Timetable

KL: Keynote Lecture, CT: Contributed Talk, IT: Invited Talk.

Wednesday, 4 February 2026

10:00–10:55	**Registration**		
10:55–11:00	**Welcome remarks**		
	Session 1		
11:00-11:30	KL	**Stuart Wittley** SKAO	SKAO Construction Update
11:30-12:00	KL	**Shari Breen** SKAO	Science with the SKA is nearly here!
12:00-12:18	CT	**Tobia Carozzi** Chalmers University	Handedness of SKA-low antenna and instrumental Faraday rotation
12:18-12:36	CT	**Victor Gustafsson** University of Hamburg	Towards direction dependent full polarization imaging
12:36-12:54	CT	**Harri Hellgren** Qamcom Research and Technology	SKA-MID receiver and synhronization development
12:55-14:00	**Lunch**		
	Session 2		
14:00-16:25	IT	**Laura Spitler** Max Planck Institute for Radio Astronomy	Transient Science with the SKAO
14:25-16:43	CT	**Jun Yang** Chalmers University	Detecting Structural Changes of the Jet Base at Event-Horizon Scales in M60*
14:43-15:01	CT	**Boy Lankhaar** University of Oslo	The nuclear dyanmics of nearby extreme galaxies
15:01-15:19	CT	**Santiago del Palacio** Chalmers University	Coronal emission from radio-quiet AGNs at high redshift
15:20–15:40	**Coffee/Break**		
	Session 3		
15:40–16:05	IT	**Carmen Toribio** Chalmers University	Enabling SKA science in the SKA Regional Centre Network – towards Science Verification
16:05–16:23	CT	**Julia Healy** University of Manchester	Revealing the HI Environment of a Compact Obscured Nucleus in the Zone of Avoidance
16:23–16:41	CT	**Sabine König** Chalmers University	SKA et al. as new tools to study the evolution of compact obscured nuclei throughout the history of the Universe
16:41-17:06	IT	**Jens Jasche** Stockholm University	Towards an AI Center for Science at Stockholm University

17:06-17:24	CT	**Robert Cumming** Chalmers University	Sharing a baseline: Globally coordinated schools visits to radio observatories
19:00-end	**Conference Dinner at Hasselbacken**		

Thursday, 5 February 2026

	Session 4		
9:05-9:30	IT	**Michele Bianco** ETH Zurich	Probing the Epoch of Reionisation: Progress and Perspectives from the SKA Data Challenge
9:30-9:48	CT	**Ivelin Georgiev** Stockholm University	Physical interpretation of the IGM parameters of the 21-cm power spectrum from cosmic reionization
9:48-10:06	CT	**Viktor Köhlin Lövfors** Chalmers University	The impact of Lyman Werner feedback on the epoch of reionization
10:06-10:24	CT	**Sambit Kumar Giri** Stockholm University	Mapping the Growth of Ionized Bubbles: SKA's Window into Cosmic Reionization
10:24-10:49	IT	**Philippe Zarka** Chalmers University	Low-frequency radio emissions from stellar and exoplanetary systems
10:50–11:10	**Coffee/Break**		
	Session 5		
11:10-11:35	IT	**Laurence Perreault-Levasseur** Université de Montréal and Mila	TBA
11:35–11:53	CT	**Tom Bakx** Chalmers University	Revealing Cosmic Structure Formation Through Machine Learning on Archival and SKA-Era Surveys
11:53–12:18	IT	**Greta Guidi** IPAG Grenoble	Protoplanetary disks and the onset of planet formation with the SKAO
12:18–12:36	CT	**Per Bjerkeli** Chalmers University	astromoprh – a machine learning approach to morphological analysis
12:36–12:54	CT	**Sara Lunqvist** Luleå University of Technology	A Multi-Wavelength Analysis of AGN and Star-Forming Cluster Galaxies
12:55–14:00	**Lunch**		
	Session 6		
14:00–14:25	IT	**Antonino Marasco** INAF - Padova Observatory	Observing HI in and around simulated galaxies
14:25-14:43	CT	**Vicente Salinas** Chalmers University	Searching for dual AGN in galaxies using multi-wavelength observations
14:43-15:20	Discussion panel: Machine Learning and AI in the SKA era		
15:20–15:40	**Coffee/Break**		

	Session 7		
15:40–15:58	CT	**Sam Ponnada** Caltech / Chalmers University	Hooks, Lines, and Sinkers: How AGN Feedback and Cosmic Ray-Transport Shape the Far-Infrared Radio Correlation of Galaxies
15:58–16:16	CT	**Alice Knutas** Chalmers University	A new method for observationally constraining cosmic ray diffusion in nearby galaxies
16:16–16:34	CT	**Nushkia Chamba** Chalmers University	Where the Stars Stop: The Edge of Local Group Galaxy M33
16:35–16:50	**Closing remarks**		

List of Abstracts – Talks

Wednesday, 4 February 2026

SKAO Construction Update

Stuart Wittley KL

SKA Observatory

The Square Kilometre Array Observatory (SKAO) is a global collaboration of Member States whose mission is to build and operate cutting-edge radio telescopes to transform our understanding of the Universe, and deliver benefits to society through global collaboration and innovation. Headquartered in the UK, its two telescope arrays are being constructed in Australia and South Africa and will be the two most advanced radio telescope networks on Earth.

The SKAO is advancing through a key phase of construction and system integration as work progresses on SKA-Low in Australia and SKA-Mid in South Africa. This presentation provides an update on the Observatory's technical progress, highlighting recent integration milestones and early performance indicators from both telescopes. We outline the evolving approaches to verification, commissioning, and operations planning that are shaping the path toward Early Science. Key challenges associated with scaling to full observatory capability are discussed and the presentation concludes with an overview of the forthcoming steps that will lead the SKAO from construction into routine scientific observation later in the decade.

The SKAO recognises and acknowledges the Indigenous peoples and cultures that have traditionally lived on the lands on which the SKAO facilities are located.

Science with the SKA is nearly here!

Shari Breen KL

SKA Observatory

The major SKAO scientific milestones of Science Verification and first cycles are now on the horizon, not only building excitement but also the desire for details of what these milestones might look like from a user perspective. In this talk, the expected timelines to the various scientific milestones and the build up to the full complement of capabilities and steady state operations, will be presented. Details of the availability of arrays, telescope modes, data products and project types through these milestones will also be discussed, along with the pathways and tools that will enable the community to engage with SKA data during these pioneering initial phases.

Handedness of SKA-low antenna and instrumental Faraday rotation

Tobia Carozzi**, Paola Di Ninni (INAF) **CT**

*Onsala Space Observatory, Chalmers University, Sweden

SKA-low will use SKALA4.1 antennas. These are dual-polarized, log-periodic antennas that cover 50-350 MHz. SKA-low has several key science projects, among them the magnetism KSP that will measure Faraday rotation to infer magnetic fields. However computational electromagnetic (CEM) simulations show that the SKALA4.1 exhibits Faraday rotation even when receiving purely unpolarized emission. In other words SKALA4.1 antennas exhibit *instrumental Faraday polarization*. This is due to the mechanical structure of SKALA4.1 that consists of alternating tiers of 4 dipole arms in a pinwheel-like configuration, with each pinwheel having a specific handedness with respect to the bore-sight direction. Simulations with a mirror image version of the SKALA4.1 shows the exact opposite handedness. I discuss this phenomenon and its consequence for SKA Data Challenge 4 and suggest a fix using not just SKALA4.1 but also its mirror imaged antenna.

Towards direction dependent full polarization imaging

Victor Gustafsson**, Adelie Gorce, Garrelt Mellema **CT**

*University of Hamburg, Germany

Current and upcoming radio interferometers are increasingly limited by direction dependent effects, which distort wide-field images and can bias derived science products. These effects are now routinely mitigated through direction dependent calibration, often referred to as third generation calibration. However, full polarization imaging adds extra complexity, and end-to-end strategies that treat direction dependent effects consistently in Stokes I, Q, U, and V are still relatively scarce.

In this talk I present a full polarization imaging workflow built around DDFacet, which models the sky in facets and applies direction dependent corrections locally. I will walk through my current project, starting from direction independent calibrated data obtained in multiple pointings and epochs. By combining all datasets in the visibility domain we form a deep mosaic model without imposing a hard sensitivity cut. Using this model, we perform direction dependent calibration and assess how the improved solutions propagate into polarized imaging.

I will then introduce Faraday Synthesis, a framework that unifies aperture synthesis and rotation measure synthesis during deconvolution. Using both simulations and real data, I will show how Faraday Synthesis improves polarized imaging fidelity, reduces artefacts, and provides a cleaner basis for downstream polarization analysis. I will conclude with first results from the Abell 3391/3395 system and discuss the implications for wide-field polarization studies with MeerKAT and the SKA.

SKA-MID receiver and synhronization development

Harri Hellgren **CT**

Qamcom Research and Technology, Sweden

I would like to present the effort Qamcom Technology and Research has been done for the SKA-MID SPFRXS123 receiver development and production. It inlcudes work from design to first measures from the sky. I will also present the project to develop an alternative synhronization and timing system for the Mid receivers.

Transient Science with the SKAO

Laura Spitler **IT**

Max Planck Institute for Radio Astronomy, Germany

Transient radio emission originates from many different astrophysical scenarios ranging from the mergers of compact objects to the small-scale plasma physics in neutron star magnetospheres. For all source classes, the dimension of time provides an additional avenue to understand the underlying physics. The Square Kilometer Array Observatory will provide powerful capabilities for the study of radio transients, and in this talk I will describe the role of both the SKA-mid and SKA-low, highlighting a few of their strengths. I will discuss in more detail how the SKAO will advance our understanding of the origin of fast radio bursts, as well as using them as cosmological tools.

Detecting Structural *Changes of the Jet Base at Event-Horizon Scales in M60*

Jun Yang*[*], Xiaopeng Cheng (KASI, Republic of Korea) **CT**

[*]Onsala Space Observatory, Chalmers University, Sweden

Supermassive black holes (SMBHs) in active galactic nuclei (AGN) often launch powerful relativistic jets. As the launching sites, the jet bases, i.e. radio cores, exhibit strong variability and provide unique insights into jet formation and SMBH physics. Leveraging the high sensitivity of SKA-Mid, high-resolution VLBI observations enable us to probe these restless jet bases with unprecedented astrometric precision. Among known AGN, M60 hosts a nearly dormant SMBH, analogous to Sgr A* but featuring a compact core (M60*) plus a faint jet. Using SKA-VLBI at Ku band, we anticipate achieving a differential astrometric accuracy of a few micro-arcseconds—comparable to one Schwarzschild radius ($\sim$5 μas) for M60*. This capability opens the window for detecting structural variations in the jet base and predicting newly born jet components during various flares. In this presentation, we report our preliminary assessment of the scientific potential of M60* observations and provide an update on the current status of SKA-VLBI development at 15 GHz.

The nuclear dyanmics of nearby extreme galaxies

Boy Lankhaar **CT**

University of Oslo, Norway

In this talk, I will present a combined radio (e-MERLIN) and sub-millimetre (ALMA) interferometric study of the nuclear dynamics of the nearby luminous infrared galaxy Zw049.057. I will show how the combination of (spectral line) tracers at different wavelengths reveals an intricate dynamical system in the nuclear region, consisting of multiple molecular outflows emerging from a compact, disk-like structure. At radio wavelengths, OH and formaldehyde megamasers are used as key spectral-line tracers of the dense and outflowing gas, and I will highlight the scientific gains that the dramatic improvement in sensitivity (and polarization capabilities) of the SKA will bring for these tracers. Finally, I will talk about the synergy between prospective SKA studies of these deeply obscured nuclei and complementary observations with ALMA and the AtLAST telescope; working towards a complete, multi-scale, multi-phase view of nuclear feedback in extreme galaxies.

Coronal emission from radio-quiet AGNs at high redshift

Santiago Del Palacio **CT**

Chalmers University of Technology, Sweden

The investigation of the origin of the radio/mm emission from local radio-quiet AGNs has been revolutionized in recent years using ALMA observations, showing that the mm flux is a robust proxy for the AGN luminosity. Moreover, some promising sources at higher redshifts have been found in lensed quasars, proving that these studies are not limited to local galaxies. Here we show how we can extend this research beyond redshift 2 using SKA-Mid. This can potentially shed light on the intrinsic AGN luminosities of $z = 2$–4 sources, independently of dust obscuration.

Enabling SKA science in the SKA Regional Centre Network – towards Science Verification

Maria Carmen Toribio Perez **IT**

Onsala Space Observatory, Chalmers University, Sweden

The SKA Regional Centre Network (SRCNet) will host the SKA Science Archive, and it will provide the user community with the resources to carry out their scientific analysis of SKA data. The upcoming Science Verification campaign for SKA-Low AA2 starting in 2027 will be the first opportunity for the user community to access SRCNet. In this talk, I will give an overview of the SRCNet and an update on its status and timeline. I will highlight the work done within the Science Delivery value stream of the SRCNet in preparation for Science Verification in 2027 and beyond.

SKA et al. as new tools to study the evolution of compact obscured nuclei throughout the history of the Universe

Sabine König **CT**

Onsala Space Observatory, Chalmers University, Sweden

Neutral atomic hydrogen (HI) provides the gas reservoir that fuels star formation. Environmental mechanisms in galaxy clusters alter the fate of this gas, impacting the evolution of galaxies. These range from gravitational to hydrodynamical effects, which might in turn ignite or boost internal processes such as AGN and gravitational instabilities. MeerKAT HI and radio continuum data of the nearby Antlia cluster (d = 38 Mpc) offers the opportunity to explore in detail the distribution of the neutral atomic gas in and around galaxies. Furthermore, the unrelaxed nature of Antlia, and its connection to the Hydra cluster via a filamentary structure to the north presents unique circumstances to study galaxy evolution in the early stages of cluster formation. One remarkable example is the Seyfert II galaxy NGC3281, located at the north east part of Antlia, notable by its active nuclei and strong HI absorption. In this preliminary study, we look in detail at the HI emission and absorption of NGC3281 and its surroundings, in order to uncover its possible formation history, and provide insight about how the AGN present at the center of the galaxy may have been triggered and is interacting with its surrounding environment. Future studies will involve a detailed analysis on all the HI sources in Antlia as a whole to better characterize the different evolutionary mechanisms in the cluster's galaxies.

Revealing the HI Environment of a Compact Obscured Nucleus in the Zone of Avoidance

Julia Healy **CT**

University of Manchester, UK

Neutral atomic hydrogen (HI) often extends well beyond the stellar disks of galaxies, providing both the raw fuel for star formation and a sensitive tracer of environmental interactions. To address outstanding questions regarding the evolution of compact obscured nuclei (CONs), a class of active galactic nuclei, it is crucial to understand the role HI plays in fuelling both central AGN activity and associated starbursts, and how this compares to more "normal" galaxies.

In the first part of this talk, I will present recent MeerKAT HI observations of the nearby CON ESO 173-G015. Located at the edge of the Zone of Avoidance, these data allow us to identify and characterise the local environment of the galaxy in unprecedented detail. The HI morphology and kinematics reveal clear signatures of past and ongoing environmental interactions, offering new insight into the evolutionary history of this system.

In the second part, I will discuss how the UK SKA Regional Centre (UKSRC) is engaging the UK radio astronomy community in the development of science support infrastructure, and how this collaborative approach is helping to prepare the community for the SKA era.

Towards an AI Center for Science at Stockholm University

Jens Jasche IT

Stockholm University, Sweden

This presentation outlines the vision and design of a proposed AI Center for Science at Stockholm University, aimed at building a coherent interdisciplinary community around AI-driven scientific research.

AI-related efforts at the university are currently distributed across departments and disciplines. The proposed center addresses this by organizing collaboration around core scientific processes, hypothesis generation, experimental design, modeling and simulation, data analysis, and knowledge synthesis, rather than around specific domains or rapidly evolving technologies. This process-oriented structure provides stable common ground for interdisciplinary exchange.

The center is envisioned primarily as a community-building platform that connects researchers, shares methodological expertise, and promotes best practices through seminars, workshops, and collaborative activities. Researchers across diverse fields often face similar challenges in model validation, interpretability, and reproducible workflows; the center creates space for such cross-disciplinary learning.

A strong commitment to methodological rigor, reproducibility, and responsible AI underpins all activities, ensuring that advances remain robust as technologies evolve. By connecting currently isolated efforts into a shared research community, the proposed AI Center for Science aims to accelerate discovery, strengthen AI methodology at Stockholm University, and position the university as a leading environment for responsible, AI-enabled science.

Sharing a baseline: Globally coordinated schools visits to radio observatories

Robert Cumming, Daniel Rosqvist CT

Onsala Space Observatory, Chalmers University, Sweden

In all the SKAO's member countries, school classes visit radio astronomical facilities and discover the excitement of international science. During 2024 and 2025, the pilot project Sharing a baseline tested ways of coordinating visits to observatories in Finland, Italy, the Netherlands, Spain, South Africa and Sweden. Based both on these experiences, and including research and best practices in virtual exchange, we are preparing recommendations which could be used broadly in coordinating class visits to observatories in SKAO member countries and beyond.

Thursday, 5 February 2026

Probing the Epoch of Reionisation: Progress and Perspectives from the SKA Data Challenge

Michele Bianco **IT**

ETH Zurich, Switzerland

Radio astronomy is entering a transformative era. The Square Kilometre Array (SKA) is set to deliver unprecedented volumes of data on the Epoch of Reionisation (EoR). Key challenges lie in extracting the faint 21-cm signal of neutral hydrogen from observations dominated by foregrounds and instrumental effects that are orders of magnitude stronger. Additionally, developing new techniques and tools is necessary to analyse the detected signal without the risk of discarding valuable astrophysical and cosmological information.

With these objectives in mind, the Square Kilometre Array Observatory (SKAO) is organising a series of data challenges. The recent SKA Data Challenge 3 (SDC3) was divided into two parts. Part (A) aimed to test the scientific community's readiness to extrapolate the 21-cm from foreground-contaminated mock observations of the SKA-Low, while Part (B) investigates the efficiency with which the reionisation history can be inferred from summary statistics such as the 21-cm 2D power spectra.

In this talk, I will present my results from the SDC3, parts A and B, which combine simulation-based training, normalising flows, U-Net architectures, and uncertainty-aware architectures to recover 21-cm tomographic maps from the SDC3 realistic interferometric data. I will also illustrate how radio astronomers are integrating Artificial Intelligence (AI) techniques to face the challenges with 21-cm observations with SKA, and how the SDC3 started to address them.

Physical interpretation of the IGM parameters of the 21-cm power spectrum from cosmic reionization

Ivelin Georgiev **CT**

Stockholm University

During the Epoch of Reionization (EoR), the ultraviolet radiation from the first stars and galaxies ionized the neutral hydrogen in the intergalactic medium (IGM), which can emit radiation through the 21-cm hyperfine transition. Due to this, the 21-cm signal from the EoR is a direct probe of the IGM and the first ionizing sources, and its measurement is a key science priority of radio interferometers, such as the LOFAR, MWA, HERA, and the prospective SKA.

These observatories are actively placing valuable upper limits on the 21-cm power spectrum, giving us a first glimpse into how reionization has transpired. However, as the detection of the 21-cm signal approaches, thoroughly understanding its features becomes increasingly important.

In this talk, I will present the interpretation of the IGM-based framework pioneered by the LOFAR collaboration and how it can be applied to interpret its latest upper limits. I will discuss our latest advancements in the physical interpretation of the IGM framework and how we can adapt our model across the EoR redshift range. Our results showcase key relations between the 21 cm power spectrum and parameters such as the halo clustering bias, the effective bubble sizes of ionized regions, and the global neutral fraction.

The impact of Lyman Werner feedback on the epoch of reionization

Viktor Köhlin Lövfors **CT**

Stockholm University, Sweden

The receiver pedestal unit (RXPU) for the Square Kilometre Array (SKA) has the function of packetizing the sampled date from the receivers. It contains an FPGA with high frequency clocks and large power consumption. The mechanical compartmentalizing of the RXPU should address interfaces, practical handling, transportation, cooling and electromagnetic compatibility (EMC).

Due to the importance of molecular hydrogen for the cooling of primordial gas, the photodissociation of H_2 by Lyman Werner (LW) radiation is central to our understanding of early star and galaxy formation. The quenching effect of LW radiation from early star forming halos is expected to be an important source of feedback on the epoch of reionization. It therefore affects the temperature and ionization state evolution of the intergalactic medium and impacts observational signatures, such as the 21cm signal. I will describe the physics behind the impact of the LW background and show some preliminary results from a new implementation of the effect in a large scale reionization simulation.

Mapping the Growth of Ionized Bubbles: SKA's Window into Cosmic Reionization

Sambit Kumar Giri **CT**

Stockholm University, Sweden

The growth and coalescence of ionized bubbles around early galaxies represents one of the most fundamental processes in cosmic reionization, yet remains observationally elusive with current facilities. As the first sources of radiation ionized their surroundings, these expanding bubbles evolved from small, isolated regions into the large-scale structures that eventually permeated the entire intergalactic medium. The Square Kilometre Array Observatory will revolutionize our ability to study this process by enabling direct imaging of individual ionized regions across cosmic time. Unlike current experiments limited to statistical detections through the power spectrum, SKA's extraordinary sensitivity and resolution will allow us to trace bubble size distributions, growth rates, and morphologies in unprecedented detail. I will present how visibility phase information and advanced statistical techniques can extract non-Gaussian signatures that reveal the complex, inhomogeneous nature of reionization. By leveraging simulation-based inference methods combined with SKA's multi-scale observations, we can constrain the nature of ionizing sources, distinguish between competing reionization scenarios, and directly test theoretical models of bubble dynamics. This approach showcases how SKA will transform bubble growth studies from statistical inference into direct observation—fundamentally advancing our understanding of this transformative cosmic epoch.

Low-frequency radio emissions from stellar and exoplanetary systems

Philippe Zarka, et al* **IT**

Observatoire de Paris - PSL - CNRS, France

After a long and difficult period of emergence, the detection of low-frequency radio bursts from star-planet interactions and exoplanetary magnetospheres is now reaching maturity. Dozens of detections of circularly polarized radio bursts have been obtained with the LOFAR and NenuFAR radiotelescopes, thanks to the development at Observatoire de Paris of a new powerful method combining the advantages of imaging and time-frequency analysis, well adapted to the detection of slow polarized transients. Applied to SKA, this method will hopefully bring many hundred more detections. The theoretical framework to interpret these bursts is well-developed, based on the physics of Solar system planetary magnetospheres' dynamics and of radio emission generation, embedded in simulation codes such as Palantir (to predict emitted frequencies and flux densities) and ExPRES (to interpret observed dynamic spectra). I will summarize the state-of-art of this research field at the crossing of star-planet plasma interactions, comparative exo-magnetospheric physics, and exo-space weather.

(*) P. Zarka, C. Tasse, X. Zhang, C. Louis, E. Mauduit, J.-M. Griessmeier, J. Turner, L. Lamy, J. Girard, A. Loh, Q. Duchêne, and B. Poux-Bouret

Machine Learning in the SKA era (place holder)

Laurence Perreault-Levasseur **IT**

Université de Montréal and Mila, Canada

TBD.

Revealing Cosmic Structure Formation Through Machine Learning on Archival and SKA-Era Surveys

Tom Bakx **CT**

Chalmers University of Technology, Sweden

The Square Kilometre Array will revolutionize our understanding of cosmic structure formation through unprecedented radio continuum surveys reaching z>6. However, interpreting multi-wavelength overdensities remains challenging due to heterogeneous data quality, selection effects, and observational biases. We present a machine learning framework designed to validate and characterize protoclusters using combined radio and submillimeter observations on the most star-forming and massive galaxies in overdense systems, paving the path for similar science on SKA deep fields. We have compiled >200 high-redshift (z=2-7) protocluster candidates combining radio (ATCA, VLA, MeerKAT), submillimeter (SCUBA-2, LABOCA, ALMA), and optical (JWST, Euclid) data spanning 5 square degrees. With 14 spectroscopically confirmed systems and 44 additional fields from an ongoing ALMA Program, we develop supervised learning models that handle heterogeneous survey parameters on thousands of tentative protocluser members. Using physically motivated features (surface density metrics, spatial clustering, multi-wavelength flux distributions, and redshift-dependent scaling), we are able to combine over 2000 hours of single-dish submillimeter data to quantify systematic biases and test the cosmic build-up of the largest coherent systems in the Universe. This project serves as a key example of how observations with next-generation facilities can use ML-driven bias mitigation to enable robust tests of cosmological structure formation models by direct comparison to cosmological models.

Protoplanetary disks and the onset of planet formation with the SKAO

Greta Guidi **IT**

IPAG Grenoble, France

Protoplanetary disks are formed as an outcome of angular momentum conservation during the collapse of molecular cloud cores, and regulate the accretion of material onto the forming star. Understanding the mechanisms regulating disk dispersal, mass loss, and angular momentum transport, is crucial for connecting the physical properties of disks to the formation and architecture of planetary systems. While significant advances have been made in characterizing the dust and molecular gas components of disks, thanks to observatories such as ALMA, VLA and VLT, some crucial information is still missing. In particular, the emission from large solids and the ionized gas component are much less explored, due to the limitations of existing facilities. In this talk I will discuss how the future SKAO, with its unprecedented sensitivity at centimeter wavelengths, will advance our understanding of dust and gas evolution in disks by probing pebble emission and ionized gas tracers. I will present new estimates and simulations of dust thermal emission, as well as free-free and recombination lines from ionized gas in disks, with particular emphasis on SKA-Mid Band 5, developed for the forthcoming SKA science book within the Cradle of Life working group. Finally, I will highlight the synergies between the SKAO and other existing facilities in the context of protoplanetary disk evolution studies.

astromoprh – a machine learning approach to morphological analysis

Per Bjerkeli, Jouni Kainulainen, Maria Carmen Toribio Perez **CT**

Chalmers University of Technology, Sweden

Exploring the large and complex data generated by modern telescopes requires automated methods that can extract and organize physically meaningful information, ideally with the least manual interaction.

We have developed a machine-learning package, ASTROMORPH, that can extract morphological information from various astronomical data sets. The package is based on a self-supervised learning method and does not rely on morphological classes or parameters predefined by the user, nor on the availability of comprehensive training data.

We apply astromorph in two contrasting science cases representing different astronomical domains: images of protoplanetary disks observed with the Atacama Large Millimeter/submillimeter Array (ALMA), and infrared dark clouds observed with Spitzer and Herschel. In both cases, we demonstrate how astromorph produces scientifically meaningful embeddings that capture morphological differences and similarities across large samples. We conclude that our user-friendly pipeline is broadly applicable and a useful tool to enable discovery in large observational datasets, ready to use on SKA data.

A Multi-Wavelength Analysis of AGN and Star-Forming Cluster Galaxies

Sara Lundqvist**, *Kelley Hess (Onsala Space Observatory/Chalmers University) **CT**

*Luleå University of Technology

We present an analysis of the Hydra cluster, focusing on the classification of active galactic nuclei and star-forming galaxies. Our data consisted of mosaics in radio (from MeerKAT) and r-band (from DECam), along with a redshift and infrared catalog (from 6dFGS, NED, and WISE). We performed 2D source finding on the radio mosaics, and crossmatched detected radio sources with corresponding infrared and redshift measurements, resulting in 112 crossmatched sources. From the ratio of the 1.4 GHz radio continuum and 22 micron infrared fluxes (q22), we conclude that Hydra hosts a central active galactic nucleus, located in NGC 3309. Star-forming sources are more scarce around the Hydra cluster core, while undefined sources peak here. Interestingly, we find a strong correlation between composite galaxies and ram pressure stripping: $\sim$83% of all identified ram pressure stripping sources with a q22 classification (SF/composite/AGN) are composites. A connection between ram pressure stripping and composite sources has been suggested in previous studies, based on robust observational evidence, but never fully understood. Here, we suggest that ram pressure stripping within Hydra-like clusters enhances nuclear activity and star formation, based on the fact that ram pressure sources generally show an excess in both mid-infrared and radio wavelengths, mostly independent of mass and Hubble morphologies. Alternatively, higher nuclear activity (such as that observed in composite sources compared to star-forming sources) could drive outflows or disturb the gas distribution, making a source more susceptible to ram pressure stripping, which in turn enhances star formation.

Observing HI in and around simulated galaxies

Antonino Marasco **IT**

INAF - Padova Observatory, Italy

Cosmological hydrodynamical simulations are powerful tools for studying the gas cycle within and around galaxies. Over the past decade, significant progress has been made in translating simulation outputs into observable quantities, enabling direct comparisons with observational data. In this talk, I will review recent advances in this field, focusing on neutral hydrogen (HI) as a key tracer of gas accretion and outflow processes. I will discuss the latest comparisons between state-of-the-art simulations and HI observations in galaxies from SKA precursors, and outline future prospects for connecting simulations and observations in the era of next-generation radio surveys.

Exploring the neutral gas of galaxies in the Antlia cluster with MeerKAT

Vicente Horacio Salinas Froemel*[*], Clara Cabanillas de la Casa (Instituto de Astrofísica de Andalucía), Kelley Hess[*], Sarrvesh Sridhar (SKAO)*** **CT**

[*]Chalmers University of Technology, Sweden

Neutral atomic hydrogen (HI) provides the gas reservoir that fuels star formation. Environmental mechanisms in galaxy clusters alter the fate of this gas, influencing the evolution of galaxies. These mechanisms range from gravitational interactions to hydrodynamical effects, which can ignite or enhance internal processes such as AGN activity and gravitational instabilities. The current picture of cluster galaxy evolution is thus shaped by a complex interplay of these factors. Using MeerKAT HI and radio continuum observations, we present the most detailed description to date of the neutral gas distribution in the nearby Antlia cluster (d = 38 Mpc). The unrelaxed nature of Antlia and its connection to the Hydra cluster via a filamentary structure provide a unique environment for studying galaxy evolution in the early stages of cluster formation. A particularly striking example is the Seyfert II galaxy NGC3281, located in the northeast region of Antlia, which exhibits strong HI absorption and an actively accreting nucleus. Notably, NGC3281 is one of the most variable Compton-thick X-ray sources, suggesting intense and ongoing AGN fueling. Our analysis of HI emission and absorption in NGC3281 and its surroundings provides key insights into how the AGN has been triggered by environmental interactions. We report the discovery of an isolated, large, starless HI cloud extending up to 180 kpc from NGC3281, while carrying the kinematic signature of the galaxy's rotation. This structure likely results from both tidal interactions and ram pressure stripping in the cluster environment, making NGC3281 one of the clearest examples of a galaxy undergoing multiple simultaneous evolutionary processes. Future studies will analyze all HI sources in Antlia in greater detail, refining our understanding of the environmental processes shaping galaxy evolution within clusters.

Hooks, Lines, and Sinkers: How AGN Feedback and Cosmic Ray-Transport Shape the Far-Infrared Radio Correlation of Galaxies

Sam Ponnada **CT**

Chalmers University of Technology, Sweden

The far-infrared–radio correlation (FRC) is one of the most promising empirical constraints on the role of cosmic rays (CRs) and magnetic fields in galaxy formation and evolution. While many theories have been proposed in order to explain the emergence and maintenance of the FRC across a gamut of galaxy properties and redshift, the nonlinear physics at play remain unexplored in full complexity and within a cosmological context. We present the first reproduction of the z $\sim$ 0 FRC using detailed synthetic observations of state-of-the-art cosmological zoom-in simulations from the Feedback in Realistic Environments (FIRE-3) suite with explicitly evolved CR proton and electron (CRe) spectra, for three models for CR transport and multichannel active galactic nucleus (AGN) feedback. In doing so, we generally verify the predictions of "calorimeter" theories at high FIR luminosities and at low FIR luminosities, the so-called "conspiracy" of increasing UV radiation escape in tandem with increasing CRe escape, and find that the global FRC is insensitive to orders-of- magnitude locally variable CR transport coefficients. Importantly, the indirect effect of AGN feedback on emergent observables highlights novel interpretations of outliers in the FRC. In particular, we find that in many cases "radio- excess" objects can be better understood as "IR-dim" objects with longer-lived radio contributions at low z from Type Ia supernovae and intermittent black hole accretion in quenching galaxies, though this is sensitive to the interplay of CR transport and AGN feedback physics. This creates characteristic evolutionary tracks leading to the z = 0 FRC, which shape the subsequent late-time behavior of each model. I will discuss how the SKA will uniquely enable us to understand how AGN feedback and CR transport operate in galaxies across cosmic epochs by expanding radio continuum datasets in both breadth and depth.

A new method for observationally constraining cosmic ray diffusion in nearby galaxies

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Cosmic rays provide non-thermal pressure in the interstellar medium (ISM), affecting star formation and galactic winds, which in turn alter phase structure and pressure balance in the circumgalactic medium (CGM). Recent numerical studies have shown that these effects depend strongly on the diffusion of cosmic rays in the ISM, typically quantified by an effective diffusion coefficient. Methods for constraining the diffusion coefficient observationally often rely on one-dimensional correlations between the resolved radio and IR emission of galaxies. The radio emission traces cosmic ray electrons diffusing in the ISM, while the thermal IR emission is expected to trace the injection sites of cosmic rays.

We develop a new method to constrain the diffusion coefficient of cosmic rays based on the morphological similarity of radio and IR images. To test our method, we use numerical simulations where the diffusion coefficient is known. Specifically, we use cosmological zoom-in simulations of Milky-Way-type galaxies run as part of the FIRE suite of simulations. The simulations self-consistently evolve the transport of cosmic ray electron spectra from supernova injection through the ISM and CGM. We generate synthetic observations of radio and IR emission for simulations with varied treatments of cosmic ray transport and quantify the morphological similarity of images using spatial gradients of the intensity.

The method is tested for different spatial scales and wavelengths, and shows that models run with diffusion coefficient $\sim 10^{28} cm^2/\mathrm{s}$ show higher morphological similarity between radio and IR compared to cases with higher diffusion coefficients.

Our results show that comparing radio and IR morphology of Milky-Way-type galaxies can be used as a reliable probe of the cosmic ray diffusion coefficient. With the increased sensitivity of SKA compared to current facilities, we expect that this methodology can be applied to a large sample of galaxies.

Where the Stars Stop: The Edge of Local Group Galaxy M33

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Sharp cut-offs in galaxy light profiles—often called stellar edges—provide important clues into how star formation and the environment shape galaxy outskirts. Since this feature has traditionally been studied in the optical, its connection to the gas component remains largely unexplored. In this talk, we will examine the Local Group galaxy M33, focusing on the galaxy's edge in both stars and gas. We demonstrate low surface brightness sensitivity in both the stellar and HI components of M33 out to $\sim$100 arcmin, a factor of three beyond the stellar edge. We reveal how the position and density of the edge vary across the disk, highlight deviations from the fiducial star formation threshold and discuss these results within the context of M33's interaction with Andromeda. Combining the deep and high-resolution images from SKA with Rubin LSST and Euclid in future studies will enable the characterization of galaxy edges for larger, morphologically diverse samples.