disks in nearby (<20 Mpc) galaxies. Theoretically, however, they remain challenging to explain. The necessary metrics, i.e. timescales, spatial-scales and rates of star-formation, are best obtained from high-resolution (<0.1 arcsec) observations of individual units of star-formation, i.e. clusters and associations, but due to the large sky extents of XUV disks, they become prohibitively expensive to survey. Roman will be capable of observing \emph{entire} XUV disks, from optical to near-infrared, at HST-like resolution over 0.28 sq deg field-of-view with single pointings per galaxy. However, it will not provide near-UV or blue (<450nm) information, which is critical for correctly measuring ages and masses of young clusters and associations. We therefore propose an HST SNAP proposal to supplement a future Roman surveys, to provide the required blue+UV lever-arm for a sample of roughly 40 galaxies. At the expected execution rate of SNAP observations, we will obtain the largest sample of UV-through-IR pointings of XUV disks at star-formation rates lower than previous probed, and produce complete catalogs of clusters, associations, field stars and their ages, masses, and clustering properties. Comparing this legacy low SFR sample with the substantial stellar catalogs in the inner galaxies will yield a conclusive understanding how star-formation is different in such extreme environments.

Proposal Category: GO (GO-Archival)
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: Galaxies
ID: 18080
Program Title: The High Redshift Lyman Continuum Survey

Principal Investigator: Scarlata, Claudia

PI Institution: University of Minnesota - Twin Cities

The epoch of reionization (EoR) is a crucial event in the cosmic history. While the James Webb Space Telescope (JWST) is advancing our knowledge of reionization sources, a key factor in modeling reionization is the escape fraction of hydrogen-ionizing Lyman continuum (LyC) radiation (fesc). f_esc cannot be measured for galaxies at redshifts z>4. HST observations have provided insights into fesc and its calibrators in local galaxies, but the evolution of galaxy properties over time raises uncertainty about the application of these calibrations to EoR systems. We propose the High redshift LyC survey (HzLCS), a program designed to measure fesc and its indirect estimators at z=3.1-3.5. With 53 orbits of HST WFC3/UVIS and 24hours of JWST NIRISS(F200W) Wide Field Slitless Spectroscopy and imaging we will measure fesc for ~140 galaxies at these redshifts. The survey will target 20 well-separated fields, providing HST deep F336W images covering LyC wavelengths, as well as two HST optical bands, and JWST spectroscopy for redshift and galaxies' physical property measurements. By minimizing systematic uncertainties, our strategy cuts the uncertainty in fesc to 15%, matching local-universe precision and unlocking evolutionary studies just 1 Gyr after reionization ended. We make our data public immediately.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18081
Program Title: Using 35 year old tidal disruption events to test the fundamentals of accretion disk theory

Principal Investigator: Mummery, Andy

PI Institution: Institute For Advanced Study

Tidal Disruption Events (TDEs) occur when stars pass too close to supermassive black holes and are torn apart by tidal forces and subsequently accreted. The oldest known TDE candidates are six sources discovered by the ROSAT X-ray satellite in the 1990's, which showed soft X-ray flares which decayed to unobservable X-ray flux levels over $\sim 5-10$ years. In the following 20 years our theoretical and observational understanding of TDEs has strengthened, and a substantial breakthrough has occurred: while significant uncertainties remain in the origin of the UV/optical light emitted during the initial flare, late-time optical/UV emission is known to originate from accretion disks in these events, and to last for at least $\gtrsim 2000$ days. This means, despite their X-ray emission having faded decades ago, all six ROSAT TDEs should be bright and detectable in the UV today, over 30 years after disruption. The detection with HST of bright UV emission from these six events would allow six black hole mass measurements to be performed, but the detection or non-detection of each of these systems will teach the disk theory community a great deal about black hole accretion disk stability at low luminosities, something which is observationally inaccessible to any other known massive black hole disk systems.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18082
Program Title: A Deeper Look at the Type Iax Supernova Remnant Pa 30

Principal Investigator: Cunningham, Tim

PI Institution: Harvard University

Pa 30 is an extraordinary supernova remnant harboring a central hot star with fast outflows, and showing a stunning radial filamentary morphology. The stellar remnant and the lack of hydrogen or helium suggests that the supernova was caused by a partially failed thermonuclear explosion in a white dwarf, classifying it as a type Iax supernova. This remnant offers a rare opportunity to study this new class of supernova in our own Galaxy. We here propose to complement a recently-approved Cycle 4 JWST MIRI imaging program with a deep narrowband image in [S II] of the entire nebula with HST WFC3. The proposed image will allow us to 1) study the sub-arcsecond structure of the line-emitting filaments, 2) measure with high precision the edge of the nebula in [S II], providing the first benchmark to measure the expansion of the ejecta, and 3) map with high precision, in conjunction with the JWST/MIRI image, the location and spatial extension of the filaments with respect to the dust.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18083
Program Title: Extreme-UV to Near-UV Spectroscopic Exploration of the Lensed Quasar PG 1115+080

Principal Investigator: Fian, Carina

PI Institution: Universidad de Valencia, Observatorio Astronomico

Emerging evidence indicates that traditional models of black hole accretion are incomplete - quasar accretion disks appear systematically larger than predicted, a discrepancy that challenges our understanding of disk structure, black hole growth, and the use of quasars as standard candles. Gravitational microlensing has been proven successful in studying quasar interiors that remain unresolvable by conventional imaging techniques. The gravitationally lensed quasar PG 1115+080 offers an ideal natural experiment; its fold-caustic configuration produces a close image pair that, through microlensing effects, serves as a "zoom" on the smallest emission regions. We propose a small HST/STIS program designed to obtain continuous spectroscopy from the extreme ultraviolet (UV) to the near UV. This extensive spectral coverage will probe the innermost emission regions of the quasar - capturing the hottest accretion disk zones near the Lyman limit and linking them to the extended near UV continuum. Our observations will cover a wealth of emission features, including prominent broad lines and several little-explored lines in the extreme/far UV, thereby offering new insights into the ionization structure and gas kinematics of the broad-line region. By measuring the wavelength-dependent microlensing magnification of the continuum, we will determine the disk size as a function of wavelength - a critical test of thin-disk theory. These observations are especially timely, as HST/STIS is currently the only facility capable of accessing the extreme and far UV regimes. Without it, this spectral window, and the physics it probes, will remain out of reach.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18084
Program Title: Searching for the Survivor: Deep HST Imaging of the Explosion Site of SN2022jli

Principal Investigator: Su, Jianing

PI Institution: University of Toronto

Binary physics is important as >60% massive stars form in some kind of interacting binary system. The identification of progenitor systems of stripped-envelope supernovae (SESNe) offers one means to directly constrain binary evolution pathways, with implications ranging from the evolution of massive stars to the integrated stellar light from distant galaxies. Although the method by which SESN progenitors lose their envelopes remains uncertain, growing evidence have been shifting the paradigm from single star models to binary models. In recent years, five direct detections of surviving companions to SESN have been detected. However, the sample size is still too small to be statistically meaningful. Since suitable candidates for this type of search are rare, each additional new data point carries significant statistical weight. Here, we propose deep WFC3/UVIS optical and UV imaging of the only suitable SESNe target for a deep companions search in Cycle 33: SN 2022jli, which already has strong evidence of having a surviving companion. As with other companion searches, we plan to detect or place meaningful limits on any surviving companion. We also propose one orbit each to obtain F555W astrometry on the recent SN2024abfo and SN2024iss for potential future follow-up companion searches. This study will utilize HST's unique UV capabilities and build a statistically significant sample that will advance our current understanding of binary evolution. Given the rarity of relevant events and the limited HST lifetime, acquiring these observations is critical.

Proposal Category: SNAP
Scientific Category: Galaxies
Alternate Category: None
ID: 18085
Program Title: Confirming Spectroscopic Strong Lenses Found in New Discovery Windows from DESI DR1

Principal Investigator: Huang, Xiaosheng

PI Institution: University of San Francisco

We conducted a novel strong lens search using the Dark Energy Spectroscopic Instrument (DESI) DR1. We matched DESI fibers that are < 3" apart with redshift ratios >1.3, to identify lens candidates with Einstein radii between 0.1" - 3". Visual inspection ensured that our candidates all have secure foreground and background redshifts. This search opens up two new discovery windows: (1) For galaxy-scale strong lenses (GSL), it fills the gap between the single-fiber lens search approach (theta_E <~ 1") and lens searches in large ground-based imaging surveys (theta_E >~ 1.5"). We have identified 119 Grade A and B candidates, for which we expect a confirmation rate of > 90%. (2) It allows us to find systems with very small Einstein radii, down to <~0.1". Comparing our candidates with the DESI DR1 Dwarf Galaxy Catalog led to 53 high quality dwarf galaxy strong lens (DGSL) candidates. To our knowledge, this is the first time a large sample of DGSL candidates have been found. We propose to confirm these 172 candidates with HST. For the DGSLs, we can now determine their masses by lens modeling (as opposed to velocity dispersion, which is challenging to measure beyond the Local Group). This will make it possible to probe beyond the current low end of M_halo ~10^13 M_Sun on the halo mass function, as a way to test CDM. In addition, combining the stellar masses from the Dwarf Galaxy Catalog with mass measurements, we can measure the stellar-to-halo-mass ratio, another powerful test of the CDM. For the GSL candidates in this proposal, when confirmed, we will use them to detect the presence of "dark" (sub)halos, which is predicted to exist in abundance by the CDM.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Galaxies
ID: 18086
Program Title: The impact of stellar feedback as revealed by thousands of resolved HII regions in NGC 253

Principal Investigator: McClain, Rebecca

PI Institution: The Ohio State University

We propose for full-disk narrowband H-alpha imaging of NGC253, the nearest southern massive, star-forming spiral galaxy. This imaging is critical to resolve the inner structure of 2,500 HII regions known from full-disk VLT/MUSE spectral mapping and JWST/MIRI imaging. The proposed mapping would also complement awarded HST broadband imaging that captures the stellar populations powering these regions. HII regions are the critical locations of pre-supernova stellar feedback. However, even at the 3.5 Mpc distance to NGC253, ground-based observations cannot resolve the size or morphology of the inner cores where this feedback plays out. Only HST can reach the required ~1 pc resolution. Combining these new HST data with the VLT/MUSE, JWST, and broadband HST mapping, we will (1) measure the size and morphology of each region, (2) relate these to the mass, location, and age of the powering stellar population, and (3) compare the distribution of ionized gas to the observed PAH and dust emission from JWST, linking the feedback to the surrounding ISM and testing models of PAH destruction in ionized gas. This proposal will be the first-ever data set that combines full optical spectral mapping, JWST IR imaging, pc-resolution ionized gas mapping, and resolved UV-optical mapping of the stellar population. This unprecedented data set is crucial for expanding our understanding of HII region physics and stellar feedback, along with the countless possible applications to resolved sources, ISM, stellar, and galactic wind studies.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18087
Program Title: Time-resolved UV spectroscopy of the magnetic O star HD 54879

Principal Investigator: Erba, Christiana

PI Institution: Space Telescope Science Institute

The magnetic O-type star HD 54879 has a strong, complex magnetic field. Long-term optical spectropolarimetric monitoring has now revealed the star's extraordinarily long rotation period of 7.02 yr. Each of these characteristics are unusual among the known population of magnetic O stars. One UV spectrum of the star was previously obtained during Cycle 24, but it is now clear that the timing of this observation did not correspond with points of maximum or minimum emission, limiting our ability to constrain the wind parameters or probe the structure of HD 54879's complex magnetosphere. We propose a total of 4 new HST/STIS observations during Cycles 33-35 to obtain the first high-resolution UV spectra of the star near its positive and negative magnetic extrema and near magnetic null, which correspond to states of maximum and minimum UV emission. Since the magnetospheric structure is asymmetric, we expect the UV line profiles to vary significantly as the star rotates between these key phases. The only way to characterize the wind structure of HD 54879's magnetosphere is through quantitative UV spectroscopy, and HST is the only instrument with which these observations can be obtained. HD 54879's uniqueness as an apparently young, slowly rotating magnetic O star with a complex magnetic field makes it a prime target to place urgently needed empirical constraints on the interplay between a complex magnetic field and stellar mass loss, as well as the field's effect on angular momentum transport and stellar evolution.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18088
Program Title: A New Benchmark Set of Massive Stars Spectra to Distinguish Wolf-Rayet Stars and Very Massive Stars

Principal Investigator: Berg, Danielle

PI Institution: University of Texas at Austin

Determining the stellar content of UV-bright star-forming galaxies is crucial to understanding the origin and evolution of massive stars and their impact on their host galaxies across cosmic time. Despite the importance of massive stars, current stellar population synthesis models cannot reproduce a number of stellar and nebular spectral features in high-ionization galaxies, e.g., broad HeII emission. We propose HST/COS far-UV spectra covering 913-1940 angstroms for 14 integrated star-forming regions and galaxies. These spectra will probe a suite of wind features that are sensitive to the very-massive-stars (VMSs) and classical Wolf-Rayet stars (cW). While the vast majority of far-ultraviolet (FUV) stellar studies to date focused on wavelengths >1300 angstroms, the extension of the proposed spectra to the very-blue FUV (< 1300 angstroms) is essential to capture the high-ionization features sensitive to the youngest ages, capable of distinguishing the presence of the most extreme young VMSs from the more evolved cWRs. These data will be used to construct the first FUV spectral catalog of integrated star-forming regions that can diagnose the presence of, and distinguish between, WRs and VMS. This atlas will provide crucial benchmarks for stellar population models to accurately constrain the relative importance of the most extreme and massive stars.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18089
Program Title: Uncovering the optical emission in the brightest X-ray Jet

Principal Investigator: Meyer, Eileen

PI Institution: University of Maryland Baltimore County

Despite the fact that jets from actively accreting super-massive black holes were first understood to exist over 40 years ago, we are still in ignorance about many primary aspects of these systems -- including how jets are launched from the black hole itself, to their particle makeup and even the nature of the emission mechanism at high energies. The exquisite spatial resolution of Chandra lead to the discovery that these jets continue to accelerate particles to multi-TeV energies very far from the central black hole, as evidenced by unexpectedly strong X-ray emission on these scales, which remains poorly understood. While Chandra has discovered over 200 X-ray emitting kpc-scale jets, most lack corresponding HST observations, needed to characterize fully the SED and identify the radiation mechanism(s) operating in jets on larger scales. This proposal requests multi-band (IR, optical, UV) observations of the X-ray brightest jet so far discovered, RGB J1512+020A. Hosted by a powerful quasar, tentative ground-based detection of the brightest component in the jet suggests that the radio, optical, and X-rays each belong to a distinct emission component, a signature which has been reported previously in the very low-power jet in M84. These 'optical anomalies' have major implications for our understanding of both jet physics and the impact of jets on their environment. Until the unknown optical and X-ray emission mechanisms are clearly identified, it is impossible to properly measure or account for the impact of jets on their environment.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18090
Program Title: Unraveling Common Envelope Evolution with Star Clusters: A new post-common envelope binary in the Alessi 12 open cluster

Principal Investigator: Grondin, Steffani

PI Institution: University of Toronto

The progenitor systems of type Ia supernovae and gravitational wave sources are believed to arise from a mass transfer process known as common envelope (CE) evolution. Although a large fraction of binary systems will undergo CE evolution, the detailed physics remains poorly understood, largely due to the lack of observed benchmark systems where both the pre-CE and post-CE conditions are known. While post-CE systems containing a white dwarf (WD) and main-sequence (MS) star have been observed, they are located in the field, making it difficult to gain insights into their pre-CE parameters. Finding post-CE systems in star clusters can provide an independent constraint on the binary's age, but only two WD+MS post-CE systems in a star cluster have ever been found. Recently, a new WD+MS post-CE system was discovered in the Alessi 12 cluster. Alessi12-PCE is an ideal candidate to study CE evolution as it (i) is a cluster member, (ii) is a confirmed short-period binary and (iii) has clear spectral features of both a WD and a MS star in an optical spectrum. However, while spectral features at optical wavelengths can measure a WD's temperature and surface gravity (and thus its mass), there are systematic uncertainties that can have a significant impact on the inferred pre-CE conditions. Thus, we request 4 orbits with HST COS to obtain an ultraviolet spectrum to measure the effective temperature and surface gravity of Alessi12-PCE from its Lyman-alpha feature and use this measurement to refine the precision on the WD's mass. Alessi12-PCE will be just the third WD+MS post-CE binary ever identified in a star cluster, highlighting the necessity of this data.

Proposal Category: GO (GO-Archival)
Scientific Category: Galaxies
Alternate Category: None
ID: 18091
Program Title: An Exciting New Population of Luminous Point Sources in Nearby Galaxies

Principal Investigator: Irwin, Jimmy

PI Institution: University of Alabama

An exciting new class of X-ray emitters with no detectable emission above 0.3 keV has recently been discovered within galaxies observed with early archival Chandra ACIS-S data, dubbed 'hypersoft' X-ray sources. Within the narrow 0.15-0.3 keV X-ray bandpass these sources emit up to 1e38 erg/s with bolometric luminosities potentially as high as 1e40 erg/s. The estimated blackbody temperatures of these source are constrained to be below 21 eV (250,000 K), making them strong EUV, and potentially FUV emitters detectable with HST. The available X-ray data indicate the sources are not persistent over ~5 year time scales. Previous WFC3/UVIS/F225W observations of large, nearby elliptical galaxies taken in 2009 have found FUV-bright point sources in those galaxies that we suggest are the FUV tails of hypersoft X-ray sources. We propose WFC3/UVIS/F225W re-observations of two of those nearby large elliptical galaxies known to possess hypersoft X-ray sources to search for variable FUV-bright sources that have turned off (or on) since the initial 2009 F225W observations that would be strong evidence for a new, unrecognized very high bolometric luminosity class of objects in galaxies.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18092
Program Title: Connecting stellar mergers to peculiar stellar behavior with a Rosetta Stone young merger remnant

Principal Investigator: Hoadley, Keri

PI Institution: University of Florida

Binary and multi-star systems make up over 1/3 of the star systems in the Galaxy, with some ending with the complete engulfment of one star by another. The latter process is observed only in a few cases because the engulfment happens quickly, but is a likely outcome for a sizable fraction of the all binary systems. Current models of stellar mergers suggest that the merger remnant puffs up to large radius, carries additional angular momentum, and leadis to the formation of a convective zone and active dynamon. Over time, the star contracts, spinning up further and leading to the formation of a rapidly rotating star with significant stellar activity. The mergence of a convective zone may lead to the generation of a strong magnetic field. Magnetic fields may drive magnetorotational accretion of surrounding material, slow down rotation via magnetic breaking, and power jets -- all of which transport angular momentum from the merger remnant. Therefore, it remains unclear whether these systems evolve to become a rapid rotators. TYC 2597-735-1 was recently identified as a stellar merger remnant, whose collision occurred a few thousand years ago. It sits in an observationally rare category - one whose merger was old enough to emerge from its dusty aftermath, yet recent enough to still exhibit signs of a stellar merger. Our program will use HST/COS FUV and HST/STIS NUV spectroscopy to obtain a complete UV (1150 - 3000 {\AA}) spectrum at low- to moderate-resolution of TYC 2597 to disentangle the physical processes (magnetic activity, accretion, and outflows), probed using UV hot gas lines, warm circumstellar H2 features, and the UV accretion continuum, that shape its final state.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18093
Program Title: Photoevaporating disks in the final evolution phase: Probing Sigma Orionis with HST/WFC3

Principal Investigator: Mauco, Karina

PI Institution: European Southern Observatory - Germany

The evolutionary pathways of protoplanetary disks differ depending on the surrounding environment. Theoretical models and observational evidence point to external photoevaporation by OB stars playing a significant role in the evolution of planet-forming disks in clusters. As the majority of exoplanet we know did form in such environments, it is mandatory to better understand this process. The effect of external photoevaporation is a depletion of the disk outside-in, severely shortening disk lifetimes. Previous studies have focused on analysing externally-induced disk winds in young (<1-2 Myr) star-forming regions and in high radiation fields. Here we aim to target the intermediate age (3-5 Myr) and milder radiation field Sigma Orionis cluster, a region with disks that have never been imaged in visible light with HST or other high spatial resolution instruments before. We propose, for the first time, to resolve the final stages of disk dissipation caused by photoevaporation with the UVIS camera of HST/WFC3 in three narrow-band filters, tuned to reveal the cocoon around the targets, tell-tale proxy of ongoing external photoevaporation from the massive stars at the center of the cluster. We will thus measure the size of the ionization fronts, and infer the mass loss rates in the winds. These observations will allow us to determine key diagnostics necessary to constrain external photoevaporation models at a later stage of disk evolution and at lower incident radiation than previously observed.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18094
Program Title: Fireworks at the Gate: HST Observations of the Next Active Object in the JFC Transition Region

Principal Investigator: Noonan, John

PI Institution: Auburn University

The last six years have seen the discovery of three active objects in relatively circular orbits near Jupiter: P/2019 LD2, P/2020 MK4, and P/2023 V6. Each of these objects was discovered near their closest approach to the Sun, but the similarities end there. LD2 has remained strongly active since discovery, MK4 ceased activity and may have fragmented, and V6 hasn't been seen by ground-based observatories since October of 2024 implying it has dimmed by at least seven magnitudes. The varied behaviors of these objects indicates that their orbits within the "Gateway", where Centaurs become Jupiter Family Comets (JFCs) and vice versa, may not be a particularly peaceful zone. Given that these objects are the direct precursors of the JFCs, we need to understand their ongoing evolution better if we want to understand how the JFCs have been processed since their formation. We propose a four orbit non-disruptive Target of Opportunity carryover observation to observe the next object discovered to be active within the Gateway to constrain the source and physical properties of the activity and measure the size of the nucleus, or any fragments, directly. Only HST has the sensitivity and resolution to detect these active nuclei and thus place constraints on just how active objects in the Gateway can be.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18095
Program Title: The Hidden Engines That Could: Tracing Clump Formation and Evolution in the Hearts of Infrared-Luminous AGN Hosts

Principal Investigator: Linden, Sean

PI Institution: University of Arizona

Galaxies evolve through a combination of secular processes, such as cold gas accretion, and through non-secular processes, such as galactic mergers, which can trigger massive starbursts and powerful active galactic nuclei (AGN). The ideal laboratories for studying the co-existence of starburst and AGN activity at high-resolution are low-redshift luminous infrared galaxies (LIRGs), which are primarily gas-rich merging spirals that drive the formation of massive star-forming clumps that rival in size and SFR surface density those found in high-redshift galaxies. We propose a HST WFC3/IR program to obtain Pa-beta line emission (F130N and F132N) and adjacent wide-band continuum (F110W and F160W) observations of 16 LIRGs that host AGN in the local Universe. Although many LIRGs have been mapped in Pa-beta emission, LIRGs that host powerful AGN (with a bolometric luminosity fraction > 20%) have been critically missed in existing studies. Due to the redshifts of these powerful AGN, their Pa-beta emission cannot be observed in the near-IR (NIR) with the available narrow-band filters on JWST. With measurements of the Pa-beta equivalent width, we will estimate the ages, masses and star formation rates of these stellar clumps and compare them to clump properties of previously studied starburst-dominated LIRGs. This proposed work provides, for the first time, a study of how AGN affect the formation and evolution of massive stellar clumps in nearby LIRGs.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Intergalactic Medium and the Circumgalactic Medium
ID: 18096
Program Title: COS-RAD: Where Radio Jets Meet the Halo gas

Principal Investigator: Roy, Namrata

PI Institution: The Johns Hopkins University

We propose COS-RAD, a 26-orbit HST/COS program to conduct the first UV absorption-line survey of the circumgalactic medium (CGM) in powerful FRII radio galaxies at z<0.6. While JWST is now exposing how radio jets disturb gas on ISM scales, COS-RAD will reveal their large (halo)-scale impact-- probing how mechanical jet-driven feedback alters the ionization, kinematics, and mass of multiphase gas in the CGM. We will observe 7 carefully selected radio galaxies using bright background quasars whose sightlines pass through the jet-inflated shocked cocoon region, aligned near the jet axis where feedback effects are strongest. Using the G130M/1291 grating, we will detect the full suite of UV absorption lines, from neutral species to highly ionized tracers like OVI, capturing the CGM's thermal structure, ionization state, and gas flows. COS-RAD addresses two fundamental science goals: (1) Constrain the extent, ionization, and metal content of shocked gas in jet-inflated cocoons, and (2) Test whether radio jets dynamically disturb or accelerate CGM gas, producing distinct kinematic signatures compared to non-jetted systems. These observations will deliver the first direct, multiphase constraints on how radio-mode feedback reshapes galaxy halos, which is crucial for anchoring jet feedback models in cosmological simulations. Only HST/COS provides access to the UV diagnostics needed to probe the CGM gas across a range of ionization potentials and densities, and to uncover this hidden phase of AGN feedback.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18097
Program Title: Breaking the mass sheet degeneracy in strong lensing time delay cosmology with a new sample of double source plane lenses.

Principal Investigator: Li, Tian

PI Institution: Portsmouth University/ICG

Despite years of scrutiny, the measurement of H0 from SH0ES is still at 5-sigma tension with early-Universe probes. If the 8% difference is real it implies physics beyond LCDM. It is essential to develop independent methods with sufficient precision and accuracy to confirm or rule out the tension. A number of collaborations used gravitational time delays to measure H0 to 2% precision assuming that the mass density profiles of massive elliptical galaxies are described by a power-law or stars + Navarro Frenk White dark matter halos. However, if the assumption is relaxed under the mass sheet transformation, the precision of H0 from time delays drops to 8%. Strong lenses with two background sources at different redshifts (double source plane lens, DSPL) allow tight constraints on the main degeneracy of the Hubble constant measurement from time-delay cosmography. We have discovered 9 new galaxy-scale candidates from a combination of Euclid lens searches, and we plan to observe them with HST WFC3. HST is the BEST telescope suitable for this science due to its wavelength coverage and resolution. With our new samples, we are able to increase the measurement of H0 from Time Delay lenses from 6-8% to 2-4%. In addition, due to the second ring providing an extra aperture within which the mass is well constrained, DSPLs are better compared to lens systems with a single ring in almost every other science category involving galaxy scale strong lensing.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: None
ID: 18098
Program Title: Is Sulfur stored in the refractory or volatile component of planetary building blocks?

Principal Investigator: Bonsor, Amy

PI Institution: University of Cambridge

Sulfur plays a key role in geochemical cycling on the Solar System's terrestrial planets and is required by all life. It can also form important spectrally active species in exoplanet atmospheres, affecting their climates and habitability. Yet, how abundant sulfur will be in exoplanets depends critically on how it is delivered to rocky planets during their formation, a journey that remains uncertain. Most notably it is not clear whether Sulfur is stored in the refractory (dust) phase of planetary building blocks or rather the volatile (ice) phase, the latter being much more readily lost to planets forming in the warm inner disk. This proposal will determine the Sulfur abundances in the planetary material in the atmospheres of 12 white dwarfs. Alongside oxygen, the abundances will tell us whether Sulfur is in ice or dust, providing a sufficiently large sample to answer the null hypothesis that Sulfur is predominantly found in the ice phase.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18099
Program Title: Uncovering the Ionizing Sources in Metal Poor Galaxies: UV Spectroscopy of an X-ray Observed Sample

Principal Investigator: Lehmer, Bret

PI Institution: University of Arkansas Main Campus

Recent investigations have shown that star-forming galaxies (SFGs) show signatures of hard ionizing spectra (based primarily on the presence of nebular He II 4686), with a rising fraction of SFGs showing these signatures with decreasing metallicity. While stellar population models struggle to reproduce these emission lines, emerging binary population synthesis models are showing promise in reproducing these spectral signatures. In this proposal, we aim to obtain critical UV spectroscopy with HST/COS (G140L) for a legacy sample of 15 metal-poor SFGs (MPGs) with Z ~ 0.03-0.2 Zsol that have or will have securely measured X-ray properties and span a range of optical ionization conditions. UV spectroscopy will provide unique emission/absorption-line diagnostics that aid in characterizing the stellar and nebular conditions, including photoionization versus shock signatures, ionizing spectral hardness, and stellar population ages that cannot be obtained from optical spectra. We will simultaneously model the UV spectra along with rich multiwavelength data suites from X-rays, SDSS spectra, and UV-to-IR photometry to obtain complete pictures of the shapes of intrinsic ionizing continuua of these galaxies, their detailed star-formation histories, and the role that binary populations play in powering extreme emission lines.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18100
Program Title: Characterization of a new class of white dwarfs with line emission

Principal Investigator: Elms, Abbigail

PI Institution: University of Warwick

Two white dwarfs within 40 pc present currently unexplainable characteristics - pure-hydrogen atmospheres, H-alpha and H-beta line emission, anti-phase photometric and emission-line variability, and lack of an observable magnetic field (< 0.05 MG). These stars are similar to an emerging class of 26 white dwarfs that share the same properties except that they have large magnetic fields (> 5 MG) detected through Zeeman-split emission lines. These white dwarfs closely cluster on the Hertzsprung Russell diagram, suggesting than an intrinsic process is responsible for their emission - possibly through a new short-lived evolutionary stage. We propose time-resolved ultraviolet spectrophotometric observations of the emission line white dwarf WDJ0412+7549 to test whether one or two regions of the star have inhibited convection resulting from a small magnetic field, while other regions are able to remain convective. The impact of even small (< 0.05 MG) magnetic fields is expected to be important on atmospheric temperature stratification, resulting in a radiative temperature structure and an anti-phase between UV and optical photometric variability. It is crucial to test whether a small magnetic field could generate an active chromosphere which consequently causes Balmer line emission. This is only possible with Hubble, as the ultraviolet spectral energy distribution is the only way to test against other scenarios. These observations will be integral to our understanding of DAe white dwarfs, atmospheric structures of magnetic stars, and what mechanism drives line emission variability.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18101
Program Title: A New Approach to Determine the Ionizing Fluxes of Rapidly Rotating Oe Stars at Low Metallicity

Principal Investigator: Wofford, Aida

PI Institution: National Autonomous University of Mexico

Oe rapidly-rotating main-sequence emission-line stars can dominate the ionization of H II regions, particularly at low metallicity, where they are relatively common and reach earlier (hotter) types. When line emission fills-in their key optical absorption lines, it is extremely challenging to infer their spectral type, effective temperature/Teff, and ionizing spectrum using conventional optical analysis. FUV spectra offer the only route for constraining these fundamental stellar properties. However, few FUV spectra of Oe stars are available, and most of them are of stars in complex regions that prevent us from using their associated nebulae to validate their ionizing fluxes. We have used data from the integral field spectroscopic survey, SDSS-V Local Volume Mapper, to identify two SMC-field Oe stars with relatively isolated H II regions. The stars have high-quality optical spectra from 6-8 m class telescopes and are likely to sample different temperature regimes (one early- and one late-type). We request HST/COS G130M+G160M observations of these stars in order to cover the crucial 1160-1190 and 1550 Ang spectral regions. The FUV spectra will enable us to assess the impact of rapid rotation on their ionizing fluxes and to infer stellar wind properties. Due to their isolation, the Oe star H II regions can be used to validate the stellar ionizing fluxes predicted from models fit to the HST/COS spectra. Our study will be the first that combines stellar and nebular spectra to constrain the highly uncertain contribution of Oe stars, known to be more common at low metallicity, to the ionizing fluxes/feedback of their host galaxies.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18102
Program Title: Investigating Saturn's Equatorial Winds at Equinox

Principal Investigator: Simon, Amy

PI Institution: NASA Goddard Space Flight Center

We propose a time-critical multi-wavelength study to develop a 3D picture of Saturn's equatorial region near equinox using 12 orbits of HST WFC3/UVIS and 10.6 hours of JWST MIRI/MRS. Saturn's stratospheric temperatures, vertical windshears, and meridional flows are influenced by seasonal temperature gradients, as well as wave-driven equatorial oscillations. We propose to test 5 hypotheses: 1) The speed, structure, and altitude of Saturn's stratospheric equatorial jet has changed since 2015 due to modulation by the equatorial oscillation; 2. Planetary-scale stratospheric circulations will switch direction at equinox; 3: Saturn's tropical windshear zones are asymmetric about the equator due to seasonal contrasts, affecting the 3D structure of the equatorial zonal jet; 4. Saturn's post-winter clouds and hazes (south) will be thinner and have different composition than post-summer (north); 5: Stratospheric hydrocarbons will be symmetric about the equator at high pressures but show deeper local maxima at northern and southern latitudes. We will address these hypotheses by using the powerful combined broad wavelength coverage of these two instruments to measure atmospheric temperatures, cloud-traced wind fields, and compositional tracers of upper altitude meridional circulation. These values will be compared with 2015 HST + Cassini solstice values, as well as 2022 MIRI data, to better understand the combined effects of solar insolation and wave-driven oscillations on atmospheric circulation. The unique geometry present around equinox, with both hemispheres simultanenously visible, will not repeat until 2039.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18103
Program Title: Anatomy of a fall: Dissecting the environment-driven transformation of late-type Virgo cluster galaxies with HST UV-optical imaging of star clusters, associations, and HII regions

Principal Investigator: Thilker, David

PI Institution: The Johns Hopkins University

Understanding galaxy evolution in dense cluster environments remains a significant challenge. While recent works have highlighted trends like the outside-in removal of cold interstellar medium (ISM) and reduced star formation (SF) activity, key questions about the cessation of SF remain open. To address this, we propose a survey of 40 late-type Virgo cluster galaxies, probing down to the scale of individual star clusters, associations, and nebulae, while tracing galaxies at different stages of cluster infall. We will obtain WFC3/UVIS NUV/U/B/V/I and H-alpha imaging, which builds on ALMA and MUSE surveys to offer a complete census covering stellar populations and structures, HII regions, molecular clouds, ionized and molecular gas kinematics, and metallicity. These data are crucial for tracing the flow of matter and energy through the gas-SF-feedback cycle, which drives galaxy evolution. Our primary scientific goals, achievable only with HST, are to: (1) accurately age-date stellar components to infer evolutionary timescales/SFH of the disk, using clusters as a precision probe; (2) quantify the coupling and efficiency of feedback into the ISM from birth to hundreds of Myr enabling a test of ram pressure / gas stripping models and (3) study the physical conditions set by gas removal processes during infall and their impact on localized SF activity. The resulting data will be released as a Treasury of cross-observatory images and catalogs, linking CO clouds, stellar objects, and HII regions in cluster galaxies. Our findings will be contrasted to recent results for field galaxies enabling a clear identification/characterization of the impact of environmental transformation.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: Stellar Physics and Stellar Types
ID: 18104
Program Title: Hydrodynamic atmospheric escape in a benchmark sample of exoplanets in the hot-Neptune desert

Principal Investigator: Dos Santos, Leonardo

PI Institution: Space Telescope Science Institute

The extensive census of transiting exoplanets with the Kepler satellite revealed a robust dearth of highly-irradiated Neptunes, which we think is carved by a combination of photoevaporation driven by high-energy irradiation and high-eccentricity migration. However, this hypothesis has been challenging to test with observations of atmospheric escape because most Kepler planets orbit faint stars, which are not amenable to transmission spectroscopy. The tables have since turned in our favor, as recent transit surveys discovered several planets in the hot-Neptune desert that orbit bright stars. We have identified a benchmark sample of hot planets in the desert with densities and sizes consistent with having a significant H/He primordial atmosphere, and are likely undergoing hydrodynamic escape. With regards to detectability, this key sample is unmatched by any other combination of exoplanetary and host parameters, and provide our best chances at testing photoevaporation of hot Neptunes. In this program, we aim to study signatures of hydrodynamic escape in three hot sub-Jovians worlds using the unique ultraviolet capabilities of HST. We predict that the strong planetary outflow drags heavy species, such as Mg and Fe, to the exosphere of the planet, producing detectable signatures in transmission spectroscopy. Using a suite of modeling tools to interpret these signatures, our observations will provide, for the very first time, mass loss rate constraints for planets within the hot Neptune desert.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18105
Program Title: HST Superluminous Supernova UV Legacy Program

Principal Investigator: Quimby, Robert

PI Institution: San Diego State University

Shining 5--10 magnitudes brighter in the UV than more common types of supernovae, superluminous supernovae (SLSNe) can potentially be detected to z~20 and used to measure cosmic chemical and star formation histories, the high-mass end of the stellar initial mass function, galaxy outflows and evolution, and they serve as one of our only probes of the very high redshift universe. However, to exploit this potential we must improve our understanding of SLSN FUV features so that we can distinguish their redshifted appearance from other, rare transient events, as only the rest-frame FUV will be observed for all detections at z>4 and even for JWST for the earliest events. The FUV bands also contain unique information that will shine new light on the power sources of SLSNe and the late-phase evolution of their massive star progenitors. We propose to observe 6 low-redshift (roughly z<0.15) SLSNe in Cycle 33 using COS and STIS to cover the FUV through the NUV. These observations will produce the first pre-peak FUV SLSNe spectra, the first high-quality FUV spectral time series of SLSNe, vastly increase the available sample of SLSNe with rest-frame FUV spectra, and distinguish the set of UV spectral features common among low-redshift SLSNe from those that contribute to the diversity of the population. Together with supporting ground-based observations, this program will define an unprecedented legacy sample that will bring observers and theorists alike into the JWST and Roman Space Telescope era.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Galaxies
ID: 18106
Program Title: Stellar Initial Mass Function and Dark Matter from [OII] and Paschen-alpha Emission Maps Of the Giant Dragon Arc in the Hubble Frontier Fields Galaxy Cluster Abell 370

Principal Investigator: Kelly, Patrick

PI Institution: University of Minnesota - Twin Cities

The ~30 arcsecond Dragon arc at z=0.72 created by the Abell 370 cluster is the most prolific known source of microlensing events of individual stars at a cosmological distance. A total of ~50 stars have been detected across only two ultra-deep UV-optical HST and two shallow JWST visits. Recent work finds that the observed microlensing events may exhibit a broad bias towards the negative-parity side of the critical curve, which holds the promise to distinguish among forms of substructure produced by different dark-matter candidates. Improved constraints on the location of the cluster's critical curve, however, are needed. Furthermore, the microlensing events, if they can be combined with a spatially resolved recent star-formation history, will yield constraints on the upper-end of the initial-mass function (IMF) across the giant arc. Here we propose to take advantage of a pair of coincidences between the WFC3 UVIS F645N filter and [OII] nebular emission from the Dragon arc at z=0.72, and between the JWST NIRCam F323N filter and Paschen alpha emission. Since nebular emission is not, as a rule, found at the same locations as star-forming clumps visible in broadband images, the proposed data yield a new and independent set of constraints on the path of the critical curve. Pairs of counterimages of HII regions identified by their [OII] / Paschen alpha ratio will precisely bracket the location of the critical curve. Moreover, the fluxes of HII regions should not be affected by stellar microlensing, so we can, for the first time, unambiguously detect the existence of millilensing due to dark-matter subhalos in a cluster.

Proposal Category: GO
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: Galaxies
ID: 18107
Program Title: Baryonic Escape, Abundances, and Thermodynamics in Cosmic Ecosystems (BEATriCE)

Principal Investigator: Johnson, Sean

PI Institution: University of Michigan

Galaxy growth is inextricably linked to cosmic ecosystems-the intergalactic & circumgalactic medium (IGM/CGM)-which contain the fuel for future star formation and upon which kinematic, thermal, and chemical signatures of the resulting feedback are inscribed. Unveiling these hidden drivers of galaxy evolution was ranked among the three key priorities for this decade by ASTRO 2020. However, observations of the CGM/IGM are primarily limited to low redshift ($z<0.5$) and Cosmic Noon ($2<z<3.5$), leaving ~85% of cosmic metals unaccounted for at the critical $z=1$ epoch when galaxies settle from bursty youth to their modern order and quiescence. We propose an ambitious but efficient program to supplement archival HST UV spectra with new high-resolution NUV spectra for six $z>1$ quasars with archival HST images and deep MUSE galaxy surveys to inform Baryonic Escape, Abundances, and Thermodynamics in Cosmic Ecosystems (BEATriCE) . BEATriCE will revolutionize studies of the gaseous ecosystems in which galaxies evolve over nearly 2/3 of cosmic time by establishing a sample of 100 $z=1$ galaxies with surrounding CGM/IGM probed by contiguous FUV-NUV spectra. The new NUV spectra will cover the HI Lyman series and a suite of multi-phase, multi-element ions to capture the diverse nucleosynthetic history and physical properties of the CGM. Leveraging galaxies identified in existing MUSE surveys and both new and archival UV spectra, BEATriCE will secure the HST UV spectral legacy at a new epoch, enabling pioneering archival studies over the coming decade as we plan for the Habitable Worlds Observatory.

Proposal Category: GO (GO-Archival)
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: None
ID: 18108
Program Title: Beyond hydrogen and helium: an exhaustive survey of escaping metals in ultra-hot Jupiters around bright, hot stars

Principal Investigator: Dos Santos, Leonardo

PI Institution: Space Telescope Science Institute

Two decades ago, HST UV observations spearheaded the discovery of atmospheric escape from exoplanets, and it is now widely accepted that this process explains exoplanet population demographic features, the chemical composition of atmospheres in Solar System bodies, and resolves the curious lack of atmospheres in worlds orbiting M dwarfs. A wave of theoretical efforts to understand escape in hot exoplanets ensued, with the caveat that many efforts have assumed that atmospheres are composed of pure H+He. With the knowledge that this assumption limits our understanding of atmospheric escape, we hit a breaking point in our theoretical efforts: how do we best incorporate metals in our models? Our blindspot to the effects of metallicity has a downstream effect that limits our capacity to assess if smaller planets are able to retain their volatile-rich atmospheres, as they tend to be more metal-rich than larger exoplanets. While hot Jupiters orbiting A-type stars are under no threat of losing significant fractions of their mass, they are the best targets to study atmospheric escape because they have the strongest and most detectable signals of exospheric metals in transmission spectroscopy. These signatures can only be observed by HST in the ultraviolet. The new observations we propose to observe will complement archival data from previous programs and yield an comprehensive survey that will measure the abundances of metals in their outflows and assess how efficiently these planets are evaporating. Our study exhausts the sample of known ultra-hot Jupiters orbiting bright A-type stars, the most extreme planets known to us.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18109
Program Title: Lightning Strikes Twice: A Panchromatic View of Shock Power in the Closest Type II Supernovae of the Decade

Principal Investigator: Jacobson-Galan, Wynn

PI Institution: California Institute of Technology

Late-time observations of type II supernovae (SNe II) are a window into the uncertain mass-loss history of their red supergiant (RSG) star progenitors as well as a direct probe of the physics of shock interaction as SN ejecta collide with distant circumstellar material (CSM). We propose a long term monitoring program to obtain HST UV spectroscopy of SNe II 2023ixf and 2024ggi, the closest SNe of the decade, that currently show excess X-ray-to-radio emission at late-times from on-going CSM interaction. This unprecedented multi-wavelength campaign will enable the first spectral energy distributions of their kind, capable of directly constraining the unknown thermalization efficiency of radiation produced by the SN shock and the characterization of UV emission line spectra from the post-shock gas. These observations will also directly constrain the highly debated mass-loss histories of RSGs in the final centuries-to-millenia before core-collapse.

Proposal Category: GO (GO-Archival)
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: None
ID: 18110
Program Title: Unveiling the dynamics of the Great Orion Nebula

Principal Investigator: Robberto, Massimo

PI Institution: Space Telescope Science Institute

Thanks to the extraordinary lifetime of the HST, we have today a unique opportunity of unraveling the fascinating dynamics of the Orion Nebula with its elusive multitude of jets, Herbig-Haro objects, shocks etc that fill the region, all tracers of a violent early epoch where newborn stars endure the rapid destruction of their parental clouds by their high mass companions. While previous proper motions studies have focused on the nebular core region, two large HST programs, GO9460 and GO10246 have covered almost simultaneosuly the Extended Orion Nebula, an area about 15 times larger, in Halpha around year 2004, but no second epoch as yet been taken. Twenty years later, this observation is now critically needed before HST completes his lifetime.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Galaxies
ID: 18111
Program Title: Ultraviolet Spectroscopy and Optical Imaging of 4 Local Broad-Line Blue Compact Galaxies, Which Resemble Distant Little Red Dots

Principal Investigator: Bauer, Franz

PI Institution: Space Science Institute

Blue Compact Dwarf (BCD) galaxies are a unique class of low-mass, low-metallicity, gas-rich, high star formation rate systems. A small subset have been found in the local Universe (z=0.1-0.3) to exhibit persistent broad emission lines (BL-BCDs) and concave SEDs indicative of hosting obscured AGN, potentially with overmassive supermassive black holes. These BL-BCDs lack strong hard X-ray emission, show little optical variability, and have extreme blueshifted H and He absorption features, challenging traditional AGN diagnostics. Intriguingly, many high-redshift `little red dots' (LRDs) found by JWST show similar characteristics. We propose to acquire far-UV spectra and 3-color WFC3/UVIS imaging for a sample of four well characterized BL-BCDs. These data will better elucidate the contributions from the AGN and stellar population and potentially provide critical input on a number of uncertain properties of BL-BCDs, and by extension, distant LRDs.

Proposal Category: SNAP
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18112
Program Title: Beyond the Quasar Redshift Frontier: Uncovering Rapidly Accreting Supermassive Black Holes at z>8 with HST/WFC3 and Euclid

Principal Investigator: Wolf, Julien

PI Institution: Max Planck Institute for Astronomy

Luminous quasars trace rapid accretion onto supermassive black holes (SMBHs) throughout cosmic time, reaching back to the universe's first few hundred million years. Discovering these early accreting SMBHs is critical for understanding the formation pathways of the first black holes and the cosmic epoch of reionization in general. In February 2024, the Euclid space mission began its wide-area (~14,000 deg^2), deep optical and near-infrared (NIR) survey, offering an unprecedented opportunity to uncover quasars beyond the current redshift frontier at z ~ 7.5, previously set by ground-based surveys. Euclid is expected to identify several hundred z > 7 quasars down to AB magnitude ~24.5, potentially extending quasar discoveries to z ~ 10. However, Euclid alone can only provide photometric candidates: timely spectroscopic confirmation is essential. Capitalizing on previous successful ground-based spectoscopic runs, we propose a highly efficient HST WFC3/IR snapshot survey using the G102 and G141 grisms to spectroscopically confirm z>7 quasar candidates down to J<23.5, selected from the projected ~2,600 deg^2 of available Euclid sky. Our 125 targets span a broad right ascension range. Each HST orbit will enable robust confirmation of a candidate's nature, whether it is a quasar or a contaminant such as distant ultracool dwarfs. A single discovery would provide strong constraints on SMBH formation models. Additionally, spectra of contaminants will yield valuable insights into the atmospheres of distant cool dwarfs. Our program will likely identify the first confirmed quasars at z > 8, a groundbreaking result for HST and a transformative step in high-redshift quasar science.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18113
Program Title: UV Exo-Aurorae: Multi-Wavelength Observations of a Radio Emitting T-dwarf to confirm Auroral Activity in the Ultraviolet.

Principal Investigator: O'Toole, Cian

PI Institution: Trinity College Dublin

We propose simultaneous UV and radio observations with HST/STIS and the VLA of 2M1047+21, a cool, radio-emitting brown dwarf, to measure the first UV auroral emission from an extrasolar world. Over the last two decades, brown dwarfs have been discovered to emit powerful radio signatures indicative of aurorae. However, a conclusive detection of auroral UV emission on a brown dwarf has remained elusive. This program will constrain electron precipitation energies, resolve the magnetosphere structure and verify if auroral processes in brown dwarfs follow similar scaling relations to planetary aurorae. Detecting auroral emission in the UV would bridge the gap between the stellar and planetary regimes and complete picture of extrasolar auroral emission.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: None
ID: 18114
Program Title: Unveiling Hidden Protoplanets: Direct Extinction Measurement at Optical Wavelengths in the Planet-Formed Gap of AS209

Principal Investigator: Cugno, Gabriele

PI Institution: Universitat Zurich

While disk substructures provide compelling indirect evidence for the presence of accreting protoplanets, direct detections remain frustratingly scarce and extinction by circumstellar and circumplanetary dust is often invoked as an explanation. AS 209bkg, a background star shining through the outer gap of the well-studied disk around AS 209, offers a unique opportunity to test this hypothesis. By performing transmission spectroscopy of AS 209bkg, we can directly measure the extinction caused by dust in a planet-forming disk gap for the first time. Existing data constrain the extinction at wavelengths longer than 1 um, but the extinction solutions diverge at shorter wavelengths. This is a critical spectral region for the search for protoplanets, as most searches for accretion signatures target the Halpha line at 0.656um - right where extinction may be strongest. We propose to use the imaging capabilities of WFC3 in three filters spanning 0.8-1.2um to detect AS 209bkg and measure the wavelength dependence of extinction across this key range. Our results will provide the first empirical calibration of optical dust attenuation in disk gaps and will directly inform the interpretation of low-yield Halpha imaging surveys, helping determine whether elusive protoplanets are truly missing or simply veiled in dust.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18115
Program Title: HD 96670: A pilot study to characterise low luminosity stripped stars around bright O stars

Principal Investigator: Sen, Koushik

PI Institution: University of Arizona

Massive stars stripped of their hydrogen-rich envelopes are one of the most common products of binary interaction. They are the progenitors of stripped-envelope supernovae and binary compact object mergers. Uncertain assumptions in binary mass transfer, including the efficiency of mass and angular momentum transfer, affect our understanding of stripped-envelope supernovae and gravitational wave merger progenitors. Without empirical constraints from stripped stars, parameter-space degeneracies are likely to persist despite the anticipated growth in data in the coming decade. Observationally, only a few stripped stars have been detected because the light from their much brighter B- or O-star companions dominates the spectral signature. Recent simulations indicate that high-quality FUV spectra from HST/STIS are ideal for identifying low-luminosity stripped stars with O-star companions. We propose a pilot study requiring only six orbits to characterise the first discovered stripped star+O star binary, HD 96670, in the Milky Way. We will cross-correlate model spectra of stripped stars with the observed spectrum to derive the radial velocities of the stripped star. Combined with the O-star radial velocity curve from the literature, we will provide the first dynamical mass estimate for a stripped star+O star binary. This project will pave the way for more extensive programs to identify populations of stripped star+O star binaries with luminosity contrasts down to 1%. We demonstrate how our analysis of HD 96670 will serve as a cornerstone for providing robust empirical constraints on mass and angular momentum transfer efficiency in massive binary evolution.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18116
Program Title: Improving BH Scaling Relations in High-Mass AGNs: Insights from HST Imaging and Dynamical Modeling

Principal Investigator: Wang, Shu

PI Institution: Seoul National University

Accurate constraints of the black hole mass-bulge velocity dispersion (M_BH-sigma_*) relation for active galactic nuclei (AGNs) are essential for understanding the cosmic evolution of BH-host connection. However, the accuracy of AGN single-epoch BH mass estimates critically depends on the empirical broad-line region radius (R)-luminosity (L) relation. Recent reverberation mapping (RM) studies suggest that the R-L relation may have a shallower slope, leading to the potential overestimation of single-epoch BH masses for high-luminosity AGNs. This highlights the need to better understand the offset in the R-L relation, including precise host galaxy subtraction to minimize biases. Even with the RM M_BH measurements, the AGN M_BH-sigma_* relation remains elusive, exhibiting a shallower slope compared to that of quiescent galaxies due to the lack of > 10^8 solar-mass BHs. Here, we propose HST WFC3 UVIS/IR imaging for a sample of moderate to high-luminosity reverberation-mapped AGNs. Our sample includes 10 AGNs with the most accurate BH mass measurements obtained from dynamical modeling of RM data. This dataset significantly expands the current sample to 10^9 solar masses, allowing for a more robust constraint on the AGN BH-host relation. We will use these observations to (1) accurately remove host galaxy starlight, calibrate the broad-line region R-L relation, and update single-epoch BH mass estimates, and (2) characterize host galaxy structural properties, which are essential for understanding the intrinsic scatter of the M_BH-sigma_* and M_BH-M_bulge relation.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: None
ID: 18117
Program Title: Probing the Source of Extreme Nitrogen Enrichment in MRK 203

Principal Investigator: Tremonti, Christy

PI Institution: University of Wisconsin - Madison

One of the most startling discoveries made by JWST is a population of UV-bright z > 6 galaxies that are metal-poor and extremely nitrogen-rich with N/O ratios 15 times higher than expected for their metallicity. While this unusual enrichment pattern appears to be a rare phenomenon at high-z, it is notable that the C/N/O abundance patterns match those of second generation stars in globular clusters, suggesting that this may be a common, albeit short-lived, phase associated with the formation of massive star clusters in dense environments. Only 1 local analog of the N-rich high-z galaxies is known, suggesting that the conditions that give rise to these abundance patterns are extremely rare in the local universe. Here we propose to study a second galaxy, MRK 203, which has a high density central region with an N/O ratio 5 times the solar value (comparable to the high-z galaxies) and a normal N/O ratio outside the nucleus. The galaxy has much higher metallicity and lower ionization than the N-rich high-z galaxies, but it enables us to probe the phenomenon of N-enrichment over a much wider range of galactic conditions. We propose U,B,I-band WFC3 imaging to characterize galactic conditions giving rise to the N-rich nuclear cluster(s) and H-alpha narrow band imaging to provide key constraints on the photoionization rate. We additionally propose COS FUV spectroscopy of the nuclear regions of MRK 203 to precisely constrain the cluster age and determine if the N-enrichment is due to rapid cooling of stellar wind ejecta from Wolf-Rayet stars or very massive stars (M > 150 M_sun).

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18118
Program Title: VFTS 812: A Quiescent Eccentric Black Hole Binary in the LMC?

Principal Investigator: Deshmukh, Kunal

PI Institution: Institute of Astronomy, KU Leuven

Understanding how black holes form in massive binary systems is a central question in modern astrophysics, with direct implications for the origin of gravitational-wave sources. VFTS 812, an eccentric 17-day period binary in the sub-solar metallicity environment of the Tarantula Nebula was identified as a prime candidate hosting an O4V star with a possible black hole companion. Current optical observations strongly suggest a non-luminous companion exceeding the typical mass threshold for black holes, but cannot definitively exclude a faint, non-degenerate star. Furthermore, the primary mass and atmospheric properties are not constrained enough to trace its past evolution. We propose HST UV observations to decisively determine if the unseen companion in VFTS 812 is indeed a black hole, clarify the physical properties of the O4V primary, and reveal signatures of past mass-transfer episodes. A UV spectroscopic analysis will precisely constrain the rotation and wind characteristics key to understanding the systems evolutionary history. Confirming the black hole companion candidate will provide critical insights into supernova natal kicks, the evolution of massive stars in low-metallicity environments, and the formation of merging binary black holes.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: Stellar Physics and Stellar Types
ID: 18119
Program Title: Probing Accretion and Inner Disk Gas in the Youngest Planet System with HST

Principal Investigator: Espaillat, Catherine

PI Institution: Boston University

We propose far- and near-ultraviolet observations with HST to investigate the gas content and accretion behavior in the young star-planet system IRAS 04125+2902. This system hosts the youngest known transiting planet (3 Myr) and the first found around a T Tauri star, offering a rare opportunity to study how a close-in planet affects disk-star accretion. Previous studies suggest IRAS 04125+2902 is a weak or non-accretor, but the planet may be dynamically influencing the flow of gas from the disk to the star. We request multiepoch HST COS/STIS spectra to monitor the system over the orbital period of the planet and the stellar rotation period. FUV data will detect emission from hot gas in the innermost disk, while NUV data will be sensitive to low-level accretion. These observations will reveal whether gas is present close to the star and whether the planet modulates accretion. This will shed light on the formation of close-in planets and the evolution of star-disk-planet interactions. Combined with approved JWST and ALMA observations, our study will provide a comprehensive view of the gas, dust, and planetary dynamics in this benchmark system.

Proposal Category: SNAP
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18120
Program Title: A COS Legacy Survey of Gaia DR3 WD+MS binaries

Principal Investigator: Yamaguchi, Natsuko

PI Institution: California Institute of Technology

We propose a COS snapshot survey targeting a newly identified population of white dwarf (WD) + main sequence (MS) binaries with astrometric orbits from Gaia. These systems, characterized by orbital periods of 100-1000 days, bridge an observational gap between short-period post-common envelope binaries and wider systems that avoided binary interaction. Identified through strong FUV excess with GALEX photometry, our sample uniquely probes the low-mass WD regime that is underrepresented in dynamically-selected samples. Our proposed HST observations will (1) robustly measure WD masses and radii independent of evolutionary models, (2) test and calibrate spectroscopic WD mass-radius relations using precise dynamical mass constraints, and (3) provide direct measurements of wind mass loss rates from giant stars via metal pollution of companion WD atmospheres. By accessing previously unexplored regions of the orbital period and mass ratio parameter space, this program will open a new window on population demographics of evolved binary populations, constraining models of binary stellar evolution and mass transfer. Our sample contains 62 binaries in which a WD dominates in the FUV but the companion dominates in the optical. The WDs -- which can thus only be studied in the UV -- are sufficiently bright that their parameters can be constrained with 300-2000s COS observations, well-suited for a snapshot program.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: None
ID: 18121
Program Title: A Punctured Pufferfish: Atmospheric Escape from a Neptune-mass Planet Inflated to the Size of Jupiter

Principal Investigator: Duvvuri, Girish

PI Institution: Vanderbilt University

We propose to observe 5 transits of HIP 67522 b, a Neptune-mass planet inflated to Jupiter's size orbiting a 17 Myr old solar analog, in the near ultraviolet to measure its mass loss rate, outflow velocity, and exospheric structure. HIP 67522 b is a planet where we can precisely measure transit depths with both Hubble and JWST and study a planet's atmosphere as a structure in its entirety instead of piecemeal. In fact, JWST has already measured this planet's infrared transmission spectrum. The goal is to use the metallicity constraint from JWST in tandem with HST near-ultraviolet transits to measure the rate of Fe+ and Mg+ mass-loss for HIP 67522 b, construct the most complete map of a young planet's escaping atmosphere thus far, and thereby anchor the initial stages of sub-Jovian-mass planet evolution.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18122
Program Title: When Changing-Look Quasars Wake-Up, Do They Look the Same as Before They Went to Sleep?

Principal Investigator: Duffy, Laura

PI Institution: The Pennsylvania State University

Changing-look quasars (CLQs) show dramatic variability in their broad emission lines and non-stellar continuum strengths on time scales of months to years, challenging models for quasar accretion flows. The currently favored theory for the observed behavior is that the transition from a high, quasar-dominated state to a low, galaxy-dominated state is caused by a changing accretion rate leading to a transition in the accretion flow structure. The typical, geometrically thin, optically thick disk changes to an advection dominated accretion flow (ADAF), as is seen in X-ray binaries. Direct observations of such changes in the accretion flow structure, however, have not yet been made. Thus, we propose to observe two CLQs that have recently returned to a high state to thoroughly test the changing-accretion flow hypothesis. Testing this hypothesis is important for understanding the stability of quasar accretion flows and has implications for feedback from the AGN onto the host galaxy. Both targets were well-characterized in their low states with HST UV spectroscopy, and both have recently turned back on according to optical observations. With new UV spectra, we will probe the structure of the accretion flow by comparing the high state UV-optical spectral energy distributions (SEDs) with low-state UV-optical SEDs and with theoretical models of ADAFs and thin disk SEDs. We will also probe the structure of the broad line region (BLR) by characterizing UV broad emission lines and comparing measurements to predictions from various BLR models. This will serve as a conclusive test of the hypothesis that changes in the accretion flow structure are responsible for the changing look.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: None
ID: 18123
Program Title: The most-massive globular cluster in the Fornax dSph to shed light on the mass-budget problem of multiple populations.

Principal Investigator: Milone, Antonino

PI Institution: Universita degli Studi di Padova

This proposal is aimed at constraining the mass budget problem related to the multiple populations (MPs) in globular clusters (GCs). Discoveries, largely made by HST, have clarified that MPs are ubiquitous in Milky Way and in Fornax GCs. One of the most acknowledged scenarios predicts that MPs are different stellar generations. To account for the low fractions of first-population stars (1P), which is the mass-budget problem, proto-GCs must have been significantly more massive, with the missing 1P stars lost in the assembly of the Galactic Halo. While MPs have been found in Fornax GCs, there could not be enough stars in the field of this galaxy to account for much more massive proto-GCs. Unless high fractions of 1P stars will suggest that Fornax GCs did not lose significant mass, MPs in Fornax will challenge the multiple-generation scenario. We propose to analyze the MPs in Fornax 3 and obtain, for the first time, the proper photometric diagrams to disentangle 1P and 2P stars and to infer accurate population fractions. With a mass comparable to Galactic GCs, Fornax 3 is ideal to constrain the mass-budget problem. The multiple-generation scenario predicts that the amount of lost 1P stars is higher in massive GCs. Moreover, it is placed in the low-metallicity tail of the field distribution, which comprises a small number of stars. In the end, a low fraction of 1P stars, similar to Milky Way GCs, will challenge the multiple generations scenario. On the contrary, if this scenario is correct, we expect a predominance of 1P stars. In both cases, our results will help in solving the mass budget conundrum.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18124
Program Title: Logos-Zoe: a triple or quadruple trans-Neptunian system?

Principal Investigator: Thirouin, Audrey

PI Institution: Lowell Observatory

(58534) 1997 CQ29 (a.k.a Logos-Zoe) is a dynamically Cold Classical system in the trans-Neptunian belt. The primary, Logos, and its satellite, Zoe, have similar brightness inferring a nearly equal-sized binary. Based on Hubble Space Telescope (HST) images obtained since 2001, it has been noticed that both system's components have large lightcurve variabilities on very different timescales. Logos' variability is over a short-time scale of hours whereas Zoe's variability seems to be on a long-time scale of days to months. New ground-based observations obtained over five years with 4 to 6-m class telescopes have proven that this system is more complicated than initially thought. Logos is a high mass ratio contact binary with a rotational period of about 17 hours. But, despite five years of unresolved ground-based observations, the rotational period of Zoe remains unknown. The brightness variation of Zoe is consistent with a highly elongated object or even a contact binary based on HST images. We request eight non-consecutive orbits to observe the Logos-Zoe system to 1) constrain the rotational lightcurve of Zoe inferring its rotational period and shape, 2) update the mutual orbit determination, 3) model and predict the upcoming mutual events season of this highly complex system, and 4) challenge the current formation models for binary/multiple systems. The Logos-Zoe mutual event season will start in 2026 and will end in 2029 with only up to two events per year, implying that we are running out of time to characterize this system. The next mutual event season will be in 151 years, therefore, this is the only chance in our lifetimes to understand this system.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18125
Program Title: Brown dwarfs or white dwarfs with debris disks? Exploring the faintest stars of 47 Tucanae with HST and JWST

Principal Investigator: Milone, Antonino

PI Institution: Universita degli Studi di Padova

Recent JWST photometry has identified a sequence of ultracool stars in 47 Tucanae, potentially representing a population of brown dwarfs. If this hypothesis holds, the abundance of brown dwarfs would significantly exceed predictions based on a standard mass function. However, JWST's infrared capability alone is insufficient to distinguish between brown dwarfs and potential white dwarfs with debris disks. To investigate this faint stellar population further, we propose deep UVIS/WFC3 observations in the F606W filter, which is the only dataset that, combined with archival NIRCam data, allows us to examine whether stars in this color-magnitude diagram (CMD) region, traditionally linked to brown dwarfs, may also include white dwarfs with debris disks. By analyzing the distribution of stars in CMDs generated with the new F606W observations alongside archival JWST data in the F115W and F322W2 bands, we aim to test two scenarios: (1) if these stars are exclusively brown dwarfs, they will remain undetected in F606W due to their low luminosity in this band; (2) if a subset comprises white dwarfs with debris disks, these stars will follow the white dwarf cooling sequence, as debris disk flux primarily enhances F322W2 but has minimal impact on F606W and F115W. This study seeks to refine our understanding of low-mass object distributions in globular clusters and may provide new insights into planetary system remnants around white dwarfs.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Intergalactic Medium and the Circumgalactic Medium
ID: 18126
Program Title: Efficient selection of Lyman Continuum emitters at z > 3

Principal Investigator: Beckett, Alexander

PI Institution: Space Telescope Science Institute

Understanding which galaxies dominated the ionizing flux (Lyman continuum, LyC) that reionized the early Universe requires measuring the escape fraction of galaxies during that epoch. This cannot be done directly, so instead we need to use indirect indicators calibrated on galaxies observed shortly after reionization. The Parallel Ionizing Emissivity (PIE) survey is an ongoing effort to address this by detecting over 400 galaxies across ~50 independent fields that can be stacked to measure how LyC emission varies with galaxy properties. This survey uses F336W imaging to probe pure LyC at 3.1<z<3.5, alongside F625W and F814W to select U-dropout galaxies for spectroscopic follow-up, which will be used to confirm redshifts and measure emission-line properties. Unfortunately, 8 fields with >3 orbits of F336W data are missing one of these bands, so cannot be used. Therefore, we propose a very small investment of WFC3 imaging to complement 40 orbits of existing data in these fields. These observations will allow us to efficiently detect dropout galaxies and thereby add over 100 galaxies at 3.1<z<3.5 to the PIE sample, of which ~30 will be confirmed as LyC emitters. Leveraging the existing data makes this program far more efficient than observing new fields. Confirmed LyC emitters will likely become prime targets for future studies with JWST. Aided by the increased sample, we will calibrate LyC indicators out to z~3.5 by measuring escape fractions as a function of stellar mass, morphology, star-formation surface density, Ly-alpha properties, UV luminosity, and UV colors, helping to understand which galaxies emitted the flux that reionized the early Universe.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Stellar Physics and Stellar Types
ID: 18127
Program Title: Imaging the Exceptional Nebulosity of the Suspected Iax Supernova Remnant of 1181 AD

Principal Investigator: Fesen, Robert

PI Institution: Dartmouth College

A recently discovered Galactic nebula appears to be the likely remnant of the historic Galactic guest star of 1181 AD which was a subluminous supernova (SN) outburst. The remnant's striking and unique filamentary morphology, relatively low 1200 km/s expansion velocity, the extraordinary properties of its central star, plus its unusual elemental make-up matches predicted properties of the poorly understood Iax subclass of H-poor thermonuclear supernovae. As one of only five Milky Way supernova reported in the past millennium, we propose WFC3/IR images sensitive to its sulfur and iron emission lines to reveal its subarcsecond structure, compare these line emissions to the dust distribution seen in the mid-infrared, and understand the luminosity history of the central star's 16,000 km/s wind. These data will provide crucial insights into the nature of Iax supernovae.

Proposal Category: GO (GO-Archival)
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: None
ID: 18128
Program Title: Search for an Intermediate-Mass Black Hole in Globular Cluster 47 Tuc

Principal Investigator: Casetti, Dana

PI Institution: Southern Connecticut State University

Intermediate-Mass Black Holes (IMBHs), with masses between ~100 and 100,000 solar masses, are expected to exist at the cores of Globular Clusters (GCs), but their existence has yet to be decisively confirmed observationally. Predictions suggest the influence of an IMBH would be limited to the central few arcsec of the GC core, an observationally challenging environment. It is here proposed to obtain highly precise proper motions at the core of 47 Tuc (NGC 104) in an effort to detect an IMBH. Existing archival WFPC2 observations for this cluster provide ideal first-epoch material that, when combined with the proposed new WFC3 observations, will provide an unprecedented 26-yr baseline for space-based, stellar proper motions. The expected relative proper-motion uncertainties will be on the order of 4 to 10 microarcsec/yr. The presence of an IMBH will be made via the detection of fast-moving stars at the GC center, i.e., orbital motion that would otherwise exceed the GC's escape velocity in the absence of an IMBH, along with detailed fitting of the observed velocity-dispersion profile with a theoretical mass-distribution model.

Proposal Category: GO
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18129
Program Title: Intersection of Extremes: Probing the Wind of BP Cru

Principal Investigator: Bernini Peron, Matheus

PI Institution: Astronomisches Rechen-Institut Heidelberg

Massive stars are frequently found in binary or multiple systems. Within the diverse types of multiples, high-mass X-ray binaries (HMXBs) are a particularly intriguing class of objects. They are characterized by strong X-ray emissions due to the accretion of material from a massive donor star onto a compact remnant. Their analysis offers unique insights into the physics of stellar winds and binary evolution. Using the unique capabilities of the HST, we aim to conduct a pilot and pioneering study of BP Cru, a HMXB system whose mass donor is a B hypergiant (BHG) - a B-type star close to the Eddington-limit with hybrid characteristics of "typical" B supergiants and luminous blue variables. Marking a crucial intersection among the evolution of massive stars, probing the wind of BP Cru provides a unique opportunity to investigate the nature of BHGs as well as wind-fed HMXBs. Obtaining the first high-quality UV spectra of this singular target and combining them with archival data for other spectral regions as well as state-of-the-art atmosphere models, we will (1) shed light into the evolutionary status of BP Cru, (2) measure the wind properties, and (3) constrain the conditions for wind accretion by the compact remnant, an aspect still highly uncertain in HMXBs. Additionally, this study will also boost our knowledge on radiatively driven winds for cooler regimes by evaluating the conditions and mechanisms for wind launching.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18130
Program Title: Understanding AGN variability with Fairall 9: a legacy spectroscopic echo-mapping experiment with STIS

Principal Investigator: Hernandez Santisteban, Juan

PI Institution: University of St Andrews

We propose HST monitoring of the X-ray bright, unobscured AGN, Fairall 9 with full UV-optical spectroscopic coverage with STIS at a 4-day cadence over a 5-month campaign, coupled with intensive Swift UV/X-ray (every 2 days) and sub-daily ground-based monitoring (3 per day). Our aims are 1) to determine the origin of the reverberating components, quantifying the compact accretion disk and the more extended inner wind and broad-line regions and thereby resolve the puzzle of light travel time lags and inferred accretion disk sizes being larger than expected from theory; 2) to determine the relationship between X-ray and UV-optical variations. The newest variability models predict that fluctuations propagate from an intrinsically variable UV disc into the X-ray corona, giving a UV lead, whereas disc reverberation models can only make UV lags. This HST+Swift+ground-based campaign will provide a legacy dataset to explore the fundamental variability mechanisms and give a template to interpret future continuum revervberation mapping experiments (e.g., LSST) on higher-redshift AGN.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Galaxies
ID: 18131
Program Title: Unveiling Wandering Black Holes: HST Imaging and UV Spectroscopy of Off-nuclear Tidal Disruption Events

Principal Investigator: Yao, Yuhan

PI Institution: University of California - Berkeley

The hierarchical assembly of galaxies and dynamical interactions in galactic nuclei naturally predict a population of off-nuclear massive black holes (MBHs), yet direct observational evidence remains limited. Off-nuclear tidal disruption events (TDEs) provide a unique avenue to probe these elusive wandering MBHs. We propose HST ToO observations of two offset TDE candidates selected with optical time-domain surveys. For each candidate, we request 1 orbit of WFC3 imaging and 4 orbits of SITS UV spectroscopy. The imaging will confirm the off-nuclear nature of the transient, precisely measure its offset from the host galaxy nucleus, and search for morphological signatures of recent mergers. The spectroscopic observations will constrain kick velocities and provide key diagnostics for this rare class of events. This program will increase the number of optically selected off-nuclear TDEs from one to three, enabling the first steps toward characterizing the demographics and physical origins of offset MBHs powering TDEs.

Proposal Category: GO
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Stellar Physics and Stellar Types
ID: 18132
Program Title: The first UV spectra of optically overluminous and featureless tidal disruption events

Principal Investigator: Yao, Yuhan

PI Institution: University of California - Berkeley

We propose 8 orbits of HST STIS ultraviolet spectroscopic ToO observations to study a rare subclass of tidal disruption events (TDEs) characterized by featureless optical spectra. Only ~10 such events have been identified to date, and none have UV spectra. Compared to typical TDEs, these events exhibit higher UV and optical luminosities and are hosted by more massive black holes (M_BH ~ 10^8 Msun), where general relativistic effects are more pronounced. They may arise from the disruption of massive stars and/or involve rapidly spinning black holes. Owing to their high luminosities, these events are expected to dominate the high-redshift TDE population to be uncovered by LSST, JWST, and Roman. This program will deliver the first UV spectroscopic observations of this elusive subclass, providing critical insights into their origin and enabling the first exploration of their rest-frame UV properties. These data will illuminate the physics of black hole accretion in extreme relativistic regimes and guide the identification of high-z TDE candidates in forthcoming surveys.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18133
Program Title: Probing the TNO Density Transition with Mid-Size 2013 FY27

Principal Investigator: Ragozzine, Darin

PI Institution: Brigham Young University

The density distribution of Trans-Neptunian Objects (TNOs) provides key insights into the composition and interiors of outer solar system bodies, with broad implications for planet formation and evolution. Only ~20 TNOs have measured densities which seem to fall into three categories: small TNOs have similar low densities and large TNOs have similar high densities. The "transition region" (diameters of 400-900 km) only has 5 known densities which show a surprisingly rapid transition between these two regimes. While the density-size relationship was thought to be linear, a recent measurement breaks this trend, suggesting the need to explore other interpretations. This proposal targets 2013 FY27, a rare TNO in the transition region with a known satellite and a diameter of ~760 km. Previous HST observations were insufficient to determine its orbit due to a small near edge-on orbit. We propose a focused 5-orbit program to obtain precise relative astrometry of FY27 and its satellite to measure the density of FY27 and to determine the possibility of information-rich mutual events. Previous observations are used to design an optimal observing program, including iterative updates to the observing schedule using state-of-the-art orbit fitting and prediction tools. Success in these goals is only plausible with HST. This program will add a valuable new data point to the poorly-understood density distribution of TNOs in the density transition, helping to resolve whether composition or porosity drives the transition. The resulting insights on composition and interiors have broad importance in astrometry through improved constraints on planet formation and evolution.

Proposal Category: GO
Scientific Category: Galaxies
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 18134
Program Title: A Far-Ultraviolet Spectroscopic Survey of AGN Dwarf Galaxies

Principal Investigator: Veilleux, Sylvain

PI Institution: University of Maryland

The far-ultraviolet (FUV) band below 2000 A is rich in spectroscopic diagnostics of the massive star populations, active galactic nuclei, and neutral and ionized gas phases of the ISM. The recent launch of JWST has ushered in a new era of extragalactic astronomy where these diagnostic tools have been used extensively to study galaxies at the epoch of reionization, down to stellar masses below that of the LMC. An unexpectedly large fraction of these galaxies appear to host fast-accreting massive black holes (BHs), but the exact role played by the AGN in powering the emission lines and driving outflows is still highly uncertain due in part to our incomplete understanding of AGN physics in dwarf galaxies. CLASSY has provided a comprehensive FUV spectral database of nearby star-forming galaxies, which has shed light on the ISM conditions and processes associated with massive stars in dwarf galaxies, but AGN dwarf galaxies have largely been excluded. To address this weakness, we propose a sensitive high-resolution FUV spectroscopic study of 8 nearby sub-LMC dwarf galaxies with AGN that span a broad range of BH masses, Eddington ratios, and host properties. The COS spectra will allow us to explore, for the first time in dwarf galaxies: (1) the dependence of FUV emission line diagnostics on AGN properties, (2) the FUV BLR properties and their use as BH mass indicators, and (3) the rate of incidence and properties of AGN-driven outflows. The resulting data products will serve as local benchmarks to help the community interpret the rest-frame FUV spectra of high-z AGN obtained with JWST and upcoming ELTs. Given the legacy value of these data, the proprietary period is shortened.

Proposal Category: GO
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18135
Program Title: Examining Cometary Volatile Storage Mechanisms with HST Observations of C/2024 E1 (Wierzchos)

Principal Investigator: Bodewits, Dennis

PI Institution: Auburn University

Sulfur is a critical yet poorly understood component of protoplanetary disk chemistry, with less than 0.1% of its cosmic abundance observed in the gas phase. Comets, as chemically primitive bodies formed in the solar nebula midplane, are key tracers of early disk composition. This proposal targets Comet C/2024 E1 (Wierzchos), a dynamically new Oort Cloud Comet with a close perihelion (0.57 au). As near-surface layers are thermally processed and stripped during solar passage, post-perihelion observations provide a unique opportunity to probe deeper, less-altered material when the coma most closely reflects the nucleus. Using HST's ultraviolet capabilities, we will measure production rates of H2O, CO, atomic carbon, and sulfur-bearing species (S, CS, S2) to derive the comet's C/O and S/O ratios, key tracers of formation conditions and chemical inheritance. These observations will test predictions of volatile depletion, sulfur sequestration, and thermal evolution in the early solar system, and provide essential constraints on the sulfur depletion problem in disk chemistry.

Proposal Category: GO
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: Supermassive Black Holes and Active Galaxies
ID: 18136
Program Title: Where is the central black hole in the LMC?

Principal Investigator: Seth, Anil

PI Institution: University of Utah

The presence of massive black holes remains poorly constrained in dwarf galaxies, especially in the late-type dwarfs that dominate the population. The nearest late-type dwarf galaxy, the Large Magellanic Cloud (LMC), is an important case in point. Despite its proximity, the presence of a massive black hole in the LMC remains unsettled, largely because of the uncertainty in the location of the center of this tidally disturbed galaxy. The recent discovery of a population of hypervelocity stars emanating from the central regions of the LMC strongly suggest that a massive black hole is present, but its location is poorly constrained. We will address this in two ways: first, we will obtain new HST imaging for two LMC hypervelocity stars, combining these data with Gaia to measure ultra-precise proper motions and localize their origin near the LMC's center a factor of 9 better than existing constraints. Second, we will obtain new imaging of NGC1916, the most likely nuclear star cluster of the LMC. When combined with archival HST data, this will allow us to measure high-precision proper motions (~3 km/s), enabling clean identification of cluster members. With this data we will weigh any black hole in this cluster through both dynamical modeling and the possible identification of any fast stars near the black hole. If a massive black hole is present in the LMC, these proposed observations offer the best chance to both reveal it and constrain its mass.

Proposal Category: SNAP
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Galaxies
ID: 18137
Program Title: Compact lensed quasars: are they hidden in the known quasar catalogs?

Principal Investigator: Yue, Minghao

PI Institution: Massachusetts Institute of Technology

So far, only ~30 compact lensed quasars (with lensing separation <1") have been reported, while the expected number is ~200. Finding these missing compact lensed quasars is crucial in at least three aspects: (1) correcting for the magnification bias in quasar luminosity function measurements; (2) characterizing the mass profile and circumgalactic medium of less-massive (<10^10M_sun) galaxies (i.e., the deflectors of compact lenses); (3) identifying highly-magnified quasars to study the SMBH-host coevolution. The majority of compact lensed quasars might have been identified as un-lensed quasars in surveys like SDSS; therefore, the most effective way to find them is to obtain high-resolution imaging for spectroscopically-confirmed quasars that show potential lensing structures. To this end, we developed a novel method to identify compact lensed quasars via their large image fitting residuals in ground-based surveys. This method successfully recovers known lensed quasars with lensing separations down to ~0.4". Using this method, we build a sample of 119 quasars in the DESI Legacy Imaging Survey footprint. We propose snapshot WFC3/UVIS F600LP imaging to unambiguously confirm or disprove the lensing hypothesis for these quasars. Assuming a completion rate of 30%, we expect to find ~20 compact lensed quasars, nearly doubling the current sample. This compact lensed quasar sample will enable various studies of the deflector galaxies (mass profiles, CGM, etc.) and the background quasars (QLF, host galaxies, etc.). As a bonus science, this project will find a few close quasar pairs, which are valuable objects for constraining AGN triggering mechanisms and galaxy merger evolution.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: None
ID: 18138
Program Title: For Whom the Metal Flows: an FUV transit of the young AU Mic c

Principal Investigator: Rockcliffe, Keighley

PI Institution: University of Maryland, Baltimore County

Atmospheric escape is theoretically a ubiquitous process among planets with atmospheres. It has the power to shape the entire exoplanet population, potentially leading to a lack of close-orbiting gaseous planets and creating the common sub-Neptune exoplanet type. Despite the impact of this process, questions like what variables control it and when it is the most efficient remain open. This motivates the search and characterization of atmospheric escape in young systems, where the process may be the most influential. We propose for one transit of AU Mic c, a sub-Neptune with an 18 day period, with HST/STIS E140M. This will allow us to investigate and confirm the young planet's potentially metallic outflow. Confirmation of the presence of metals will place strong constraints on AU Mic c's outflow structure and kinematics, providing an important test case for atmospheric escape models.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: None
ID: 18139
Program Title: Tracing Accretion in the Planetary Regime: A Comprehensive UV/Optical Survey of the Late Stages of Planet Formation

Principal Investigator: Jiang, Lillian

PI Institution: University of California - Santa Barbara

Gas accretion onto giant planets shapes their formation timescales and angular momentum transfer from circumplanetary disks, yet details of this process remain poorly understood due to the scarcity of known accreting protoplanets. For instance, it is unclear whether inner accretion disks dissipate on similar timescales as stars, what processes shape this evolution, and whether the empirical relations between emission line strength and accretion rate established for stars are valid in the planetary-mass regime. Young free-floating planetary-mass objects offer a unique opportunity to examine accretion in isolation without the influence of a host star. We propose to use WFC3/UVIS to map the evolution of accretion in the planetary-mass regime (3-13 Mjup) by increasing the number of direct accretion rate measurements as traced by hot gas in the UV and Halpha emission by a factor of six. This program will determine the accretion fraction of isolated planetary objects in three young associations---Taurus (~1-2 Myr), Upper Sco (~5-11 Myr), and the beta Pic moving group (~26 Myr)---to trace the evolution of viscous accretion across the first 30 Myr for the largest sample of isolated planetary-mass objects to date. For accreting objects, this campaign will also calibrate the Halpha line luminosity-to-UV continuum excess relation in a model-independent manner at planetary masses---a critical connection needed to map ground-based Halpha emission of young planets into total accretion luminosity across all wavelengths.

Proposal Category: GO
Scientific Category: Exoplanets and Exoplanet Formation
Alternate Category: Stellar Physics and Stellar Types
ID: 18140
Program Title: Flares, Everywhere and All at Once: An NUV/Optical Flare Study of Proxima Centauri

Principal Investigator: Bennett, Katherine

PI Institution: The Johns Hopkins University

The impacts of flares remain one of the biggest unknowns in the ability of a close-in rocky M dwarf planet to retain its atmosphere. Specifically, understanding the cumulative flare flux incident on a planet over its geologic lifetime relies on quantifying both the flare rate and flare spectral energy distribution (SED). However, we are often limited to using broadband optical flare studies to extrapolate flare rates to other wavelengths, and it is becoming increasing apparent that UV flare rates extrapolated from optical flares are greatly underestimated. Unfortunately, these studies rely on broadband flares observed across epochs and/or observatories. With HST's WFC3/G280 grism, however, we can for the first time observe NUV-to-optical flare spectra simultaneously. This reveals both the relative NUV and optical rates and the precise NUV SED, which greatly influences planetary atmospheric escape and photochemistry. We target Proxima Centauri, as it is an M-dwarf planet host known to flare frequently, and is also close enough (and therefore bright enough) to be observed in the NUV/optical. We will observe 23 nonconsecutive orbits to observe approximately five flares (95% confidence interval of 2-11 flares). In the case that no flares are detected, we will collect high S/N spectra of an M-dwarf. This is critical for improving M-dwarf models, which are increasingly used to correct for stellar contamination in transmission spectroscopy studies. This is the first study that targets multiwavelength flare observations from a single instrument, and promises to open the door to a new avenue by which to probe flare physics and their impacts on planetary atmospheres.

Proposal Category: AR
Scientific Category: Solar System Astronomy
Alternate Category: None
ID: 18141
Program Title: Characterizing Planet Formation through a Outer Solar System Binary Survey Simulator

Principal Investigator: Ragozzine, Darin

PI Institution: Brigham Young University

Solar System Small Bodies provide direct insight into the formation and evolution of the solar system and to planet formation in general. Of particular value are Outer Solar System Binaries (OSSBs) since they encode information about a variety of planetesimal formation processes like the Streaming Instability, collisional evolution, and dynamical stirring. HST has invested a significant amount of solar system observations to discovering these binaries, but almost no effort has been devoted to measuring the observational biases to determine the true underlying frequency of OSSB binaries. Without information on the binary fraction as a function of size, dynamical class, and other properties, many important questions about planet formation are left unanswered. In this Archival proposal, we will characterize the Detection Probability of over 500 outer solar system small bodies observed with HST. Using the same pipeline on real and injected objects minimizes biases and allows a "Binary Survey Simulator" to leverage hundreds of non-detections to rigorously test binary population models. Bayesian parameter inference on binary population statistics (like frequency as a function of size, orbit and relative brightness) will finally provide OSSB population models. This enables a variety of investigations but we focus on three major questions related to differences between Trojans, Centaurs, Cold TNOs, and Hot TNOs that inform specific planet formation processes. This project maximally leverages HST's unique archival dataset to answer open questions in planet formation. Since it uses only HST archival data, it is ideally and uniquely suited for Archival Program support.

Proposal Category: AR
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: Galaxies
ID: 18142
Program Title: Modeling the Double Nucleus and Overmassive SMBH in NGC 4486B Using HST and JWST

Principal Investigator: Valluri, Monica

PI Institution: University of Michigan

NGC 4486B, a compact elliptical close to M87, has a double nucleus similar to that in M31 that is probably an eccentric nuclear stellar disk. We found a supermassive black hole (SMBH) of mass ~3.5-4.8x10^8Msun (7-16% of the stellar mass) offset by 6 pc from the galaxy's photometric center. This proposal aims to build the first eccentric nuclear disk model for NGC 4486B fitted to archival HST imaging and STIS and NIRSpec kinematics to measure the disk's mass, inclination, and precession rate. The SMBH has a velocity of +144 km/s relative to the galactic center, likely due to a gravitational wave (GW) recoil kick from a black hole (BH) merger that also scoured out the galaxy's large, shallow core. Our model will also yield the fraction of counter-rotating orbits, which depends on the BH's kick velocity and disk circular velocity and determines the disk's longevity. Using the highly efficient phi-GPU software, we will run direct N-body simulations of the post-kick evolution of circular nuclear disks embedded in the N-body model of NGC 4486B constrained by HST and JWST data. These simulations will provide insights into the formation and evolution of eccentric nuclear stellar disks surrounding SMBH. Our modeling code and simulations will be made public and are applicable to future HST, JWST, and ELT observations of double nuclei in e.g., M31, VCC128, VCC1107, and FCC208. Insights gained from this study will inform our understanding of the formation and dynamical evolution of SMBH and their nuclear disks and have implications for interpreting observations by LISA, NANOGrav, and other GW observatories.

Proposal Category: AR
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18143
Program Title: Seyfert outflows and their connection to AGN feedback: A new paradigm

Principal Investigator: Arav, Nahum

PI Institution: Virginia Polytechnic Institute and State University

AGN outflows play an important role in feedback processes that control galaxy evolution and the growth of central black holes. Over the past several years a paradigm shift regarding the physical parameters and picture of Seyfert outflows has occurred. In particular, monitoring variability of the outflow absorption troughs in NGC 5548 yielded the first comprehensive, yet simple, model that can explain the physical characteristics of AGN outflows. Compared with previous analyses, the new results are different by a factor of 10 in the distance of the outflow from the central source (R), two orders of magnitude in total outflowing column density (NH), and ascribe trough variability to changes in the photoionization of a constant NH absorber, in contrast with the previous picture of changing NH. Similar results were obtained for the outflow observed in NGC 7469. WE PROPOSE to apply this new paradigm in reanalyzing most of the large multi-epoch archival HST data of Seyfert outflows (~800ks total), including the newly released large data set of Mrk 817, to: 1) Fundamentally revise our NH, R, ionization parameter, mass flow rate and kinetic luminosity estimates in the 12 best-observed Seyfert outflows. 2) Study the obscurer phenomenon in these objects. 3) Use the new reliable parameters to perform a comparative study of Seyfert outflows: try to determine the relationship between the velocity, distance, mass flux and energetics of the outflows to the luminosity, BH mass, Eddington ratio, and orientation of their AGN.

Proposal Category: AR
Scientific Category: Supermassive Black Holes and Active Galaxies
Alternate Category: None
ID: 18144
Program Title: Quasar outflows in the HST/UV archive: Measuring major contributors to AGN feedback

Principal Investigator: Arav, Nahum

PI Institution: Virginia Polytechnic Institute and State University

There has been major progress recently in the study of quasar absorption outflows and their potential contribution for AGN feedback. HST spectral observations of the 500 A-1050 A rest-frame (hereafter, EUV500) in medium redshift objects (z ~ 1) uncovered a rich phenomenology of absorption troughs. The quality and quantity of EUV500 diagnostic troughs allow us to probe the very high ionization phase, which carries 90% or more of the outflowing material, as well as determine the distance of most outflows from the central source (R). The first objective is impossible to achieve with the thousands of available ground-based spectra, and R can be measured in only ~ 1% of them. The EUV500 effort yielded the most energetic outflows measured to date with enough kinetic luminosity to be major agents of AGN feedback processes. The HST spectral UV archive includes observations of more than 1000 quasars. These observations were taken for studying intervening absorption systems, and quasar outflows detected in these spectra were rarely analyzed. WE PROPOSE an archive program to study the EUV500 outflows found in these spectra. Based on previous studies, we expect to find 20-30 very high ionization outflows (tripling the existing sample), and 10-15 outflows with measurable distance (doubling the existing sample).

Proposal Category: AR
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: None
ID: 18145
Program Title: Unraveling the Tarantula's Web: A precise, high-resolution dust map of 30 Doradus

Principal Investigator: Murray, Claire

PI Institution: Space Telescope Science Institute

We propose to conduct a deep, archival census of dust in the Tarantula Nebula (also known as 30 Doradus/Dor), the most luminous star-forming region in the Local Group. Located in the Large Magellanic Cloud (LMC), the Tarantula (also known as 30 Doradus/Dor), is suffused with active star formation and is near enough (~50 kpc) for individual stars and clouds to be fully resolved. These conditions make 30 Dor the ideal laboratory for studying the formation and evolution of starbursts in galaxies. Leveraging archival Hubble Space Telescope imaging from the Hubble Tarantula Treasury Program (HTTP), we will constrain the intrinsic properties of resolved stars and dust simultaneously. Our goal is to produce a new, high-resolution (~pc-scale) map of the total dust extinction in 30 Dor, independent of standard emission tracers, to resolve the structure and properties of the dusty ISM and how it is shaped by this enigmatic starburst.

Proposal Category: AR
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: Galaxies
ID: 18146
Program Title: A Complete Characterization of Multiphase Circumgalactic Gas in the Cosmic Afternoon through Forward Modeling

Principal Investigator: Sameer, Sameer

PI Institution: University of Notre Dame

The multiphase circumgalactic medium (CGM) surrounding galaxies serves as a crucial laboratory for understanding galaxy formation and evolution. Despite significant observational progress, our understanding of this medium-particularly its highly ionized components traced by OVI-remains elusive due to uncertainties in ionization mechanisms and spatial distribution. We present a systematic forward modeling framework to fully characterize the physical and chemical properties of multiphase CGM gas using the publicly available COS CGM Compendium (CCC), a HI-selected dataset comprising ~170 absorption systems with OVI coverage at z<1. Our approach will: 1) Apply rigorous forward modeling techniques to simultaneously analyze multiple gas phases, incorporating both equilibrium and non-equilibrium ionization models across the full suite of UV+EUV absorption lines tracing gas at T < 10^6 K; 2) Establish quantitative relationships between high and low ionization phases to reveal underlying CGM structure properties; 3) Correlate derived gas properties with host galaxy characteristics through comparisons with galaxy-selected and OVI-selected surveys; 4) Benchmark our results against state-of-the-art cosmological simulations to validate our methodology and provide feedback for theoretical models; and 5) Deliver public high-level data products, including an efficient forward modeling toolkit for characterizing multiphase absorption spectra. This comprehensive analysis will provide unprecedented constraints on the baryon cycle during a critical epoch of galaxy evolution.

Proposal Category: AR
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18147
Program Title: Characterizing the dynamics of compact objects in the globular clusters 47 Tucanae, Terzan 5, and Liller 1 via N-body simulations

Principal Investigator: Kremer, Kyle

PI Institution: University of California - San Diego

Globular clusters are ideal laboratories for studying how dynamical processes shape the formation and evolution of compact objects. Ample populations of radio pulsars, X-ray binaries, and cataclysmic variables are now observed in Milky Way globular clusters with specific abundances orders of magnitude higher than Galactic field populations. These populations are particularly pronounced in the most massive and dense systems. Galactic clusters 47 Tucanae, Liller 1, and Terzan 5 are prime examples: 47 Tuc and Ter 5 host more known pulsars than any other globular cluster, while Lil 1 exhibits unprecedented gamma-ray emission, hinting at a vast pulsar population of its own. Modern simulations and observations are now poised to further unveil the compact object populations of these massive clusters in unprecedented detail. Upcoming HST and JWST time-series photometry of these three clusters will provide the best insights yet into the ultracompact binaries in these systems. Meanwhile, state-of-the-art N-body techniques incorporating all relevant physics for compact objects are now capable of simulating these massive behemoths in their entirety. We propose to compute a public suite of N-body simulations of 47 Tuc, Ter 5, and Lil 1 to support these HST/JWST observations. These parallel numerical/observational efforts will provide the most robust constraints yet on compact binaries in the high-mass/high-density tail of globular clusters. This will provide unprecedented insight into the role of globular clusters in forming radio pulsars,``multi-messenger'' gravitational wave sources, and the presence of intermediate-mass black holes in these systems.

Proposal Category: AR
Scientific Category: Stellar Populations and the Interstellar Medium
Alternate Category: None
ID: 18148
Program Title: Honing the J-AGB method

Principal Investigator: Goldman, Steven

PI Institution: Space Telescope Science Institute

The extragalactic toolkit for resolving the Hubble tension has recently expanded to include the J-AGB method, which uses evolved carbon-rich asymptotic giant branch (AGB) stars as standard candles for distance measurements. For carbon stars within a specific infrared color range, two internal processes are thought to regulate luminosity within a narrow, mass-dependent range, making them reliable distance indicators. However, we have evidence that these regulatory processes break down in metal-rich environments, casting doubt on the assumption that the stars are carbon-rich. This proposal seeks to determine the metallicity threshold at which the J-AGB method becomes unreliable and to quantify the associated uncertainties in distance measurements. We propose to analyze archival medium-band WFC3 imaging data from three observing programs, enabling us to chemically classify AGB stars in 18 fields in the Andromeda (M31) and Triangulum (M33) galaxies, and a sample of 22 nearby dwarf galaxies. The well-defined metallicity gradients in M31 and M33, along with the lower metallicity dwarf galaxies, allow us to probe a transition from metal-poor, carbon-star-dominated regions to metal-rich regions where carbon stars are scarce or absent. This study will refine the J-AGB method to improve distance estimates and reduce uncertainties in Hubble constant measurements.

Proposal Category: AR
Scientific Category: Intergalactic Medium and the Circumgalactic Medium
Alternate Category: Stellar Populations and the Interstellar Medium
ID: 18149
Program Title: Ionized Gas around the Small Magellanic Cloud

Principal Investigator: Fox, Andrew

PI Institution: Space Telescope Science Institute - ESA

We propose a comprehensive survey of the diffuse ionized gas in and around the Small Magellanic Cloud (SMC) using an analysis of archival ULLYSES data. By measuring the absorption from low-ion and high-ion metal lines in the COS and STIS spectra of 133 massive stars in the SMC, we will characterize the kinematics and ionization conditions in the diffuse disk and halo gas of the SMC. Specific goals include mapping the gas kinematics across the face of the SMC, measuring the gas ionization level, determining the influence of the bright star-forming region NGC 346 on the gas, and quantifying the SMC's mass loss rate in ionized gas. This study will advance our understanding of the Magellanic System and the fueling of future star formation in the Milky Way, since much of the gas lost by the SMC will ultimately enter the Milky Way. More broadly, this study will address gas transfer in interacting host/satellite systems and shed light on how low-mass star-forming satellite galaxies lose gas through ionized outflows and interactions with their massive hosts.

Proposal Category: AR
Scientific Category: Stellar Physics and Stellar Types
Alternate Category: None
ID: 18150
Program Title: Fueling a New Era of Data-driven Exometeorology with the HST Legacy

Principal Investigator: Zhang, Zhoujian

PI Institution: University of Rochester

The Hubble Space Telescope has transformed exometeorology by enabling time-resolved spectroscopic monitoring of brown dwarfs. These groundbreaking observations revealed quasiperiodic variability and top-of-atmosphere inhomogeneities, fueling advances in light curve analyses, 2D surface mapping, and general circulation models. Yet, quantitative constraints on the physical mechanisms driving variability - particularly patchy clouds and hot spots - remain limited. We propose to fill this gap by developing the first framework for time-resolved atmospheric retrievals. Our work builds on a newly developed method - the first to characterize both patchy clouds and hot spots within a unified framework. This method has successfully fitted a single-epoch JWST spectrum of a late-L brown dwarf while reproducing its HST photometric variability, laying the groundwork for full time-series analysis. We will apply this framework to archival WFC3/G141 time-series spectra, paired with publicly available single-epoch spectra, of 13 variable brown dwarfs, deriving their atmospheric properties (e.g., cloud composition, sedimentation, vertical mixing, thermal anomalies), and tracking how they evolve over time. The sample spans a wide range of ages, inclinations, and spectral types, enabling population-level studies of brown dwarf weather. Our program provides a computationally tractable foundation for interpreting upcoming JWST spectroscopic monitoring, where time-resolved retrievals have not been developed. By unlocking the full potential of HST's archival data, we will deliver a scalable, open-source tool for atmospheric retrievals - fueling a new era of data-driven exometeorology.

Proposal Category: AR
Scientific Category: Galaxies
Alternate Category: None
ID: 18151
Program Title: Finding Low Halo Mass Strong Lenses in HST Archive

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The nature of dark matter (DM) is critical to cosmology, yet cold dark matter (CDM) remains largely untested at halo masses below 10^{13} M_{Sun}. This proposal outlines a novel approach to probe CDM predictions down to halo masses of $\sim 10^{11}$ M_{Sun} through archival analysis of high-resolution Hubble Space Telescope (HST) images. We aim to systematically discover gravitational lenses with small Einstein radii ($0.03'' \lesssim \theta_E < 0.5''$), using advanced machine learning methods to identify previously overlooked lenses. The proposed research specifically targets low halo mass (LHM) lenses, encompassing "deci-" and "centilensing," as a direct test of CDM predictions. Using a custom ResNet and a ResNet+U-Net pipeline, preliminary forecasts indicate we can detect a large number of lenses with nearly 100% purity, even in the unexplored centilensing regime. The discovery of these lenses will populate a critical gap--the "strong lensing desert"--in current catalogs of strong lenses. Additionally, unlike the discovery claims of "dark" (sub)halos, these systems can be unambiguously confirmed spectroscopically. Furthermore, we will perform lens modeling for confirmed systems, providing a rigorous statistical framework for testing CDM at unprecedentedly small scales (not counting the "dark" (sub)halo discovery claims). The results will significantly enhance future lensing studies with JWST and Roman, ultimately contributing insights into the fundamental properties of dark matter.