Roman Conference 2023 Abstracts

Invited Talks

Galaxy Evolution with Space-Based Slitless Spectroscopy: Past, Present, and Roman
By Jasleen Matharu

Wide-Field Space-based Slitless (or "grism") Spectroscopy (WFSS) is uniquely capable of providing two-dimensional, spatially resolved spectra for all the sources in the field-of-view. Both a blessing (statistics) and a curse (overlapping spectra), HST WFC3/IR WFSS has allowed us to: spectroscopically identify galaxy cluster members more efficiently than slit spectroscopy, constrain the size growth mechanisms and ages of quiescent galaxies since Cosmic Noon, directly observe inside-out growth via star formation in star-forming galaxies and outside-in quenching in cluster galaxies at $z<=1$, measure metallicity gradients in star-forming galaxies at 0.65 requiring smaller samples and with velocity information. With Roman harbouring similar grism capabilities to HST, but with 200 times the field-of-view, we will observe the interplay of physical processes both on large scales and at high resolution that drive galaxy evolution. In this talk, I will outline how sophisticated slitless data processing pipelines have enabled the wealth of WFSS science from HST and JWST. I will then explain how the science we have accomplished with WFSS to-date will inform how we use Roman to further our understanding of galaxy evolution.

Discovery and Characterization of Small Bodies in the Solar System
By Rosemary Pike

Space-based facilities provide groundbreaking insight into the composition and evolutionary history of the wealth of small bodies in the solar system. The near-infrared and mid-infrared are critical for the detection of silicates, complex organics, water ice, carbon monoxide, carbon dioxide, methanol, and other volatiles, as well as the signatures of past aqueous alteration. The presence or absence of these materials depends on the formation and evolution of these small bodies. The JWST is providing near-infrared and mid-infrared photometry and spectroscopy, which is critical for mapping the presence of volatiles in the solar system. The spectra of these small bodies provide the data necessary to create detailed reflectance models needed for linking composition determined from spectra to broad-band filter results from JWST and Roman. Current JWST programs target asteroids, distant and main belt comets, Centaurs, Trojans, and Trans-Neptunian objects. The wider field of view of Roman and the anticipated surveys will provide an unprecedented opportunity to serendipitously discover distant solar system objects and to characterize the surfaces of large numbers of known and newly discovered objects.

Weak lensing with JWST and Roman: Current Insights and Future Synergies
By Ami Choi

Over the past several decades, many different types of astronomical measurements have built up persuasive evidence that the mysterious dark energy and dark matter make up 95% of the Universe. One of the principal means of studying dark energy is through its observable effects on the large-scale structure (LSS) of the Universe. Weak gravitational lensing is a well-established tool for measuring the minute coherent correlations induced on the light traveling from distant galaxies by intervening LSS. Weak lensing analyses are extremely challenging because the distortion levels are tiny (~1%) compared to the intrinsic distribution of unlensed galaxy shapes and thus, knowledge of the point-spread function is crucial. With a design intended to control systematics at an unprecedented level, the Nancy Grace Roman Space Telescope is poised to transform astrophysical and cosmological insights using the weak lensing technique. Roman is currently in its construction and testing phase, with planned launch in late-2026. Meanwhile, JWST has already produced a wealth of commissioning and science data, which both shape the scientific landscape and teach us important lessons about mitigating systematics ahead of Roman. I will review the current weak lensing landscape, summarize emerging insights from science and facility perspectives, and discuss possibilities for future synergies between JWST and Roman.

Exoplanet Science with JWST & Roman: A Journey through Through Space and Time
By Samuel Grunblatt

14 years ago, the launch of the NASA Kepler mission revolutionized our understanding of exoplanets in our Galactic neighborhood. 18 months ago, the launch of another NASA mission triggered a similar sea change in exoplanet science. The James Webb Space Telescope is actively transforming our ability to characterize the planet population in our Galactic neighborhood, providing new and unexpected insights into planet compositions and atmospheres that were previously impossible. In the near future, the Roman Space Telescope will extend our knowledge of exoplanets even further, identifying planets in regions of parameter space that are currently incredibly difficult to access. The Roman Galactic Bulge Time Domain Survey will reveal tens to hundreds of thousands of planets and candidates in more distant regions of our Galaxy. Thousands of these planets will be detected at star-planet separations similar to the known Solar System planets, which cannot be probed in large numbers using current facilities, thanks to the wide field NIR capabilities and astrometric precision of Roman. Clues about planet demographics from JWST will better inform yield estimates from Roman and help us to identify the most effective approaches to extend exoplanet science. Together, JWST and Roman will unveil planet demographics across the Milky Way.

Here, There, Everywhere: Strongly Lensed Supernovae, JWST, and Roman
By Patrick Kelly

A gravitational lens can create multiple, magnified images of a background supernova explosion. Relative delays among the images of a supernova are inversely proportional to the Hubble constant, making strongly lensed supernovae a powerful potential cosmological tool. Moreover, lensed supernovae can experience microlensing by stars (and other compact objects) in the lens, which can differentially magnify the expanding SN. I will discuss a novel test of cluster lens models using the first set of JWST observations of a strongly lensed supernova, as well as a measurement of the Hubble constant using Supernova Refsdal. I will next look forward to the strongly lensed supernovae the Roman should detect, and the potential for insights into cosmology and stellar populations at high redshift.

New Insights on Luminous Infrared Galaxies from JWST
By Vivian U

Luminous infrared galaxies emit the bulk of their luminosities in the infrared, typically attributed to a combination of high levels of dust, star formation, and AGN activity. In the nearby universe, they are commonly associated with galaxy mergers, a mechanism that gives rise to heightened star-forming rates and black hole growth. For over a decade, the Great Observatories All-sky LIRG Survey has amassed multi-wavelength X-ray to radio data to investigate the starburst-AGN connection in these LIRGs as a population. Most recently, our campaign has extended to detailed studies of the dusty nature of LIRGs with spatially-resolved infrared observations from JWST. In this talk, I will review early results from our GOALS-JWST Early Release Science and General Observer programs that address the questions of how the triggering of AGN and its feedback effect depend on nuclear environments, and discuss implications for the expected transformative impact on our understanding of these important phenomena as enabled by Roman's high-resolution and wide-field imaging capabilities.

Probing the Early Universe using the Most Distant Quasars
By Jinyi Yang

The growth of the earliest supermassive black holes (SMBHs), the assembly of early massive galaxies, and the history of cosmic reionization are the most important open questions. As the most luminous non-transit objects, quasars at $z > 6$ are indispensable probes of the early Universe. The recent high-z quasar surveys have pushed quasar frontier to $z>7.5$. I will summarize the recent studies of high-redshift quasars with JWST and present predictions on future quasar investigation with the upcoming Nancy Grace Roman space telescope. JWST opens a new era of the study of early quasars, with new wavelength coverage, high sensitivity, and high spatial resolution. The investigations cover new measurements of BH mass and growth, direct image of UV/optical emission in quasar host galaxy, AGN feedback, quasar environment, and the reionization history. JWST also offers a first chance to systematically search for obscured and faint AGN/quasar at high redshift. In the near future, the Roman telescope will lead the next generation wide-field surveys of first quasars. Its deep near-infrared photometric and spectroscopic observations will allow us to deeply search and investigate quasars to redshift z~9-10, with a significantly expanded quasar sample, which will revolutionize our understanding of the earliest quasars and the cosmic reionization.

High Redshift Galaxy Surveys with JWST and Roman
By Micaela Bagley

The shape and evolution of the rest-frame UV luminosity function constrains the relative importance of the physical processes governing the conversion of gas into stars. While tremendous progress has been made with ultra-deep Hubble surveys such as the Hubble Ultra Deep Field and the Hubble Frontier Fields, there were very few pre-Cycle 1 empirical constraints on these processes at the highest redshifts. The first year of JWST observations is already changing our understanding of the high redshift universe, with many new photometrically-identified z>10 candidates as well as a growing number of spectroscopically confirmed galaxies. These early results are providing a picture of a universe that builds up mass in galaxies early and efficiently, though the Cycle 1 JWST observations cover relatively small areas and/or shallow depths. The Roman Space Telescope offers an incredible opportunity to pursue imaging at the depth of the HUDF but over an area ~100 times larger, combining areas large enough to probe the large-scale structure and clustering properties of early galaxies to overcome cosmic variance, and deep enough to constrain the faint end slope of the luminosity function. I will summarize some of the high-redshift results that have come out of this first year of JWST science operations from large programs such as CEERS, and will discuss some of the ways that a Roman deep field can advance our understanding of the high-redshift universe even further.

Globular Clusters in the Large Scale Structures from JWST to Roman
By Myung Gyoon Lee

Globular clusters are an excellent probe to investigate the distribution of dark matter from small to large scale and the assembly history of galaxy clusters and groups. There are two types of globular clusters depending on their location: galaxy globular clusters, and intergalactic globular clusters (intracluster or intragroup GCs, called IGCs). The JWST opened a new era in the study of globular clusters in galaxy clusters, exceeding the limit of the HST. The JWST/NIRCam images of a massive galaxy cluster SMACS 0723 at z=0.39 show not only a rich population of IGCs, but also gravitationally-lensed younger globular clusters in high-z galaxies behind the SMACS 0723. While the IGCs tell us the distribution of dark matter and how the cluster is assembled, the globular clusters at low to high redshift provide the time series snapshots of massive star clusters at different evolutionary phases, enabling us to understand how globular clusters evolve. Roman is an ideal telescope to study globular clusters in nearby large galaxy clusters and groups as well as resolved stars in nearby large galaxies. I will discuss how our current understanding of these globular clusters as well as resolved stars will be transformed with Roman.

Near-field Cosmology with Roman and JWST
By Nitya Kallivayalil

I will present results from the JWST Stellar Populations Early Release Science Program, and two HST Treasury programs that provides deep imaging, below the oldest main-sequence turn-off, for all presently known Milky Way and M31 dwarf galaxies. The data allow us to measure proper motions and hence construct orbital histories, measure morphologies (sizes and light profiles), and obtain star formation histories for these dwarfs, thereby addressing critical issues related to galaxy formation, cosmic reionization, and the nature of dark matter. First results include testing the prediction that hierarchical evolution occurs on all mass scales, i.e., that satellites of the Milky Way should also have companions; whether sizes of dwarf galaxies agree with predictions from cosmological simulations; and tantalizing evidence that star formation histories for dwarf galaxies associated with the Magellanic Cloud system are different from dwarf galaxies associated with the Milky Way. I will summarize our efforts to measure cross-observatory proper motions (HST-JWST-Gaia) and lessons and opportunities to extend these techniques to Roman.

Contributed Talks

Eta Tel B - 20 yrs of follow-up
By Pedro Henrique Soares da Silva de Pinho Nogueira

Eta Telescopii (hereafter called η Tel) is a ~24 Myr A0V star that has an M7/8 brown dwarf companion (η Tel B) at 4.2” away. η Tel presents a debris disk, and η Tel B is bright at H NACO observations (1.5e-3 of contrast with η Tel). In this presentation, I will show our recent follow-up of more than 20 years of NACO and HST-NICMOS observations, providing astrometric follow-up and orbital characterization. I will also present the first high-resolution spectra of the companion using CRIRES data. I am particularly interested in searching for surrounding structures and sub-brown dwarf companions by using high-contrast imaging techniques allied to heavy post-processing data analysis. Therefore, I will provide the same analysis for our coronagraphic NACO data of η Tel B, showing contrast curves and possible η Tel B companion candidates. In summary, I intend to present the most complete description of the η Tel system to date, focusing on η Tel B and its surroundings.

A Comprehensive JWST Study on Galaxies at z~9-16 and Its Implication for the Roman Surveys
By Yuichi Harikane

We present a comprehensive study on dropout galaxy candidates at z∼9−16 using the JWST/NIRCam images taken in the Cycle 1 ERO, ERS, and GO programs, and its implications for Roman observations of the high redshift universe. We carefully apply a secure photo-z selection criterion and conventional color criteria with confirmations of the ERO, ERS, and GO NIRSpec spectroscopic redshifts, and obtain a total of >20 dropout galaxies at z∼9−16, including two candidates at zphot~16. The derived UV luminosity functions at z~9-16 are better described by a double-power law function than the Schechter function, indicating a larger number of bright galaxies at z>9 than theoretical model predictions. The cosmic SFR density decreases from z∼9 to 12, and perhaps to 16, but the densities at z∼12−16 are higher than the constant star formation efficiency models, which indicates unusually high star formation efficiency probably by no suppression of star-formation by the UV background radiation at the pre-reionization epoch or an efficient UV radiation production by a top-heavy IMF possibly with Population III-like star formation. In this talk, I will also present the latest results from new NIRCam datasets calibrated with NIRSpec spectroscopic data obtained so far including successful redshift confirmation at z=10-13, and forecasts for the Roman surveys, in which we expect to detect >2000 galaxies at z>12 with Roman's Ks-band observations, allowing us to obtain the first statistical census of galaxies at such an early epoch.

The Power of NIRCam/Grism Wide Field Slitless Spectroscopy (WFSS) Observations: Early Results and Implications for Roman
By Eiichi Egami

Although grisms were originally installed in JWST/NIRCam for the purpose of phasing the primary-mirror segments, their scientific use through the NIRCam/Grism Wide Field Slitless Spectroscopy (WFSS) mode has proven to be extremely powerful, enabling efficient and unbiased sampling of galaxies over a wide range of redshift via the detections of strong rest-frame optical/infrared emission lines (e.g., [OII] 3727, H-beta, [OIII] 4959/5007, H-alpha, Pa-alpha, etc.). In fact, shallow (~10 min) NIRCam/Grism WFSS observations targeting a flux-standard star during the commissioning phase were sufficient to detect several z>6 line-emitting galaxies serendipitously, immediately demonstrating the power of this observing mode. Subsequent GTO/GO-1 programs exploiting the power of this observing mode have already produced a variety of exciting results, from the spectroscopic identifications and studies of z~5-9 galaxies in large numbers to the discoveries of overdensity/proto-cluster regions at z~5. In this talk, I will review the in-orbit performance of the NIRCam/Grism WFSS mode, early scientific results from the GTO/GO-1 programs using this mode (e.g., ASPIRE, EIGER, FRESCO), and discuss the implications for WFI/Grism surveys with the Roman Space Telescope.

ESpRESSO - high-fidelity realistic grism simulations for Roman Space Telescope
By Austen Gabrielpillai

The Roman Space Telescope (Roman) boasts an enormous field of view (0.281 square degrees), making it unmatched in the collection of hundreds of thousands of spectra via the grism slitless spectroscopic mode. Spanning a wavelength range of 1 - 1.93 µm, the grism has the capability to detect high-redshift Lyman-α emission galaxies, probes of the epoch of reionization. Learning how to process this data before launch is critical, highlighting the need for realistic mock images. We present ESpRESSO - [E]xtragalactic [Sp]ectroscopic [R]oman [E]mulator and [S]imulator of [S]ynthetic [O]bjects, grism simulation software built to emulate the on-board instrument. We use high-resolution Hubble Space Telescope WFC3 F160W images and model spectral energy distributions to create a realistic Roman foreground scene spanning ~3 WFI detectors. The scene includes multiple in-focus orders and distortions, such as the field-dependent wavelength cutoff. We highlight the development of our source injection tool, which can add custom sources into our foreground images. and our own injected high-redshift (z > 7) emission line galaxies. We will also discuss our upcoming data release and data challenge, as well as how the upcoming James Webb Space Telescope NIRCam data products will be utilized in future simulations.

Seeing the invisible: A search for AGN in Green Peas in the local universe
By Mainak Singha

The contribution of active galactic nuclei (AGN) in the reionization of the universe is highly debated. Whereas many studies suggest that AGN contribute minimally to the ionizing budget, others have shown a significant AGN contribution. An unambiguous study of nearby galaxies is hence needed to place observational constraints on theoretical predictions. Green Pea (GP) galaxies provide an invaluable opportunity to study the energetics of reionization in unprecedented detail. These compact starbursts with large Lyman continuum leakage are the best local analogs of high-z galaxies responsible for reionization. Not only GPs have been found in the early universe (z~8) through the advent of NIRSpec, but recent MIRI/MRS observations have also detected AGN in GP analogues. An archival search for X-rays from GP galaxies shows only 4 detections, with 6 times more X-ray luminosity than expected from stellar contributions. Combining our results with 3D hydrodynamical simulations, we find that the mechanical power output from AGN describes >50% of the observed X-ray emission. If so, then AGN feedback could be a key mechanism behind reionization. While JWST links NIR properties to MIR AGN diagnostics in GPs, Roman will find millions of them with the NIR properties, which will advance our understanding of reionization.

Planning for Roman: Case Study of Wide-Field Slitless Grism Spectroscopy with JWST
By Gaël Noirot

The Roman Wide-Field Slitless Grism Spectrometer aims at measuring redshifts and emission line properties of tens of millions of galaxies over a significant portion of the extragalactic sky. By doing so, it will provide the most precise mapping of matter clustering over such a large area, enabling the study of the Universe’s expansion and of the structure and distribution of baryons and dark matter through cosmic time in unprecedented details. A small number of teams have now published the first results using JWST’s slitless grism capabilities provided by the NIRISS instrument. In particular among them, a team of researchers have made the first thorough inspection and characterization of all of the grism spectroscopic data observed over an entire deep NIRISS pointing: that of the Early Release Observation of Webb’s First Deep Field, SMACS J0723.3-7327. In this talk, I will review these first JWST results using wide-field slitless grism spectroscopic data and present the many challenges of obtaining precise spectroscopic redshifts from such observations. I will also present current solutions implemented within the JWST-GTO Canadian NIRISS Unbiased Cluster Survey (CANUCS) program to overcome these challenges, offering perspectives for current and future wide-field slitless grism spectroscopic programs and observations.

Using Roman Space Telescope to find Dark Star candidates
By Cosmin Ilie

Dark stars are luminous stellar objects, made primarily of hydrogen and helium, yet powered by dark matter. Formed in the early Universe at redshift $z \sim 10-20$, some can grow supermassive by accretion to more than $\sim 10^6M_{\odot}$ and $10^9 L_\odot$. We investigate the detectability of supermassive dark stars (SMDSs) by the Roman Space Telescope (RST), motivated by our recent identification of several SMDSs candidates in the James Webb Space Telescope (JWST) data. Similarly to JWST, RST will be able to detect SMDSs at redshifts as high as $z\simeq 14$ as photometric dropouts. Thanks to its much larger effective field of view, RST will have a larger detection probability of SMDSs candidates at these redshifts (compared to JWST). JWST, on the other hand, being sensitive to higher wavelengths, can probe a larger swath of the reframe SEDs of any given high redshift objects, and, as such, confirm the Dark Star nature of RST candidates via spectroscopy with NIRSpec or photometry with MIRI/NIRCam. In the talk I will elaborate on the various possible ways to differentiate between SMDSs and early galaxies using photometry, image morphology, and spectroscopy. The detection and confirmation of any supermassive dark star will provide evidence for annihilating dark matter. Moreover, such massive stars can also be natural progenitors of the supermassive black holes powering the extremely bright quasars observed at early times ($z\gtrsim 6$).

Revealing the Large-Scale Kinematic Structure of the Galactic Center with the Roman Space Telescope
By Matthew Hosek

The Milky Way Galactic Center provides a unique opportunity to study resolved stellar populations within a galactic nucleus. With an unprecedented combination of a large field-of-view and high spatial resolution, the Roman Space Telescope will allow us to measure the proper motions for over 16 million stars in the inner 50 - 100 pc of the Galaxy. This lays the foundation to address key questions such as (1) How did our galactic nucleus form?; (2) What is the mass distribution in the central region of the galaxy?; (3) How do star clusters form and tidally disrupt near the Galactic Center; and (4) What is the production rate of hypervelocity stars, the long-theorized byproduct of dynamical interactions between stars and the central supermassive black hole? The Roman Space Telescope will place results from current and planned JWST, HST, and ground-based studies in the broader context of the large-scale kinematic structure of the Galactic Center.

Revealing the Merger Histories of Nearby Galaxies from their Stellar Halos with Roman
By Adam Smercina

Galaxies like the Milky Way (MW) host vast halos of stars accreted from past merger and accretion events. While the brightest structures can be studied using traditional imaging, the resolved stellar populations are the most information-rich tracers of this accreted material. The incredible wide-field of Roman, combined with the depth of JWST, will drive a new era of stellar halo science in the Local Volume. This effort will be made possible by important synergy with ground-based studies of the resolved stellar halo populations around nearby galaxies, including the upcoming Rubin LSST. From this ongoing foundational ground-based work, we have learned that the stellar halos of galaxies similar in mass to the MW are incredibly diverse. Yet, challenges unique to ground-based studies, such as poor star-galaxy separation, make more complex inferences, such as the ages, abundances, and substructure of these halos, very difficult. This is particularly relevant in galaxies' inner halos, where the disk and accreted populations are nearly indistinguishable. I will show that by utilizing the combined FOV of Roman and sensitivity of JWST, we can revolutionize our understanding of the merger histories of nearby galaxies, and decode the properties of their complex stellar halos more precisely than ever before.

Let's Go Extreme with Roman: Observing z ~ 0. 5 – 2 low and high EW ELGs
By Ali Ahmad Khostovan

Planned grism surveys with Roman will shed much light on star formation histories of galaxies near cosmic noon. Hα Equivalent Width (EW; observational proxy for specific star formation rate; sSFR) is one tracer of episodic SF activity. In this talk, I will present a new methodology of constraining intrinsic z ~ 0.4. – 2 EW distributions, show how past measurements of EW – stellar mass trends and redshift evolution are selection biased, how our approach resolves the disagreement between observations and simulations of the cosmic sSFR evolution, and highlight our measured intrinsic EW(M,z) correlation. We find high EW (sSFR; bursty SFHs) Hα emitters are numerous and important contributors to cosmic star-formation activity at z > 1.5. Recent JWST studies (e.g., EIGER) find numerous high EW emitters at EoR with extreme ISM conditions and star-formation. Past studies also find EW correlates with ionizing photon production efficiency. Including our results, this suggests high EW emitters play a major role in cosmic SF and may be analogs of high-z ionizing sources at EoR. Finally, I will discuss how we can observe typical and high EW ELGs with Roman grism by using our EW(M,z) to predict number counts and range of EW and stellar mass.

Roman Data Processing: Lessons Learned from JWST
By Henry Ferguson

There have been significant challenges in processing early data from JWST and assessing the reliability of the results. Problems often reveal themselves when trying to achieve the anticipated signal-to-noise ratios, when searching for rare sources (e.g. at extremely high redshift), or when trying to determine whether a galaxy in an unexpected part of parameter space is real or the result of some artifact. This talk will present real-world examples of such data challenges from the CEERS and NGDEEP programs, review some of the solutions and work-arounds, and discuss possible implications for Roman observing strategies and Roman data processing.

Prospects on Mapping Ionized Bubbles and Tracing the Global Evolution of the Ionized Structures during the Epoch of Reionization with Roman Space Telescope
By Intae Jung

The first year of JWST NIRSpec observations has already produced numerous spectroscopic confirmations of galaxies during the epoch of reionization (EoR) via the detection of Lyman-break or strong optical emission lines, unhindered by neutral gas in the intergalactic medium (IGM). This breakthrough has allowed for a more detailed exploration of the formation and evolution of galaxies during the EoR, which played a key role in the process of reionization. The Roman telescope's capabilities of a blind emission-line search within its vast field of view (0.281deg^2) will provide additional transformative scientific opportunities to JWST's discoveries, enabling an efficient and unbiased search for Lyman-alpha from galaxies in the EoR. While Lyman-alpha is rather limited as a spectroscopic redshift tracer due to its strong attenuation by the IGM in the EoR, it is, in other words, a tracer of ionized bubbles in the mostly neutral IGM. Reionization models suggest that the size of single ionized bubbles at z ~ 7 - 8 is around ~10cMpc (or ~5') in radius, where the most luminous galaxies (mAB ~ 25mag) coexist with their fainter companions. A deep grism observation of ~12hr exposure with Roman, for example, can reach a line sensitivity of ~1.5e-17 cgs, corresponding to Lyman-alpha of EW=20A from the luminous galaxies. One pointing of such deep exposure with Roman will be able to map a few tens of ionized bubbles and trace the global evolution of ionized structures via Lyman-alpha from JWST-identified galaxies.

Characterization of JWST NIRCam PSFs and Implications for AGN+Host Image Decomposition
By Mingyang Zhuang

The correlations between masses of supermassive black holes and properties of their host galaxies suggest they may coevolve over cosmic time. The unprecedented resolution, sensitivity, and rest-frame optical coverage of the Near Infrared Camera (NIRCam) onboard JWST make it ideal to study the emission and morphology of host galaxies of high-redshift active galactic nuclei (AGNs). In this work, we perform a detailed characterization of NIRCam imaging PSFs in 8 filters: F070W, F115W, F150W, F200W, F277W, F356W, F444W, and F480M, using publicly available data. We find clear spatial PSF variations across the field-of-view of NIRCam, with maximum variations in PSF FWHM ranging from ~20\% in F070W to ~5\% in the F444W filter. Using mock AGN+host systems spanning a broad range of parameters, we investigate the reliability of host measurements from AGN+host decomposition with NIRCam imaging. We find that PSF mismatch has profound effects on the derived host properties. Our results suggest that there is an artificial offset between the centroids of the AGN and its host galaxy, which is larger in host galaxies with lower surface brightness.

Lyman-alpha at Cosmic Dawn with the LAGER survey and the Roman Space Telescope
By Isak Wold

Lyman-alpha (Lya) surveys are an important tool to constrain the timing and topology of reionization. Towards this end, our group is conducting a 24 square deg narrowband Lya emitter survey at z = 6.9 — The Lyman-Alpha Galaxies in the Epoch of Reionization (LAGER) project. This survey exploits DECam's uniquely large 3 square deg FOV and detector sensitivity in the near-infrared, as well as a custom-made narrowband filter at 9642 A. I will present the latest from our JWST followup of a z=6.9 Lya overdensity and LAGER's Lya luminosity function based on four out of the eight total survey fields. We find moderate number density evolution from z = 5.7 that is consistent with a fully or largely ionized z ~ 7 intergalactic medium. Ground-based Lya surveys become highly inefficient at z>8 largely due to the increasing night sky background. The Roman Space Telescope's ability to obtain deep near-infrared spectra over a wide field of view offers the opportunity to revolutionize this redshift regime. To investigate this further, we have simulated a deep multi-position-angle Roman grism survey and tested our ability to recover z>7 Lya emitters. We show how a novel data cube search technique -- CUBGRISM -- originally developed for GALEX grism data can be applied to Roman grism data to produce a Lya flux-limited sample without the need for a continuum detection. Given our adopted reduction technique, we investigate the impact of altering the number of independent position angles and total exposure time. Our results indicate that a proposed deep Roman grism survey can achieve Lya line depths comparable to the deepest z=7 narrow-band surveys, allowing us to study the evolution of Lya populations and infer the ionization state of the intergalactic medium at cosmic dawn.

Distances with Surface Brightness Fluctuations (SBF) and Globular Cluster Luminosity Functions (GCLF) with JWST and Rubin

By Nandini Hazra

Analysis of Surface Brightness Fluctuations (SBF) and Globular Cluster Luminosity Functions (GCLF) in the optical band can provide extremely accurate distances up to 100 Mpc, while distances up to twice as large can be reached using near-infrared wavelengths. The SBF method is especially valuable for Cosmology in the era of large surveys, with distances accurate up to 3%. JWST will enable the extension of SBF studies up to 300 Mpc, with the expansion of both SBF and GCLF analyses into infrared wavelengths beyond the limit of ~2.2 microns covered by previous studies. We are currently testing an original procedure for analysing SBF and GCLF using JWST open-access data. The procedure has already been tested on HST/ACS data for a galaxy in the Hydra I cluster, where it was used to characterise the globular cluster population and measure the distance of PGC 087327. One major issue in SBF studies has been the complexity of measurements, which require extensive human input and have made it inaccessible as a tool for the larger community. To address this, we have developed and are currently testing a procedure that utilises entirely free and open-source tools, and performs SBF analysis with minimal human intervention. This pipeline naturally produces valuable results for globular cluster science as an auxiliary product, and has been built to adapt well across different instruments. We aim to automate this procedure for high-accuracy distance measurements, making it accessible to the community during the joint operations of Rubin, JWST, and Roman.

Massively Multiplexed Spectroscopy with the Prime Focus Spectrograph in the Era of JWST and Roman

By Jenny Greene

The results emerging from JWST are changing our understanding of galaxy evolution in profound and exciting ways, but still over very limited sky area. With the advent of the Roman Space Telescope, we will have the field-of-view needed to add environment. An important component of surveying large sky areas into the 2020s will remain massively multiplexed spectroscopy from the ground, which would provide critical calibrations for the Roman Grism data, as well as bluer coverage for Roman galaxies. I will describe the Prime Focus Spectrograph Galaxy Evolution Survey, scheduled to begin in 2024, and ways in which it would complement and enhance the High Latitude Survey, as well as provide a feeder to JWST for exciting detailed follow-up.

Representing cosmic structures with graph neural networks

By John Wu

In its quest to reveal the high-redshift universe, JWST has also imaged numerous galaxies in lensing clusters at low redshifts. These cluster galaxies reside in the most massive dark matter halos, which represent the "tip of the iceberg" of the cosmic web; Roman will provide detailed near-infrared imaging for billions of galaxies across diverse environments at similar redshifts. By modeling cosmic (sub)structures as mathematical graphs, we can represent the relationships between galaxy and dark matter halo properties. We will present early results using graph neural networks to represent galaxy clusters, which are trained on simulated data and applied to JWST observations, and provide novel constraints on the dark matter halo masses and maximum rotational velocities. We also discuss future extensions to the lower-mass regimes probed by the Roman High Latitude Wide Area Imaging Survey.

Probing the host galaxies of first quasars at z~7.5 with JWST data
By Weizhe Liu

The existence of luminous quasars powered by billion-solar-mass black holes in the Epoch of Reionization challenges our understanding of the formation of supermassive black holes and their coevolution with massive galaxies. While current observations have revealed a large amount of dust and molecular gas content, and intense star formation in the host galaxies of these quasars, a key missing piece for the puzzle is the stellar emission in the rest-frame UV/optical. In this talk, I will present the preliminary results from our study of the host galaxies of the highest redshift quasars at z~7.5 adopting JWST NIRSPEC/IFU data. While we are still actively analyzing the data, there is tentative evidence that the stellar emission / host nebular emission lines are likely fainter than one would expect. Our data will put new constraints on the stellar emission and ISM nebular emission from the host galaxies of these earliest quasars in the universe. Our study will also inform future JWST studies on the host galaxies of such early quasars discovered by Roman surveys.

Below the iceberg: Low surface brightness astronomy with HST, Euclid, and Roman
By Alejandro S. Borlaff

Our current view of the universe is tightly limited by the light intensity ranges that we are able to detect. Like icebergs partially afloat, apparently well-defined and non-interacting galaxies such as M31 reveal a myriad of satellites, halos, and tidal tails when observed at surface brightness magnitudes lower than 30 mag arcsec-2. Such structures are not always predicted by current Lambda-CDM models, making deep optical and NIR imaging the next frontier for galaxy evolution and cosmology. Extended low surface brightness sources like outer galactic discs, stellar halos, ultra-diffuse galaxies, or the intracluster light trace provide strong observational tests for cosmology and the structure of Dark Matter. Nevertheless, these features are thousands of times dimmer than the sky background, requiring an unprecedented advance in image processing to push the surface brightness limits to such faint levels. Upcoming observatories like NASA/Nancy Grace Roman or ESA/Euclid have the potential to become major cornerstones for the study of galactic formation and evolution, not only at high redshift but also at the dim and extended envelopes of the objects in the Local Universe. In this contribution, we describe the on-going challenges of deep astronomical imaging of extended sources from space, including segmentation, in-orbit detector calibration, as well stray-light correction. By using specific techniques to minimize unwanted systematic effects, structures can be detected down to ~31 mag arcsec⁻2 in Hubble Space Telescope images. These new techniques make it possible to reveal the large scale structures that surround the galaxies with the HST, which will be critical for the Euclid/VIS survey (Borlaff et al. 2022, Key Project Publication) and the Wide Field Instrument aboard the Nancy Grace Roman Space Telescope. We demonstrate these methods in a new version of the WFC3/IR Hubble Ultra Deep Field (ABYSS HUDF, Borlaff et al. 2019), which improves the detection of extended stellar halos that were invisible until now, revealing that they were double their size at z=0.6-1.0. This new methodology will be fundamental for future space missions with an extremely wide field of view if we want to exploit their capabilities to their true limit, providing unique datasets to study the traces of cosmological evolution in the local Universe and beyond.

Anchoring Future Roman Deep Fields with COSMOS-Web: large scale structure to transients
By Caitlin Casey

I will present the utility of the COSMOS-Web JWST treasury program for future Roman Space Telescope deep field studies. As the largest JWST deep field at 0.54deg^2, 3 times larger than all other JWST deep fields combined, COSMOS-Web will serve as the ultimate calibration field for >degree-scale Roman surveys: for tuning of photometric redshifts for high-z galaxies, for mapping large scale structure, for weak lensing cosmological measurements, and for the detection of rare, high-redshift transients. I will discuss the unique niche of COSMOS-Web in working towards results in all of these areas, from reconstructing the large scale structure galaxy density field at 65. Lessons from COSMOS-Web will be crucial in the design and execution of large Roman surveys with similar scientific goals.

The origin of the very metal-rich stars near the sun
By Ankita Mondal

Stars of all ages are found near the sun- young and old, with abundances up to about [Fe/H] = 0.5. The most metal-rich stars with [Fe/H] > 0.1, could not have formed near the sun, because the ISM near the sun is not so metal-rich. It is widely believed that they formed in the inner Galaxy and migrated out to the solar neighborhood via radial migration. The migration process moves stars from near-circular orbits at one radius to near-circular orbits at another (mostly larger) radius via transient spiral structures, and their vertical dispersion is lower after the migration, due to the conservation of z-action. From the APOGEE, GALAH, and Gaia surveys, we study the abundances and motions of stars with [Fe/H] > 0.1 near the sun. We look for chemical and dynamical properties of these stars that give insights into their possible origin in the inner Galaxy. From their (Vphi, VR) distribution, some of these metal-rich stars are associated with the Hercules moving group of stars, trapped by the Galactic bar in stable orbits. These orbits carry the stars out into the solar neighborhood. Our analysis supports this view. Unlike the stars of near-solar abundance, we find no change in orbital eccentricity distribution for the metal-rich stars. These stars have had a common dynamical history since their birth in the inner Galaxy.

Guiding future deep-wide Roman surveys with galaxy formation physics we learn from JWST
By L. Y. Aaron Yung

NASA's Roman will redefine deep-field galaxy surveys with its field of view two orders of magnitude larger than Hubble and survey the distant universe at unprecedented scales. Designing effective and efficient Roman surveys relies heavily on our understanding of structure formation across cosmic time and simulated forecasts backed by physics. On the other hand, JWST is anticipated to transform our understanding of the emerging galaxy population in the earliest episodes of cosmic evolution. In this talk, I will use the "Semi-analytic forecasts for JWST" work series as an example to demonstrate how simulated galaxy catalogs and synthetic observations can enable a wide variety of preparatory studies and can be extremely useful in guiding survey designs. I will also discuss how semi-analytic models are essentially an aggregation of physical processes that we learn from observations and are the ideal tool for bridging state-of-the-art galaxy formation and supermassive black hole growth theory to the next generation observations.

Gravitationally lensed quasars in the reionization era: the prospective for the Roman Telescope
By Minghao Yue

High-redshift quasars trace the extreme phases of SMBH and galaxy evolution at cosmic dawn. They are hosted by the most massive galaxies at their redshifts and harbor colossal SMBHs (with M_BH >~ 10^9 M_sun). With the help of lensing magnification, high-redshift gravitationally lensed quasars offer the best opportunity to conduct in-depth studies of high-redshift SMBHs and their host galaxies. However, our knowledge regarding lensed quasars at z>5 remains highly restricted due to the limited depth and sky coverage of current sky surveys. The upcoming sky surveys (like Euclid, LSST, and Roman) are expected to produce the first large sample (>~50 at z>5.5) of lensed quasars in the reionization era. In particular, the spectroscopic capacity of Roman makes it the most promising mission for building a complete sample of high-redshift lensed quasars. These lensed quasars will be valuable objects for follow-up observations using JWST and ALMA, enabling crucial experiments not feasible with non-lensed quasars. Specifically, these lensed quasars will allow us to accurately measure the quasar luminosity function, explore the faint end of high-redshift quasars, and characterize the small-scale structures (down to ~50 pc) of the quasar host galaxies.

Brown And Red Dwarfs Identified in NIR Imaging
By Benne Willem Holwerda

Low mass (sub)stellar objects are an interloper in the search for high-redshift galaxies and the lower end of the initial mass function of the Milky Way. Can these objects be identified in and typed with the extragalactic choice of filters? Initial work to identify brown dwarfs uses the Cosmic Evolution Early Release Science Survey (CEERS) NIRcam campaign. kNN nearest neighbor types these sources with the four filters (F115W, F150W, F200W, F277W). The training set is artificial photometry based on iSPEX spectra of nearby brown dwarfs. Brown dwarfs are subtyped in 30 subtypes (M0-M9, L0-L9 etc). The result of the kNN is a good classification within half a broad type but much more granular typing declines accuracy. This looks to be a viable way to identify brown dwarfs in NIRcam data for Milky Way science (scale of the Milky Way, total number of brown dwarfs in disk and halo, total number of brown dwarfs, and the galaxy-wide IMF). The Nancy Grace Roman Space Telescope is set to observe a large swath of the sky with optical/NIR bands. A similar photometric typing is possible (based on HST experience) with the promise of identifying the low-end of stellar mass function and how it is spread throughout the Milky Way for the first time.

Population III Protostar Variability in an Elliptical Orbit
By Jongwon Park

We performed radiative hydrodynamics simulations to study the formation of Population III stars (hereafter, Pop III stars). In our simulations, Pop III stars form in a hierarchical system (binaries of binaries) and have eccentric orbits. At the pericenter of an eccentric orbit, the circumstellar disks interact gravitationally, and the accretion onto the stars is enhanced. Thanks to this mechanism, the protostars enter a supergiant phase periodically and become faint in the rest frame UV but luminous in optical. We suggest this Pop III protostar variability can be observed with the James Webb Space Telescope and the Nancy Grace Roman Space Telescope when they are gravitationally lensed.

Unveiling the Low Surface Brightness Universe with Roman
By Mireia Montes

There is a huge amount of astrophysical events that remain barely studied due to the lack of large, deep surveys. This is the Universe at the lowest density of stars, largely unknown even though it promises to deliver transformational insights in our knowledge of the star formation in galaxies in the lowest mass regime, the hierarchical assembly of galaxies and clusters of galaxies, and the ultimate nature of dark matter. Deep space observations have expanded our knowledge of the properties of these faint features (e.g., HUDF, Frontier Fields) while at the same time allowing us to find unique objects. However, wide areas and larger samples are needed in order to map the full range of properties of these structures and, therefore, constrain our theoretical paradigm. Roman has the power to end this scarcity of sufficiently good quality data. In this talk, I will outline the tremendous discovery potential of Roman in the Low Surface Brightness Universe and give some examples of what might wait for the Roman eye.
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Predicting the Yields of z > 6.5 Quasar Surveys in the Era of Roman and Rubin
By Wei Leong Tee

Around 70 z > 6.5 luminous quasars have been discovered, strongly biased toward the bright end, thus not providing a comprehensive view on quasar abundance beyond cosmic dawn. We present the predicted results of Roman/Rubin high-redshift quasar survey, yielding 3 times more, 2−4 magnitudes deeper quasar samples, probing high-redshift quasars across broad range of luminosities, especially faint quasars at bolometric luminosity $\sim$ 10^10 L$\odot$ or M1450 ~ -22 that are currently poorly explored. We include high-z quasars, galactic dwarfs and low-z compact galaxies with similar colors as quasar candidates. We create mock catalogs based on population models to evaluate selection completeness and efficiency. We utilize classical color dropout method using deep optical and infrared bands to select primary quasar candidates, followed up with Bayesian selection method to identify quasars. We show that the overall selection completeness > 80% and efficiency $\sim$ 10% at 6.5 < z < 9, with 180 quasars at z > 6.5, 20 at z > 7.5 and 2 at z > 8.5. The quasar yields depend sensitively on the assumed quasar luminosity shape and redshift evolution. Majority quasar contaminants are faint dwarfs, rejection through proper motion is insignificant. Our results show that Roman/Rubin are able to discover a statistical sample of the earliest quasars in the Universe. The new valuable datasets worth follow up studies with James Webb Space Telescope and Extremely Large Telescopes, to determine quasar luminosity function faint end slope, intergalactic medium evolution during the epoch of reionization and supermassive black holes growth in the early Universe.

Finding planets with Roman and JWST
Julien Girard

I will present what the Roman capabilities are for exoplanets, who they compare and complement with JWST's. With its huge field of view and sensitivity Roman's wide field instrument will be capable of detecting an enormous amount of exoplanets using mainly the microlensing, astrometry and transiting techniques. In addition, the Roman Coronagraph technology demonstrator will allow to image directly a few giant exoplanets in visible, reflected light at unprecedented contrasts around very nearby stars. I will describe synergies between Roman and existing facilities including JWST and focus on the prospect of new, multi-technique detections.

Exoplanet characterization synergies between JWST and Roman
Néstor Espinoza

In only its first year of science operations, JWST has already revolutionized the field of exoplanet atmospheric characterization by showcasing the spectra of transiting exoplanets with an unprecedented degree of detail. This, in turn, has inspired observational and theoretical work in the field in order to understand how the chemical makeup of those distant worlds varies from system to system, and whether trends can be found to understand exoplanet atmospheres as a population. The Nancy Grace Roman Space Telescope's Galactic Bulge Time Domain Survey is set to become a key player in this endeavor through its expected yield of over ~100,000 transiting exoplanets. In this talk, I will outline the exoplanet characterization opportunities Roman will enable thanks to its exquisite multi-band photometric precision, ranging from multi-band transit spectrophotometry, to phase-curve and secondary-eclipse near-infrared measurements that will enable a population-level characterization of exoplanet atmospheres on previously unexplored dimensions. Synergies between those discoveries and JWST exoplanet characterization opportunities will also be discussed.

Posters

Probing the early assembly of black hole mass and quasar luminosity functions
By Wenxiu Li

The early evolution of the quasar luminosity function (QLF) and black hole mass function (BHMF) encodes key information on the physics determining the radiative and accretion processes of black holes (BHs) co-evolving with high-redshift galaxies. Starting from BH seed formation, we study primordial gas collapse in the biased quasar host halos. The top-heavy seed BH mass distribution ranges from several hundred to above 10^5 solar mass. We then construct a theoretical BH growth model via multiple accretion bursts constrained by z~6 QLF and BHMF observations. Imposing a luminosity limit of quasar surveys, we find that the observed Eddington-ratio distribution function is skewed to a log-normal shape, preferentially selecting more active quasars. The predicted redshift evolution of the QLF and BHMF suggests a rapid decay of their number and mass density in a cosmic volume toward z>6. We predict the detection number of quasars with m_{1450}<27 mag to be discovered in the wide-area survey layers of Roman up to z~10. The unprecedented capability and wide survey area of Roman will push BH observations to mass ranges lower than typical high-redshift quasars. The new findings will help explore the growth history of BHs in the early universe and the establishment of BH-galaxy coevolution.

Surface Brightness Fluctuations of Nearby Dwarf Galaxies in the Roman Era

By Jiaxuan Li

Dwarf galaxies are powerful probes of both dark matter and baryonic physics, but obtaining their distances and understanding their properties is challenging due to their faint nature. We explore the potential of the surface brightness fluctuation (SBF) method to accurately measure distances to classical dwarf galaxies within 60 Mpc and characterize their stellar populations using the data from the Roman High Latitude Survey (HLS) and the Vera Rubin Observatory Legacy Survey of Space and Time (LSST). We demonstrate that a combination of optical and near-infrared colors is required to greatly reduce the scatter in the SBF-color relation, enabling precise distance measurements in infrared. We further perform realistic image simulations to understand the SBF distance limit and various systematics. Based on these developments, we predict that Roman HLS will discover and characterize several thousands of classical dwarfs with $10^{5.5} < M_\star < 10^{9} M_\odot$ across all environments. These samples will advance our understanding of dwarf galaxies themselves and their connection to dark matter halos.

Multimessenger Observations of Merging Massive Black Holes with LISA and NASA’s Electromagnetic Observatories

By Kate Futrowsky

The Laser Interferometer Space Antenna (LISA) is expected to observe the gravitational radiation emitted from the inspiral and merger of massive black hole binaries (MBHBs). Although detection of the gravitational wave (GW) signals alone from such events will lead to significant scientific advancements, multimessenger observations with LISA and electromagnetic (EM) observatories such as the Nancy Grace Roman Space Telescope (Roman) will enable advances across astrophysics which are impossible with only GW or EM observations. It is therefore important to develop strategies for the successful completion of such observations, as the number of multimessenger MBHB mergers over LISA’s 4-year lifespan may be as low as a few events. Detecting EM counterparts to GW events observed by LISA may be feasible with Roman and other NASA observatories across the EM spectrum.

Additional Perspectives From JWST CEERS for Optimizing Roman Space Telescope Surveys

By Ray A. Lucas

CEERS, the JWST Cosmic Evolution Early Release Science survey program, is the primary JWST "Epoch of Reionization" and galaxy formation and evolution ERS survey intended to serve as a pathfinder for the extragalactic astronomy community, demonstrating the various kinds of science that can be achieved with JWST and much of its varied complement of science instruments in the study of distant galaxies. Among the issues addressed by CEERS are the types of science pursued, optimal observing program design, overcoming challenges in new data processing and analysis techniques, and assessment of the quality of the data and scientific results themselves. CEERS is neither as wide in area as some surveys such as JWST's COSMOS-Web and PRIMER programs, nor as deep as others such as JWST's NGDEEP program, but as a robust and varied ERS program, CEERS can still point the way to emerging scientific priorities of the Roman Space Telescope and effective survey strategies to address them. Several CEERS-based presentations at this conference will concentrate on various ways in which CEERS and other early JWST survey programs have taught us and what we have learned from them both operationally and scientifically. This can help inform the optimization of scientific aims and design of Roman Space Telescope extragalactic surveys and the best ways of implementing and accomplishing them. In this poster, we will expand on some of these issues and offer additional context for designing and optimizing scientifically prioritized Roman Space Telescope surveys.

Filter Transformations for Roman/WFI
By Meredith Durbin

We present preliminary filter transformations between Roman/WFI and other near-infrared photometric systems, including JWST/NIRCam, HST WFC3/IR, and 2MASS. These transformations are derived from synthetic photometry of four empirical spectral libraries, which together span nearly the full HR diagram and sample stellar populations from the solar neighborhood out to the Magellanic Clouds, covering a broad range of ages, metallicities, and other relevant stellar properties. In addition to global color-dependent transformations, we examine band-to-band differences for cool, luminous giant stars in particular. Theoretical atmospheres are known to have difficulty reproducing observed SED features for such stars due to their complex and variable atmospheric physics; therefore, empirical spectra are required to constrain their behavior.

WINTER: a new near-IR survey facility
By Danielle Frostig

JWST is rapidly uncovering the broad scientific potential of infrared (IR) astronomy, which will be even further expanded by the Roman telescope. Despite the wealth of science cases, the dynamic infrared sky remains relatively unexplored and JWST alone cannot monitor large survey areas. The Wide-Field Infrared Transient Explorer (WINTER) is a new time-domain instrument on a 1-meter ground-based telescope dedicated to performing a seeing-limited survey of the near-infrared sky. WINTER covers >1 degree squared field of view with six large-format Indium Gallium Arsenide (InGaAs) sensors observing in Y, J, and a short-H (Hs) band filters (0.9-1.7 microns) and conducting a wide range of time-domain surveys to a depth of J=21 magnitudes. Among many dynamic IR science cases, including studying kilonovae, tidal disruption events, and transiting exoplanets around low mass stars, over a ten year lifespan WINTER will create a deep co-added image of the near-infrared sky. By increasing the temporal baseline of all-hemisphere data on the dynamic and static IR sky, WINTER will support future investigations of variable, periodic, and transient phenomena with the Roman and JWST observatories.

Probing Early Dust Formation in the Universe via Core-Collapsed Supernovae
By Melissa Shahbandeh

Details of dust formation in the early Universe are still unknown. While AGB stars are considered primary dust producers, the first dust in the local Universe may have formed before AGB stars had time to make it. Core-collapse supernovae (CCSNe) are expected to play an essential role in dust production since their current formation rate predominates all other types of supernovae. Only some CCSNe have occurred close enough to monitor dust formation from early to late times. In fact, simultaneous measurements of the fundamental and first overtone of CO, a dust precursor, over multiple epochs have only been achieved for SN 1987A. We present photometric and spectroscopic observations from several JWST Cycle 1 programs focused on studying dust formation in individual CCSNe from early to late times. We will discuss how Roman will provide the opportunity to conduct a sample study and compare the evolution of CO and dust in different subclasses of CCSNe.

Tse Sui Luen Infrared Telescope (TSL-IR1) a Dual Channel Optical/Infrared Robotic Telescope at Las Campanas Observatory
By Rachael Beaton

The Tse Sui Luen Infrared Telescope (TSL-IR1) is a CDK400 Planewave (17-inch aperture L-500 direct drive mount) robotic telescope custom-designed for simultaneous observation in two instrumentation channels: one in the optical and one in the near-infrared. The telescope uses a single arm fork mount on an equatorial wedge to allow uninterrupted image sequences while tracking through the meridian. The mirror and lenses are optimized for consistent performance across a wide wavelength range. A long-pass dichroic separates the optical and infrared into an off- and on- axis channel, respectively, with a long-pass wavelength of ~0.93 microns. The optical arm (ZWO ASI294MM) is sensitive from 0.38 to 0.92 microns with a 22 arcmin by 15 arcmin field-of-view at 0.33 arcsec resolution and the infrared arm (Princeton Instruments SciCam1280) is sensitive from 0.93 to 1.68 microns at 0.84 arcsec resolution with a 18 arcmin by 14 arcmin field-of-view. The two channels have a common field and, thus, the optical images can be used to perform astrometric alignment of the infrared field that will be sensitive to stars several magnitudes brighter than the 2MASS individual read saturation limit. The TSL-IR1 joins a set of fully robotic telescopes in a roll-off shed with their own cloud camera and weather station. The system is optimized to produce precise time-series observations of bright stars with limited human intervention and, using mostly off-the-shelf components, is of overall modest total cost. Expected to go into full operations in 2023, this poster will describe the design elements of the telescope, show some test data with the SciCam1280, and describe some science drivers.

Where are the accreting planets? Brightness predictions and prospects for detections by Roman
By Gabriel-Dominique Marleau

Recently, theoretical scaling relationships have been obtained between the luminosity in accretion-generated hydrogen transitions, including Paschen beta (1.282 um), and the total accretion luminosity. We have also developed an improved framework for calculating line luminosities from the same non-equilibrium radiation-hydrodynamical models but combined with a more realistic, multidimensional accretion geometry. We apply both the scalings and the updated predictions to statistical studies of planet formation to assess how Roman can best catch planets as they are forming.

Dancers in the Dark: Obscured Active Galactic Nuclei across Time
By Andreea Petric

With extraordinary survey speeds and optical to near-infrared wavelength coverage in imaging and spectroscopic modes, Roman is poised to make impressive strides in understanding of general astrophysics problems like how, why, and when galaxies grow super-massive black holes, form stars, and stop forming stars. Of particular interest is the population of galaxies with active black holes in their nuclei (active galactic nuclei or AGN) that are fully or partially hidden by dust and gas, as those AGN may evolve differently than non-obscured AGN. Several X-ray through Radio imaging missions are geared to detect on the order of 10^5 obscured AGN. To realize the full scientific potential of these surveys, we must examine those objects using spectroscopic techniques to study their reddening properties, star-formation histories, and excitation conditions. With massively multiplexed spectroscopic facilities, we can efficiently measure ionized and hot molecular gas emission lines, probing star formation, AGN feedback, and gas flows in and between galaxies and the circum-galactic medium. These critical studies will shed light on the role of black holes in galaxy evolution during the epoch of peak growth activity.

Follow-up ALMA studies of HLWAS sources
By Arielle Moullet

Roman's High Latitude Wide Area Survey will provide a key piece for our understanding of the distant universe, building a deep and wide census of high-z sources, including AGN hosting galaxies and quasars at very high z. As demonstrated by an accelerating rate of publications in the field (e.g., Endsley et al., 2022, Harikane et al., 2022), ALMA is a powerhouse for pointed characterization of high-z sources, and specifically for z>3, can provide information inaccessible solely from Roman's observations. 'In particular, access to the redshifted atomic and molecular hydride lines of C, O and possibly N is crucial to obtain accurate spectroscopic redshifts, and to evaluate the state of the cold gas component. Photometry in the submm regime is a key SED point for dusty, star-forming galaxies. The recent installation of the new ALMA Band 1 (35-50 GHz) also opens up the ability to search for 'redshifted low-J CO lines, which are a good diagnostic for estimating the mass of the molecular gas reservoir. At the time of Roman's mission, ALMA's Wideband Sensitivity Upgrade (WSU) will be underway, improving the line sensitivity by a factor ~1.5, and providing much more efficient spectral scanning for redshift surveys. Using recent results as examples, this poster reviews possible ALMA follow-up studies of sources identified through the HLWA survey, and quantify how the WSU will deepen the reach of ALMA studies in this field.

Characterizing Strongly-Lensed Lyman-Alpha Galaxies at z > 4
By Alexander Navarre

Lyman-alpha is one of the most important tools for studying star-forming regions in young galaxies. As Hydrogen's brightest recombination line, it is an excellent tracer for star formation during the Epoch of Reionization. However, through complex radiative transfer, Lyman-alpha is highly sensitive to non-isotropic distributions of neutral hydrogen. Previous studies of high-redshift Lyman-alpha Emitters (LAEs) have been limited in spatial resolution, barely able to resolve sub-galactic scales, especially in smaller high-redshift galaxies. Strong gravitational lensing studies of Lyman-alpha in the high redshift universe give us an opportunity to probe spatial scales that are otherwise inaccessible. We present six

strongly gravitationally lensed LAEs at $4.1 < z < 5.2$ with high signal-to-noise HST narrowband imaging isolating Lyman-alpha. Broadband imaging from \HST (rest-frame UV) and Spitzer (rest-frame optical) is used in SED fitting, providing physical context to the LAEs. Lens models are used to determine the intrinsic, source-plane properties of the LAEs, such as mass, brightness, and physical scale. We examine the LAE morphologies in Lyman-alpha and the stellar continuum, finding that they fall into two broad categories: extended galaxy-scale halos and clumpy emission dispersed among the UV continuum. The range of Lyman-alpha extent in this sample suggests that LAEs in the distant universe are not a homogeneous class of objects.