Star Formation and Nearby Galaxies with JWST
Abstracts for Science Talks and Posters

Keck Institute for Space Sciences, Pasadena, California

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Wednesday, January 18

Physical Processes in Regions of Massive Star Formation

Jean Turner
UCLA

With it's powerful infrared capabilities, JWST will give a new perspective on star formation. Its sub-arcsecond resolution allows individual star-forming regions to be resolved in local galaxies, extending our reach to star-forming environments very different from those found in the Galaxy. With JWST and ALMA, a comprehensive picture of stars, gas, and dust can be compiled for these regions. Star formation efficiency, feedback, gas-to-dust variations, chemistry, and gas dynamics can all be probed at the scale of star clusters. These will provide a rich set of diagnostics for star formation processes and massive stellar evolution. In this talk I will focus on massive star formation and super star clusters in local galaxies to explore some of the possibilities with these two new instruments.

Studying Star Formation at High Resolution in the Magellanic Clouds

Cliff Johnson
UCSD

The Magellanic Clouds (MCs) represent an incredible opportunity to observe star-forming regions and host molecular clouds on sub-pc scales. Deep HST imaging of the MCs reveals young low-mass pre-main sequence star populations that trace recent star formation. When combined with observations of the ISM from Herschel and ALMA, these data support investigations of star formation timescales and molecular cloud evolution. Observations with JWST will reveal still-embedded young stellar objects that cannot be detected by HST. Not only will JWST observations support protoplanetary disk characterization for thousands of individual young stars, but the detection of these embedded sources facilitate stellar population studies that trace the complete lifecycle of star formation. Motivated by recent HST and ALMA observations obtained as part of the SMIDGE survey in the Small Magellanic Cloud, I discuss how JWST will play a critical role in the study of star formation and cloud evolution.

Studying Young Massive Star Clusters in Nearby Galaxies with JWST

Linda Smith

ESA/STScI

Young massive star clusters (YMCs) have been extensively studied with HST in the Local Universe. They are found in large numbers in actively star-forming galaxies and their sizes, masses and luminosities indicate that they may represent the present-day analogs of globular clusters. JWST will open many new avenues of exploration. For example, the youngest individual YMCs in star-forming complexes will be accessible for the first time at HST-like resolution, and NIRSpec multi-object spectroscopy of YMCs will allow the accurate age-dating of large cluster populations. Studies of YMCs can also of course be extended to much greater distances and will offer new insights into cluster populations as a key constituent of major star-formation events. These topics and the importance of JWST to gain a much better understanding of YMCs will be discussed.

Star Formation in the Local Group with NIRSpec

Guido DeMarchi

European Space Agency

I will present a NIRSpec GTO programme showcasing the multi-object spectroscopy capabilities of NIRSpec for stellar studies. We will obtain medium- and high-resolution spectra of hundreds of known pre-main sequence (PMS) stars with different ages hosted in massive starburst clusters in the Galaxy and Magellanic Clouds. These PMS stars were identified from HST photometry as objects with strong Hα excess emission (EW $>$ 10Å). Each cluster contains about 500-1000 such PMS stars in a typical 3'$\times$3' field, thereby guaranteeing optimal filling of the NIRSpec MSA. The ultimate scientific goal is to understand the very nature of the mass accretion process, and how the corresponding infall of gas from the circumstellar disc onto the star depends on the mass, age, and metallicity of the PMS object. This study is unique, since spectroscopic studies of PMS objects so far are limited to the solar neighbourhood and no information exists for starburst clusters and for non-solar metallicity.

Resolved Stars in Nearby Galaxies: From ANGST and PHAT to JWST

Benjamin Williams

University of Washington

JWST will provide new capabilities for studies of resolved stellar populations in nearby galaxies. In particular, the wavelength coverage, depth, and resolution capabilities of JWST need to be carefully considered in order to maximize efficiency and science output from nearby galaxy observations. I will review accomplishments from our nearby galaxy HST programs so far, discuss relevant JWST capabilities, and highlight areas that will benefit from the power of JWST.

CMD modelling of dwarf galaxies between 3 and 12 Mpc: from HST to JWST

Michele Cignoni

University of Pisa

I will discuss the detailed recent star formation history (SFH) of several dwarf galaxies between 3 and 12 Mpc from the Legacy ExtraGalactic UV Survey (LEGUS). The SFHs are derived by comparing deep color-magnitude diagrams (CMDs) with state-of-the-art synthetic CMDs generated with the latest stellar evolution isochrones. Systematics are evaluated using two independent sets of models: the MESA-MIST and PADOVA-PARSEC. In the light of these results, I will show how JWST will allow us to reach epochs as early as 10 Gyr ago in these kind of galaxies. The synergy between HST and JWST will be of paramount importance to exploit all stellar phases from the massive main-sequence and intermediate mass helium-burning stars, the realm of HST, to the much redder red clump, red giant branch and AGB/TP-AGB stars, the realm of JWST.

Evolved Stars in Nearby Galaxies with JWST: The DUSTiNGS Pathfinding Surveys

Martha Boyer

STScI

Asymptotic Giant Branch and other cool evolved stars substantially affect the observed properties of galaxies, impacting derived parameters like the stellar mass and the star formation rate. These effects are particularly pronounced in the infrared owing to cool temperatures and dust emission. I will present recent observations of evolved stars in nearby galaxies as pathfinders for future work with JWST, especially the DUSTiNGS survey and related projects. I will also discuss JWST's potential to revolutionize our understanding of these complicated and poorly constrained phases of stellar evolution.

Probing the Dusty Stellar Populations of the Local Volume Galaxies With JWST/MIRI

Olivia Jones

StscI

JWST/MIRI will enable stellar population studies akin to work done with HST on the Local Group galaxies but over a new wavelength range. MIRI-ES imaging capability is particularly suited to survey stars with an IR excess and to detangle the extinction or thermal emission from various species of dust. These dusty stellar populations include young stellar objects, evolved stars and supernovae that are bright in the IR. Using the rich Spitzer-IRS spectroscopic dataset and spectral classifications of over a 1000 objects in the Magellanic Clouds, we calculate the expected fluxes and colors in the MIRI filters for these prominent IR sources. We uses these fluxes to illustrate what JWST will see in stellar population studies for other Local Group galaxies. JWST/MIRI observations of IR sources in Local Group Galaxies will constrain how much of the interstellar dust is supplied by dying stars and probe star formation processes. We connect these results to existing galaxies with HST data.

Resolved Stellar Populations with Keck and JWST

Evan Kirby
Caltech

Keck and HST have proven highly complementary for the study of resolved stellar populations in the nearby Universe. JWST will continue this tradition through its excellent spatial resolution, unique filter set, and multiplexed spectroscopy. I will argue that Keck spectroscopy combined with JWST imaging and spectroscopy will add tremendous value to both observatories. The two observatories combined will be able to better constrain the ages of ancient dwarf galaxies, cleanly separate multiple populations in globular clusters, measure the proper motions of stars in distant galaxies, observe the entire white dwarf cooling sequence in a dozen globular clusters, and more.

Thursday, January 19

The Spectral Energy Distributions of Nearby Galaxies

Michael Brown
Monash University

JWST galaxy spectral energy distributions (SEDs) will be critical for measuring photometric redshifts, k-corrections and star formation rates. SEDs and photometry for nearby galaxies are also tools for testing models of galaxies, including stellar populations, star formation histories and dust content. Unfortunately, near-infrared spectrophotometry is limited to the very cores of nearby galaxies, while Spitzer mid-infrared spectrophotometry does not probe the lowest luminosity and lowest metallicity dwarf galaxies. I will highlight the regions of parameter space (mass, metallicity, star formation rate) that are poorly sampled by existing SEDs, with some emphasis on the limitations of my own work. I will flag areas of parameter space where photometry and galaxy SED models disagree, highlighting the need for JWST near-infrared and mid-infrared spectrophotometry.

Integral-field spectroscopy of nearby galactic nuclei with JWST

Torsten Boeker
ESA/STScI

I will discuss the potential of JWST for spectroscopic studies of nearby galactic nuclei. Following its launch in 2018, JWST will be the only facility that is sensitive over the entire near- and mid-infrared spectral range (1 - 28 μm). This wavelength range is extremely rich in spectral diagnostics, both for stellar populations and all components of the interstellar medium (dust as well as neutral, atomic, and ionized gas). The IFUs on MIRI and NIRSpec, combined with the unrivaled spatial resolution and sensitivity of the JWST telescope, promise a wealth of new insights into the immediate vicinity of galactic nuclei. Using examples from a planned guaranteed-time program of a small number of nearby galactic nuclei, I will explain the optimal observing strategies, expected performance, and science potential of IFU observations with MIRI and NIRSpec.

Star Formation and Feedback in Nearby Galaxies with JWST

Karin Sandstrom
UCSD

Small scale physical processes occurring in the interstellar medium are critical to regulating how galaxies form stars. This includes the cloud formation, the birth of stars and star clusters, and radiative and mechanical feedback from those newly formed stars on the surrounding ISM. Many of the key diagnostics of these processes are found in the near- and mid-IR, and the resolution of previous telescopes in those wavelength ranges have limited the possible targets where star-forming regions can be resolved to essentially the Local Group of galaxies. JWST will let us study critical diagnostics of the ISM and star formation across a wide variety of nearby galaxies, letting us tie the small scale physics of star formation to galactic environment. I will discuss several key questions that JWST observations will illuminate, including: how the evolution of individual star forming regions proceeds and in what ways feedback regulates their life cycle, how metallicity effects photodissociation regions and molecular clouds, and what governs the evolution of interstellar dust, which plays critical roles in many interstellar processes.

New Views on Dust with JWST

Karl Gordon
STScI

JWST will provide a new view into the dust properties in nearby galaxies, specifically through observations of dust emission (e.g., the aromatic/PAH features) and dust extinction (e.g., dust columns and silicate absorption features). The large variation of the aromatic/PAH feature strengths seen from Spitzer observations in nearby galaxies can be probed at higher spectral and spatial resolution with JWST yielding important clues to the complex properties of the carbonaceous carriers of these features. JWST spectroscopic observations towards normal stars in nearby galaxies will provide quantitative measurements of the silicate features in a range of environments and constrain the detailed characteristics of the silicate dust grains. JWST imaging observations of many stars in nearby galaxies can be used to provide a map the dust mass not based on IR emission. One implementation of this dust mass mapping method is the Bayesian Extinction and Stellar Tool (BEAST). The BEAST provides information about each star and the dust along each star's sightline in a form that is useful for studying individual stars/sightlines *and* ensembles of stars/sightlines in a hierarchical Bayesian model. Preliminary work on a tool (MegaBEAST) utilizing the ensemble information to make dust maps will be presented. The comparison between the two dust mass mapping methods will constrain the dust gain emissivities, both refining our understanding of dust grains and dust maps.

Polycyclic Aromatic Hydrocarbon emission as tracers of ISM conditions

Sacha Hony

University of Heidelberg

I will present the results from our Spitzer/IRS mapping analysis of the LMC and SMC galaxies (PIs Kemper and Bolatto). We have targeted more than 30 star-forming regions with extensive, spatially resolved mid-IR spectral mapping to determine the response of the PAH emission to the radiation of the luminous young stars. We find 1) very strong variations in the local PAH to continuum ratios directly related to the radiation environment, 2) significant variations on the PAH ionisation state (traced by band ratios) that correlation with the dust continuum colour temperature and 3) a significant dependence of the median observed band ratios with the spatial resolution of the observation. These results can serve as an important basis for planning and interpreting the enormous wealth of mid-IR spectroscopy that JWST will perform.

Evolution of Molecular gas and PAHs in Interstellar REgions (EMPIRE): A study with Spitzer, Herschel, AKARI, and Planck, in the nearby Universe.

Ronin Wu

LERMA, Paris Observatory

In this talk, we present the early science results from our database of infrared nearby galaxies. This database contains ∼160 nearby galaxies of various types, including starburst dwarf, elliptical, and spiral galaxies observed by Akari, Spitzer, Herschel. The spectral data covers the wavelength ranges continuously from 2.5 to 40 micron (AKARI/IRC and Spitzer/IRS) and from 57 to 700 micron (Herschel/PACS and Herschel/SPIRE). The broad coverage in the wavelength allows us to probe the strengths of various aromatic and aliphatic bands of polycyclic aromatic carbons (PAHs) simultaneously. Moreover, it concurrently provides the information of the physical parameters in the host photodissociation regions (PDRs) and the HII regions. Our early science results demonstrate the spatially-resolved variation of the PAH band-ratios with respect to the radiation hardness from nearby galaxies, NGC1097 and NGC1569.

Friday, January 20

Implications of Stellar & Nebular Models for JWST Observations

Julianne Dalcanton

STScI

I will briefly review the contributions of stellar populations and nebular emission to the near- and mid-IR. I will then discuss some of the key uncertainties, calibration requirements, and on-going theoretical projects that could affect how we interpret observations with JWST.

The Las Campanas Stellar Library: an essential tool to interpret NIR spectra of galaxies

Igor Chilingarian

CfA

We present the most comprehensive up-to-date intermediate resolution (R=6500) stellar library, which covers the entire near-infrared wavelength range (0.8 to 2.5μm). It contains spectra of 1000+ stars across the HR diagram collected with the FIRE spectrograph at the 6.5m Magellan Baade telescope. In particular, the library includes about 250 AGB stars, 50 LMC/SMC stars, and also a sample of chemically peculiar stars. By the start of the JWST mission we plan to produce a new generation of stellar population models which will enable the extragalactic community to interpret nearby galaxy spectra in the NIR and analyze unresolved stellar populations in a manner similar to the one used in the optical domain. The spectral resolution will be sufficient to study internal kinematics and stellar content of dwarf galaxies and nuclear star clusters in nearby galaxies also taking advantage of the superior JWST resolution and an unobscured NIR view of galaxy centers and star-forming regions.

The Variety of Nonstellar Emission in Nearby Galaxies–the JWST View

Matt Malkan
UCLA

Thanks to decades of intense observational and theoretical work,we have a pretty good idea of the emission produced by populations of stars, and the HII regions they photo-ionize. We even believe we can measureand analyze these processes in the integrated light of entire galaxies. However, other important emission processes are not as well understood, such as winds and shocks, small dust grains, and accreting black holes in galactic centers. When we look at galaxies closely, we see that each one of them is a complex composite. Boiling this down to only 2 or 3 'integrated' numbers is a great loss of information. With the advent of JWST, we may no longer be satisfied with such an oversimplification. A quantitative understanding of all these simultaneously operating phenomena in galaxies requires, in the very least, broad multiwavelength observations at the finest spatial resolution possible. The feeding of the massive black hole, as well as its impact on the surrounding galaxy (the effects of jets, winds and radiation, often simply referred to as 'feedback'), are best observed in the inner hundred parsecs. This is exactly where JWST will excel. Examples of some key problems in AGN will be considered.

Low Luminosity AGNs in Nearby Galaxies: The Power of JWST

Shobita Satyapal
George Mason University

Low luminosity AGNs are an important component of the AGN population. They are often found in the lowest mass galaxies or galaxies that lack classical bulges, a demographic that places important constraints to models of supermassive black hole seed formation and merger-free models of AGN fueling. The detection of AGNs in this low luminosity regime is challenging both because star formation in the host galaxy can dominate the optical spectrum and gas and dust can obscure the central engine at both optical and X-ray wavelengths. JWST is ideally suited to uncovering this low luminosity AGN population in nearby galaxies. In this talk, we summarize our integrated modeling approach in which both the line and emergent continuum is predicted from gas exposed to the ionizing radiation from a young starburst and an AGN, focusing specifically on the spectral diagnostics available through JWST.

The Keck OSIRIS Nearby AGN (KONA) Survey: The Role of AGN-driven Outflows in the Evolution of Seyfert Galaxies

Francisco Muller-Sanchez

University of Colorado, Boulder

I present the first results from the KONA survey, which uses the integral field unit OSIRIS plus LGS-AO to probe down to scales of 5 parsecs in a sample of 40 Seyfert galaxies. In this talk, I will describe recent work showing how AGN interact with their host galaxies. We find that AGN-driven outflows of ionized gas are ubiquitous, and that biconical models of radial outflow provide a good fit to the spatially resolved kinematics. The mass outflow rates are 2-3 orders of magnitude greater than the SMBH accretion rates, but are comparable to the estimated inflow rates to the central 25 pc, suggesting that AGN feedback suppresses accretion onto the SMBH and that AGN feedback has a strong impact on the turbulent ISM near the SMBH, probably disrupting the conditions for star formation. The prospects for JWST observations of nearby AGN will be also discussed, including the ways in which the outflows interact with the ISM and the launching mechanisms of AGN-driven outflows.

Molecular Hydrogen with JWST-MIRI as a Diagnostic of Galactic Center Heating

Elisabeth Mills

San Jose State University

I will review the use of the mid-infrared pure-rotational lines of H2 as a measure of extreme gas temperatures in the center of the Milky Way Galaxy, showing that direct observations of H2 are capable of probing a significant fraction of the molecular gas in this environment. I will also present new results on the temperature of gas in the central 5 parsecs using archival ISO data, showing that H2 both probes the highest molecular gas temperatures in this region, and distinguishes between proposed scenarios for heating this gas. I will conclude by discussing prospects for using MIRI observations of H2 rotational lines to map the spatial distribution of warm gas in regions of our Galactic center, and compare it to the nuclei of nearby galaxies. Using the MIRI instrument on JWST, all of the pure rotational lines of H2 including the S(0) line at 28.2 microns will be accessible, providing important new diagnostics for distinguishing between gas heated by PDRs, shocks, or cosmic rays.

Probing Shocks and Turbulence in the diffuse Universe through Warm molecular Hydrogen with JWST

Philip Appleton
Caltech/IPAC

During the Spitzer mission, galaxies were found that showed powerful pure-rotational mid-IR lines, but weak emission from star formation. These disturbed galaxies, compact groups, radio galaxies and cluster galaxies, required either shocks and turbulence or cosmic ray heating to explain the intense power radiated in the emission lines. In some nearby cases, the H2 lines can be shown to provide a direct measure of the turbulent energy driven into the diffuse gas by galaxy collisions or by AGN radio-jet galaxy activity. JWST, with its exquisite sensitivity at near- and mid-IR wavelengths, will be greatly change our view of warm H2 in the Universe. JWST will probe turbulence and shocks in diffuse gas from dwarf galaxies, to molecular outflows and shocks within active galaxies, to massive accretion events in galaxies, clusters and protoclusters at higher z. These processes can suppress star formation (temporarily) in molecular reservoirs, and may affect how galaxies build up stars.

Observing Luminous Infrared Galaxies with JWST

Lee Armus
Caltech/IPAC

Poster Abstracts

Mid-IR Colors of Extreme Starbursts: Implications for JWST

Nicholas Abel
University of Cincinnati, Clermont College

Supermassive black holes (SMBHs) at the centers of galaxies, which manifest as active galactic nuclei (AGNs) when accreting, are now known to be a fundamental component of galaxies and play an important role in their evolution. Detecting complete samples of AGNs and understanding their connection to the properties of the host galaxies in which they reside has therefore been an extremely important goal of extragalactic astronomy.Over the past several decades, it has become clear that a large fraction of AGNs are missed in optical surveys due either to obscuration of the central engine, or contamination of the optical emission lines from star formation in the host galaxy.This is a significant deficiency, because these elusive AGNs are often found in key phases of galaxy evolution, such as late stage galaxy mergers, when the black hole is expected to grow most rapidly, or in low mass and bulgeless galaxies, a galaxy population that may place important constraints on models of SMBH seed formation and merger-free models to SMBH growth. Mid-infrared color selection has been shown to be a powerful tool in uncovering optically hidden AGNs in a large population of galaxies. This is because the hard radiation field associated with AGNs can heat the dust to temperatures as high as the grain sublimation temperature, producing a strong mid-infrared continuum and an infrared spectral energy distribution (SED) that is clearly distinguishable from typical star forming galaxies that is independent of obscuration of the central engine. While the use of mid-infrared color selection in identifying powerful AGNs in which the AGN dominates over the stellar emission in the host galaxy is now on firm empirical ground, it is well-known that this method fails in galaxies in which the luminosity of the stellar emission from the host galaxy is comparable to the luminosity of the AGN.

In this work, we conduct a theoretical investigation of the mid-infrared spectral energy distribution produced by an extreme starburst. We employ an integrated modeling approach in which both the line and emergent continuum is predicted from gas exposed to the ionizing radiation from a young starburst and an AGN. We find that extreme starbursts can mimic AGNs in their mid-infrared colors under extreme ISM conditions. Since the star formation properties and ISM conditions become more extreme with increasing redshift, we discuss the implications of our work for AGN studies with JWST at high redshift.

Excitation Mechanisms of Near-Infrared Emission Lines in Nearby LINER Galaxy NGC 404

Anna Boehle
UCLA

We present high spatial resolution, integral field spectroscopic (IFS) observations of the nearby LINER (low ionization nuclear emission line region) galaxy NGC 404. LINERs are found at the centers of $\sim$1/3 of galaxies within 40 Mpc, but it is unclear whether accretion onto a supermassive black hole or another mechanism such as shock excitation drives their emission. We use the OSIRIS near-infrared IFS at Keck Observatory behind adaptive optics to map the strength and kinematics of [FeII], H_2, Paβ, and Brγ lines in the central 30 pc of NGC 404. We find that the ionized and molecular gas show different morphologies and kinematics on parsec scales. There are also regions with line ratios of [FeII]/Paβ that are higher than previously seen in spatially integrated spectra, significantly restricting the possible excitation mechanisms in this source. We are applying these analysis techniques to 10 additional nearby LINERs to understand what drives the emission lines in these active galaxies.

The physical properties of Spitzer/IRS galaxies derived from their UV to 22 μm spectral energy distribution

Vassilis Charmandaris
The University of Crete

We provide the basic integrated physical properties of all the galaxies contained in the full CASSIS with available broad-band photometry from UV to 22 μm. We have collected photometric measurements in 14 wavelengths from available public surveys in order to study the SED of each galaxy in CASSIS, thus constructing a final sample of 1,146 galaxies in the redshift range $0<z<2.5$. The SEDs are modelled with the CIGALE code which relies on the energy balance between the absorbed stellar and the dust emission while taking into account the possible contribution due to the presence of an AGN. We split the galaxies in three groups, a low-redshift, a mid-redshift and a high-redshift and find that the vast majority of the Spitzer/IRS galaxies are star-forming and lie on or above the star-forming MS of the corresponding redshift. Moreover, the emission of Spitzer/IRS galaxies with $z<0.1$ is mostly dominated by star-formation, galaxies in the mid-redshift bin are a mixture of star forming and AGN galaxies, while half of the galaxies with $z<0.5$ show moderate or high AGN activity. Additionally, using rest-frame NUV-r colour, Sérsic indices, optical OIII and NII emission lines we explore the nature of these galaxies by investigating their structure as well as their star-formation and AGN activity. Using a colour magnitude diagram we confirm that 97%

of the galaxies with redshift smaller than 0.5 have experienced a recent star-formation episode. For a sub-sample of galaxies with available structural information and redshift smaller than 0.3 we find that early-type galaxies are placed below the MS, while late-type galaxies are found on the MS as expected. Finally, for all the galaxies with z<0.5 and available optical spectral line measurements we find that galaxies with high AGN luminosity, as calculated by CIGALE, are most likely to be classified as composite or AGNs by optical spectral lines.

Comparing SED Fitting Tools for the KINGFISH/SINGS Sample of Nearby Galaxies

Daniel A. Dale
University of Wyoming

We present a comparative analysis of three popular tools for fitting the spectral energy distributions of galaxies: CIGALE, MAGPHYS, and GRASIL. The three tools utilize different assumptions for inputs related to star formation history, extinction curve, and stellar and dust emission; we compare outputs such as global stellar mass, dust mass, extinction, and star formation rate. The analysis relies on the updated ultraviolet-to-submillimeter broadband photometric database for the combined KINGFISH/SINGS sample of 79 nearby galaxies.

A Herschel View on local Luminous Infrared Galaxies

Tanio Diaz-Santos
Universidad Diego Portales

Luminous Infrared Galaxies (LIRGs), with IR luminosities $> 10^{11}$ Lsun, represent a key stage in galaxy formation and evolution. They are the most important population of galaxies at redshifts z > 1, accounting for more than 50% of all star formation produced in the Universe at its activity peak. Studying their local counterparts is therefore fundamental for our understanding of the physical properties and phases of the inter-stellar medium (ISM) in active galaxies, near and far. I will present results regarding the gas and dust properties of the largest, most complete sample of LIRGs in the local Universe: The Great Observatories All-sky LIRG Survey (GOALS). The full coverage of Herschel spectroscopic observations allow us to study their ISM and investigate differences among sources as a function of AGN activity, merger stage, dust temperature, and compactness of the starburst parameters that are thought to control the life-cycle of galaxies, locally and at high-z.

High Resolution NIR Imaging and Spectroscopy of the Host galaxies of Nearby AGN Galaxies

Michael Koss

Eureka Scientific

We have found an excess of closely separated, late-stage merging galaxy nuclei using high-resolution IR adaptive optics imaging of hard X-ray selected obscured quasars. These systems had previously avoided detection in lower resolution ground-based imaging because of their very small separations and excess among obscured quasars. We have additionally completed one of the largest surveys of NIR spectroscopy (0.8-2.5 μm) of nearby AGN. We will discuss the implications of these surveys for studying AGN in nearby galaxies with JWST.

Distributed High Mass Star Populations in Nearby Galaxies with JWST

Anthony Marston

European Space Agency

Relative populations of O to Wolf-Rayet to RSGs place constraints on the evolutionary sequence for massive stars. Significant populations of massive and evolved stars have been uncovered in nearby galaxies with varying metallicity, but are very likely incomplete. JWST instruments provide the potential for probing the populations of massive stars and their evolved counterparts in nearby galaxies out to as far as 20Mpc. We present methods for studying the distribution and numbers of resolved very high mass star populations in nearby galaxies using a combination of JWST NIRCAM imaging and follow-up MOS spectra.

AKARI observations of mergers: PAH emission as a star-formation probe in tidal tails of galaxies

Takashi Onaka

University of Tokyo

The PAH band features are thought to be a good probe for the study of the star-formation rate and the physical conditions of galaxies, once the formation and destruction processes of PAHs are well understood. Here we report and detection of the PAH emission in the tidal tails of two mergers, NGC2782 and NGC7727, with the Infrared Camera (IRC) onboard AKARI (Onaka et al. 2007, PASJ, 59, S401). In NGC2782, the PAH emission shows extended structures similar to those seen in the HI map in the eastern tail. PAHs may have been formed from fragmentation of small carbonaceous grains during the merger event. The star-formation rate estimated from the PAH emission is in agreement with that from the [CII] emission. In NGC7727, the PAH emission is also seen in the northern tidal tail, which does not show detectable H alpha emission. The present results suggest that the PAH emission could be a sensitive tool for the star-formation in faint, extended regions of galaxies.

Tracing Star Formation with JWST in the Prominent H II Region N 113 in the Low-Metallicity LMC

Marta Sewilo

NASA Goddard Space Flight Center

N113 is a self-contained HII region small enough to be imaged in its entirety, but large enough to showcase many important phenomena such as multiple generations of stars, stellar feedback, and different environments. About 150 YSO candidates have been identified in N113 using the Spitzer/Herschel data. These studies suffered from a number of limitations that will be solved by JWST. The greatly improved resolution and sensitivity of JWST will allow us to resolve (proto)clusters, detect lower-mass YSOs missed by Spitzer, and study the YSO environments in detail. We will be able to construct well-sampled SEDs (0.6-27 microns; NIRCam/MIRI). NIRSpec will allow us to efficiently get spectra for YSOs to study the chemical evolution in their circumstellar environments. By combining the JWST with our ALMA observations and other available data, we will build a comprehensive picture of the ISM gas phases, dust, and YSO population within N113 to study star formation in a low-metallicity region.

Extending Dust Budget Studies beyond the Local Group with JWST

Sundar Srinivasan
Academia Sinica Institute of Astronomy & Astrophysics (ASIAA)

Dust forms in evolved low-mass star outflows and supernova ejecta, and is recycled into the interstellar medium to be assimilated into molecular clouds, seeding the birth of the next generation of stars and planetary systems. Studying this dust input is therefore crucial to constrain models of galactic chemical evolution and stellar population synthesis. SAGE (Surveying the Agents of Galaxy Evolution) team members have combined mid-IR observations with near-IR/optical archival data to identify the dustiest asymptotic giant branch stars in the Magellanic Clouds as well as other Local Group galaxies, resulting in dust budget estimates over many orders of magnitude in total stellar mass. While the resolution of Spitzer data prevents such studies of further galaxies, the NIRCAM and MIRI instruments on the JWST allow us to probe galaxies beyond the Local Group. In this poster, we investigate possible candidates for extending dust-budget studies beyond our immediate neighbourhood.

Nearby galaxies as laboratories for studying the endpoints of stellar evolution

Andreas Zezas
University of Crete / IESL

The JWST will open new avenues in measuring star-formation histories and constraining stellar evolution. However, the only way to understand its endpoints is through the synergy of IR/optical and X-ray observations. The association of the stellar remnants (witnessed by their X-ray emission) with stellar populations gives the formation rate of compact objects in different stellar environments. By combining these data with population synthesis models we can determine, for example, mass-loss in the end of stellar life, supernova kicks, and their dependence on stellar age and metallicity. These constraints have far-reaching implications: understanding the compact-object mass spectrum, gravitational-wave and γ-ray burst progenitors, and the sources responsible for reionization. We will present results from concerted optical/X-ray studies of nearby galaxies, and will discuss a JWST program that will make the next major leap in our understanding of stellar remnants and their evolution.
