Nederlandse Astronomenconferentie 2022

Report of Contributions

https://indico.global/e/13075

Contribution ID: **1** Type: **not specified**

SKIES: Career opportunities and personal developments for young astronomy scientists

Tuesday 31 May 2022 14:50 (30 minutes)

The SKIES project is part of Horizon 2020 funded by the EU, and aimed to provide training on innovation, entrepreneurship and open science topics to Dutch astronomy PhD students and early-career researchers in combination with an individual mentoring programme. The training course was developed in collaboration with research institutes in Germany, Poland, Portugal, South Africa and external expert partners in entrepreneurship and space science, like the Erasmus Centre for Entrepreneurship (ECE) in Rotterdam and dotSPACE. In this talk, I will discuss the topics on which the pilot program focused and the outcome of our workshops and mentoring program offered to the Dutch astronomy young scientists. The workshops provided by the SKIES trainers during the pilot program showed that there is a real need from the astronomy PhD students to be concretely supported to achieving quality education in entrepreneurial skills and in transferring their skills to the industry and in the private sector in general, especially considering that the majority of them will not land a permanent position in academia. Overall, the lack of dedicated resources to ensure the sustainability of the entrepreneurship education of the Dutch PhD young scientists, limits their prospects of transferring their knowledge to the society and enrich industries with their expertise. We propose the continuation of the SKIES program to implement the courses and strengthen the connections between the astronomy departments and entrepreneurship, especially in the space sector. A direct involvement of the astronomical institutions in supporting the human resources engaged in the SKIES program, will ensure the quality of the entrepreneurship education and career development of the astronomy PhD students concretely.

Presenter: PUGLIESE, Giovanna (Leiden University)

Session Classification: Young Astronomers

Contribution ID: **2** Type: **not specified**

SSVI: Sterren Schitteren Voor Iedereen (Stars Shine For Everyone)

Tuesday 31 May 2022 13:30 (20 minutes)

An Astronomy Project for children with disabilities and underserved communities around the world

Stars Shine for everyone Project is a cooperation between UGent Volkssterrenwacht Armand Pien and Ghent University, started in 2015. Purpose of the project: "To give children in special education and vulnerable people the opportunity to admire the starry sky with the help of a telescope."

During the IAU100 celebration year 2019, SSVI was allowed to have an important place. In 2020 and 2021, SSVI became a partner of IAU Office for Astronomy Outreach. Competitions are organized such as 'Telescopes for All', 100 hours of Astronomy, Draw an Astronomer in which at least 30 SSVI Bresser telescopes are distributed annually. Leiden University provides shipping of the telescopes that were won at the IAU - SSVI contests.

Since 2020, there has also been a partnership with On The Moon Again, L'Astronomie Afrique and Radio France International-Autour de la Question. Since 2022, SSVI also has a collaboration with 'Beamline for Schools' (project powered by CERN). The SSVI project is currently present in over 150 countries across all continents.

Presenter: GROOTAERD, Jean-Pierre (Ghent University)

Session Classification: Plenary Session: Outreach and Equity/Diversity

Contribution ID: **3** Type: **not specified**

Astronomy at home: The library telescope

Tuesday 31 May 2022 14:05 (15 minutes)

The public observing nights at the Anton Pannekoek Institute are fully booked every month. With the arrival of corona, we moved our events online, like so many others. This served those who were interested in theory, but not those who came to us because they wanted a glimpse of the night sky through a real telescope. To still be able to serve (and expand) this part of our audience, we teamed up with the local library and started loaning out small telescopes, using the US based Library Telescope as an example. Unique in the Netherlands, soon the wait list stretched until the summer of 2022, so we quickly expanded to 4 telescopes in 4 different library locations in Amsterdam. Since then, a few other observatories have also started loaning out telescopes in local libraries and preparations are in place for even more. This talk will discuss how the project came to be and will give some pointers for future library telescope holders.

Presenter: HANKO, Esther (University of Amsterdam)

Session Classification: Plenary Session: Outreach and Equity/Diversity

Contribution ID: **4** Type: **not specified**

Inclusion and Diversity in Astronomy: Updates from the EAS and the IAU

Tuesday 31 May 2022 14:20 (15 minutes)

I will share updates on efforts to promote inclusion and diversity in astronomy from the European Astornomical Society Advisory Committee on Diversity and Inclusion , and the International Astronomical Union Executive Committee Working Group on Equity and Diversity in Astronomy. I will discuss current activity, implications and connections for Dutch and Belgian Astronomy, and how to become involved or partner with these efforts.

Presenter: NOEL-STORR, Jake (University of Groningen)

Session Classification: Plenary Session: Outreach and Equity/Diversity

Contribution ID: **5** Type: **not specified**

Equity, Diversity and Inclusion in Dutch Astronomy

Tuesday 31 May 2022 14:35 (15 minutes)

I will share updates on efforts to promote inclusion and diversity in astronomy from the European Astornomical Society Advisory Committee on Diversity and Inclusion , and the International Astronomical Union Executive Committee Working Group on Equity and Diversity in Astronomy. I will discuss current activity, implications and connections for Dutch and Belgian Astronomy, and how to become involved or partner with these efforts.

Presenter: JOSEPH, Tana (University of Amsterdam)

Session Classification: Plenary Session: Outreach and Equity/Diversity

Contribution ID: **6** Type: **not specified**

Identifying students'mental models of the apparent motion of the Sun and stars

Tuesday 31 May 2022 13:50 (15 minutes)

To study to what extent students have insight in the Apparent Motion of the Sun and Stars (AMoSS), we have designed the AMoSS test instrument with 12 multiple choice questions, which focus on distinctions between the apparent motion of the Sun and stars. We administered the AMoSS test to students of the fifth year (16-17 years old) of 6 Belgian secondary schools (N=410) during a science lesson at school and asked them to explain their choices. The analysis of the answers on the multiple-choice questions and the written explanations, reveal that, despite instruction, most students only demonstrate a rudimentary understanding of the apparent motion of the Sun and stars for different locations of the observer and different times during the year. Even university students score poorly on the test. Thanks to the classification system, which we have developed to categorize the written explanations and a latent class analysis, we are able to identify different mental models that students have about the apparent motion of the Sun and stars.

Presenter: BEKAERT, Hans (KU Leuven)

Session Classification: Plenary Session: Outreach and Equity/Diversity

Contribution ID: **7** Type: **not specified**

Welcome

Monday 30 May 2022 13:00 (10 minutes)

Presenter: DE RIJCKE, Sven

Session Classification: Plenary Session

Contribution ID: **8** Type: **not specified**

Cosmology with LIGO-Virgo-KAGRA observations and with the Einstein Telescope

Monday 30 May 2022 13:10 (30 minutes)

Presenter: GHOSH, Archisman (Ghent University)

Session Classification: Plenary Session

Contribution ID: **9** Type: **not specified**

The location of BNS mergers through short GRB hosts and NGC 4993

Monday 30 May 2022 13:55 (15 minutes)

The concurrent detection of GW 170817 and GRB 170817A secured the connection between binary neutron star (BNS) mergers and at least some short-duration gamma-ray bursts (sGRBs), allowing us to link several aspects of the two phenomena. Among the links opened by this connection, one is between the host galaxies of sGRBs and the environment of BNS mergers. From the study of sGRB hosts we can gather information about their stellar progenitors, the redshift distribution, and their dynamics, which can then be used to inform the physics underlying the production of BNS systems. Here I present a sample of sGRBs host galaxies including the host of GW 170817 (i.e. NGC 4993), and discuss the implications for the systemic velocities of BNSs and their merger times. For each host, I reproduce the galactic potential from observations and seed synthetic binary stars in it, to then evolve their orbits and record the location of BNS mergers. This allows me to compare the actual locations of sGRBs with those expected from population synthesis, and test the requirements on natal kicks to explain the observed sGRB population. While for the whole sample the galactic potentials are parametrized through scaling relations, for NGC 4993 alone a second method is presented. For this galaxy, I use also a MUSE observation to infer rotation and velocity dispersion, which allows us to infer the galactic potential directly from kinematics and to compare it with the results from the scaling relations.

Presenter: GASPARI, Nicola (Radboud University Nijmegen)

Session Classification: Plenary Session

Contribution ID: **10** Type: **not specified**

Detectability of a spatial correlation between stellar-mass black hole mergers and Active Galactic Nuclei in the Local Universe

Tuesday 31 May 2022 18:45 (15 minutes)

The origin of the Binary Black Hole (BBH) mergers detected through Gravitational Waves by the LIGO-Virgo-KAGRA collaboration remains debated. One fundamental reason is our ignorance of their host environment, as the typical size of an event's localization volume can easily contain thousands of galaxies. Statistical approaches can be used to assess the spatial correlation between these mergers and astrophysically motivated host galaxy types, such as Active Galactic Nuclei. We used a Likelihood ratio method to infer the degree of GW-AGN connection out to

Presenter: VERONESI, Niccolo

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **11** Type: **not specified**

Gravitational-wave and radio emission from black hole-neutron star mergers in the Einstein Telescope era

Monday 30 May 2022 13:40 (15 minutes)

Black hole-neutron star (BHNS) mergers have recently been detected through their gravitational-wave (GW) emission. Such mergers could also produce electromagnetic emission as a short gamma-ray burst (sGRB), and/or an sGRB afterglow upon interaction with the circummerger medium. In this talk, we present new simulations on the expected detection rates with the Square Kilometre Array Phase 1 (SKA1) of sGRB radio afterglows associated with BHNS mergers. We use recent population synthesis results of BHNS mergers and estimate their sGRB afterglow flux to obtain the detection rates with SKA1. We show the dependence of this rate on, for example, the the neutron star equation of state and GW detector sensitivity. We will argue that the much increased sensitivity of future GW detectors like the Einstein Telescope increases the chances of an sGRB localisation and radio detection substantially compared to the current generation of GW detectors. We also report on the benefits of a multimessenger analysis in inferring the properties of such a neutron star binary. We describe a fiducial BHNS merger, and simulate its sGRB afterglow and GW emission while taking systematic errors into account. We are able to infer both the binary source parameters as well as the parameters of the sGRB afterglow simultaneously when combining the GW and radio data. The radio data can provide useful extra information on, e.g., the neutron star mass but this is limited by the systematic errors involved.

Presenter: BOERSMA, Oliver (University of Amsterdam)

Session Classification: Plenary Session

Contribution ID: **12** Type: **not specified**

Going deep with MHONGOOSE: uncovering low column density HI with MeerKAT

Monday 30 May 2022 15:05 (15 minutes)

How galaxies replenish their gas supply in order to sustain star formation, is a research topic of many of the new and upcoming neutral atomic hydrogen (HI) surveys on the SKA precursor instruments. This replenishment, or accretion, of gas can potentially be detected in HI at column densities one or two orders of magnitude below previous observational limits. The Meerkat HI Observations of Nearby Galaxy Objects - Observing Southern Emitters (MHONGOOSE), a large survey programme with the SKA-precursor telescope, MeerKAT, is currently underway and is providing the deepest and most sensitive HI data of nearby galaxies until the advent of the SKA. Using the combination of MeerKAT's impressive column density sensitivity and high spatial resolution, we are now routinely detecting and imaging HI at column densities of ˜10ˆ18 cm-2, two orders of magnitude below the column densities typically found within the main galaxy disks. We are therefore beginning to uncover, in exquisite detail, the low-column density HI gas in the outskirts of galaxies, and at the same time, the complex morphology of the HI in the galaxy disk. In this talk, I will present some results to come out of the first full-depth MHONGOOSE observations which provide a tantalising picture of what is still to come, both from MHONGOOSE but also from the SKA.

Presenter: HEALY, Julia (ASTRON)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **13** Type: **not specified**

FIR emission-line luminosities to infer ISM physical properties

Monday 30 May 2022 15:20 (15 minutes)

The conditions under which the cold gas of galaxies evolves are not well known at higher redshift. The best way to understand cold gas is by studying the interstellar medium (ISM) of galaxies at different cosmic times. Far-infrared (FIR) emission lines are powerful tools for understanding the various phases of the ISM in galaxies. With this in mind, we have combined the cosmological EAGLE hydrodynamical simulations with a physically motivated multi-phase ISM model to estimate FIR emission lines. We post-process the smoothed-particle hydrodynamics data and decompose it into different ISM phases: HII regions, dense molecular gas, neutral atomic gas, and diffuse ionised gas. In our previous work, Ramos Padilla et al. (2021), we focus on the [C II] emission line at 158 microns at the local Universe. Now, we estimate eight important FIR lines, including [O I], [O III], [C II], [N II] and [N III] emission lines from z=0 to z=6. Using these FIR line luminosities we check the importance of different physical conditions in the simulated galaxies. We found that ratios like [C II]/[O III] and [N II]/[O I] help characterise the metallicities and specific star formation rates across cosmic time. Finally, we present a user-friendly webpage so other researchers can infer the physical properties of the ISM using the information from FIR line emissions.

Presenter: RAMOS PADILLA, Andres Filipe (University of Groningen)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **14** Type: **not specified**

Dynamical modeling of molecular Gas; hydrodynamics simulation of Gas disk around BH

Monday 30 May 2022 15:35 (15 minutes)

We present hydrodynamic simulations of the chemical evolution of the interstellar medium (ISM) gas influenced by the feedback from active galactic nuclei (AGN), coupled with the CHIMES code to treat the radiative cooling, AGN heating, and chemistry. We focus on the central 500 pc around the black hole (BH) where the AGN outflows and radiation couple to the ISM. In the simulation, we are modeling gas discs across a broad range of metallicities, gas fractions, and initial BH masses to evaluate the profile of the CO and H2 molecular species. By making an Adaptive Mesh Refinement grid model and radiative transfer for a given geometrical distribution of gas and/or dust, we attempt to discern between the conflicting explanations for the apparently counterrotating gas in the AGN-dominated galaxy NGC 1068.

Presenter: RAOUF, Mojtaba (Leiden University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **15** Type: **not specified**

Measuring the Star-formation Histories from SED fitting in the LEGA-C survey

Tuesday 31 May 2022 12:00 (15 minutes)

Galaxies are an amalgamation of several components (dark matter, stars, gas, and dust), constantly interacting with one another. This interaction is imprinted on the spectral energy distribution (SED) of a given galaxy. Panchromatic SED fitting can shed light on the astrophysical processes that regulate galaxy evolution. However, the current SED modeling approaches come with many caveats and limitations. A persistent issue is the poor constraint on the star-formation histories (SFH), with significant systematics on parameters as the stellar mass or star-formation rate as a result. Deep spectroscopic surveys of the stellar continuum are required to take the next step forward. This is achieved by the Large Early Galaxy Astrophysics Census (LEGA-C) survey. In this talk I will present our results from LEGA-C in the context of galaxy evolution.

Presenter: NERSESIAN, Angelos (Ghent University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **16** Type: **not specified**

The Virgo Environment Traced in CO Survey: How HI-identified environmental mechanisms affect the molecular gas in cluster galaxies

Monday 30 May 2022 16:35 (15 minutes)

Understanding galaxy formation and evolution is one of the key goals of astronomical research. With roughly half of the galaxies in the local Universe residing in dense environments, it is therefore important to study the effects of environment on galaxy evolution. It has been known for several decades that galaxy clusters harbour a relatively large fraction of early-type galaxies, suggesting that dense environments can cause the premature quenching of star formation. Several environmental processes have been suggested to contribute to this, such as ram pressure stripping, starvation, violent fly-bys, and tidal interactions. However, the relative importance of these mechanisms, and how exactly they lead to the quenching of star formation, is still very much a subject of study. Typically distributed in extended discs, atomic gas (HI) has long served as an excellent tracer for environmental processes. However, it is the molecular gas that is the direct fuel for star formation. Therefore, studying the (direct) effects of environment on the molecular gas in cluster galaxies is key to understanding galaxy evolution in such dense environements. In this talk I will discuss the first results from the ALMA large program "VERTICO: The Virgo Environment Traced in CO Survey". In particular, I will focus on how environmental mechanisms, identified using HI observations, affect the molecular gas in galaxies in the nearby Virgo cluster, by exploring resolved CO observations.

Presenter: ZABEL, Nikki (University of Groningen)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **17** Type: **not specified**

Polarised emission from aligned dust grains in nearby galaxies

Monday 30 May 2022 16:50 (15 minutes)

Non-spherical interstellar dust grains that are immersed in a magnetic field are expected to align with this field. The far-infrared (FIR) thermal emission of non-spherical grains is polarised along the longest axis of the grains. Combined, these two effects make polarised dust emission a powerful tool to study magnetic field configurations in environments where we expect a sufficiently strong alignment of the grains, like the interstellar medium in nearby galaxies. This was an important driver for the proposed B-BOP polarimeter that was part of the late SPICA mission design. In the absence of SPICA, FIR polarisation measurements can still be performed with a number of alternative instruments, including the HAWC+ polarimeter aboard SOFIA, albeit with a much reduced signal to noise ratio. To link FIR observations of nearby galaxies to theoretical predictions of galactic magnetic field configurations from magnetic dynamo theory, a forward modelling framework is required that converts a model prediction into a FIR polarisation image. We computed new optical emission coefficients for a mixture of spheroidal dust grains using our own Python module CosTuuM (Vandenbroucke, Baes & Camps, 2020) and added these to the radiative transfer code SKIRT (https://skirt.ugent.be/) to create such a framework. We applied our new framework to the Auriga galaxies (Grand et al., 2017), a set of Milky Way like galaxy simulations that include a treatment of the interstellar magnetic field. We constrained our dust model parameters by comparing all sky polarisation maps with the Planck 353 GHz observations of the Milky Way. Using the same model, we then generated synthetic images for nearby galaxies spanning a number of broad band ranges, including the HAWC+, SCUBA2, ALMA and B-BOP bands. We find a maximum observable linear polarisation fraction of 10% for face-on galaxies, which reduces to 3% for edge-on galaxies. The polarisation signal is strongest at wavelengths longer than 100 micron and correlates well with the underlying magnetic field structure. Probing the maximum linear polarisation fraction requires a minimum spatial resolution of 1 kpc.

Presenter: VANDENBROUCKE, Bert (Leiden University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **18** Type: **not specified**

Cold gas removal by low-luminosity radio jets: case of B2 0258+35

Monday 30 May 2022 17:05 (15 minutes)

The interplay between the nuclear activity and the interstellar medium (ISM) of galaxies plays an important role in their evolution: the gas accreting onto the dormant supermassive black hole turns it into an active galactic nucleus (AGN) and the ensuing activity is believed to starve the host galaxy of the fuel needed to form stars. The contribution of radio-loud AGN to this feedback effect is yet to be well understood, more so that of low luminosity radio AGN. These make up a significant fraction of the radio-loud AGN population, but are generally believed to be too weak to cause any significant impact. I will present a detailed study of the conditions of cold gas in one such low-luminosity radio AGN B2 0258+35. Our recent NOEMA CO(1-0) study has shown the presence of a fast outflow consisting of 75% of the cold gas in the central region of this galaxy. In combination with the numerical simulations of jet-ISM interaction, our study demonstrates that even low-luminosity radio sources are capable of single-handedly impacting the gas in the galaxy significantly, highlighting the importance of this class of radio AGN in the context of feedback.

Presenter: MURTHY, Suma (JIVE)

Session Classification: Parallel session

Contribution ID: **19** Type: **not specified**

Measuring the escape fraction of ionizing photons

Monday 30 May 2022 17:20 (15 minutes)

The last phase transition of our Universe is Reionization, when the first galaxies emitted energetic photons that ionized the intergalactic medium (IGM). The escape of ionizing photons from complex galactic environments is a key process to understand Reionization. However, the opacity of the neutral high redshift IGM results in the need of indirect methods of studying ionizing photons. I will present such a method, using ISM absorption lines from low-ionization states of metals, for example SiII 1260A or CII 1334A. The depth of those lines has been used as an indicator of the covering fraction of neutral gas in front of young stars, leading to an estimate of the escape fraction of ionizing photons. I will show how I produce those lines from recent Radiation-Hydrodynamics simulations, and compare them with the escape fraction in those simulations, to test the effectiveness of the method.

Presenter: MAUERHOFER, Valentin (University of Groningen)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **20** Type: **not specified**

Fountain-driven Accretion of Gas on to nearby Spiral Galaxies

Monday 30 May 2022 17:35 (15 minutes)

It is widely accepted that disc galaxies sustain their star formation by accreting gas from the external environment. In this study, we focus on one possible mechanism: hot CGM (corona) condensation triggered by the galactic fountain. Supernova feedback in star-forming galaxies continuously ejects out the plane part of the disc gas, which travels in the halo and falls back to the disc. This gas cycle, known as the galactic fountain, brings to the halo region metal-rich and cold gas, which then interacts with the coronal gas and significantly reduces its cooling time, leading to condensation and accretion. The cooling of part of the corona leaves a trace in the gas kinematics at the disc-halo interface that has been modelled in the Milky Way returning a prediction for the accretion rate very close to the Galactic star formation rate (SFR). However, whether the scenario can be extended to other spiral galaxies is unknown. We use a dynamical model of the fountain-driven corona accretion to simulate the neutral extraplanar gas (EPG) in the nearby galaxy NGC 2403 using data from the HALOGAS survey. The EPG emissions can be reproduced by our dynamical model. The accretion rate from corona condensation inferred for NGC 2403 is 0.5 M⊠/yr, very consistent with the star formation rate (0.6M⊠/yr). These results, combined to a previous kinematic study of the whole HALOGAS sample, indicate that fountain-driven corona condensation as a promising mechanism to sustain star formation in local disc galaxies. Our model also predicts the radial profile of the accretion rate, with peaks at R˜4 kpc for NGC 2403. Given that SFR of NGC 2403 peaks in the centre this shift of the accretion peak suggests a potential inside-out redistribution of gas and star formation activities in the future.

Presenter: LI, Anqi (University of Groningen)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **21** Type: **not specified**

Probing SFR of nearby galaxies with SOFIA/FIFI-LS [CII] observations

Monday 30 May 2022 14:35 (15 minutes)

The observation of the far-IR 158 μm line of singly ionised carbon [CII] plays an important role in the study of star-forming regions of the interstellar medium (ISM) in galaxies. The connection between the [CII] fine-structure line and ionised phases of the ISM, could make [CII] emission a useful alternative star-formation rate (SFR) measure. However, due to the ambiguity of the origin of [CII] line (e.g. tracing both regions of active star formation and neutral gas), full disc observations in nearby galaxies are first required to determine the fraction of [CII] that originates from different phases of the ISM. The aim of this project is to test the above assumptions using SOFIA/FIFI-LS [CII] observations of 3 nearby galaxies (NGC 3627, NGC 4321, NGC 6946). I will present our results showing that the use of [CII] as a tracer for star formation is much more complex than previously suggested within the extragalactic literature, which focused on small regions of galaxies and/or used large apertures containing many environments.

Presenter: KOVAČIĆ, Inja (Ghent University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **22** Type: **not specified**

The chemical footprint of AGN feedback in the outflowing circumnuclear disk of NGC1068

Monday 30 May 2022 17:50 (15 minutes)

In the nearby (D=14 Mpc) AGN-starburst composite galaxy NGC 1068, it has been found that the molecular gas in the CND is outflowing, which is a manifestation of ongoing AGN feedback (García- Burillo et al. 2014). The induced interaction between the AGN ionized wind & jet with the molecular gas on the CND has produced large-scale molecular shocks on spatial scales of up to 400 pc from the AGN. The outflowing gas has a large span of velocities, which likely drive different shock chemistry signatures at different locations in the CND. In this talk we are presenting our recent ALMA multi-line molecular study (Huang et al. 2022; Huang et al. in prep.) using SiO, HNCO and methanol as tracers of chemical differentiation across the CND. With a radiative transfer analysis coupled with Bayesian inference processes, we are able to determine the gas properties of the potentially shocked gas in the CND.

Presenter: HUANG, Ko-Yun (Leiden University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **23** Type: **not specified**

Cosmology from KiDS

Wednesday 1 June 2022 09:00 (20 minutes)

KiDS, the Kilo-Degree Survey, has mapped the distribution of dark matter using gravitational lensing. The final 'Legacy' analysis is underway, but results based on 2/3 of the data are available and provide interesting tests of the standard Lambda-CDM model of cosmology, including intriguing discrepancies. I will discuss these results as well as look forward to the improvements that can be expected from KiDS-Legacy.

Presenter: KUIJKEN, Koen (Leiden University)

Session Classification: Plenary Session

Contribution ID: **24** Type: **not specified**

Growing up: from KiDS to Euclid

Wednesday 1 June 2022 09:20 (20 minutes)

The KiloDegree Survey has proven to be a fertile training ground in preparation for Euclid, ESA's satellite to study the nature of dark matter and dark energy. In this talk I present some recent highlights from KiDS, with a focus on how observations can be used to account for astrophysical sources of bias, thus improving the fidelity of current and future constraints on cosmological parameters.

Presenter: HOEKSTRA, Henk (Leiden University)

Session Classification: Plenary Session

Contribution ID: **25** Type: **not specified**

Detecting cosmic rays with radio telescopes

Tuesday 31 May 2022 09:00 (20 minutes)

Detecting cosmic rays using the radio emission generated in extensive air showers that form when cosmic rays interact in the atmosphere has proven to be a highly effective technique. Existing radio telescopes can detect this signal, and the dense antenna spacing of the LOFAR telescope and the upcoming SKA telescope make these instruments ideal to probe the features of radio emission in great detail. LOFAR has been measuring cosmic rays in the 10ˆ17-10ˆ18 eV energy range for over a decade. This is the energy range where the origin of cosmic rays is expected to shift from Galactic sources, like supernova remnants, to extragalactic sources, like active galactic nuclei. In this talk we present an overview of the cosmic-ray measurements made at LOFAR, including precise measurements of the air shower development and the determination of the radiation energy for each air shower, and discuss the implications of these results. We also discuss prospects for cosmic-ray detection with the LOFAR 2.0 upgrade and the SKA.

Presenter: MULREY, Katharine (Radboud University Nijmegen)

Session Classification: Plenary Session

Contribution ID: **26** Type: **not specified**

Unveiling the Cosmic Dawn and Reionization with LOFAR-AARTFAAC

Wednesday 1 June 2022 10:00 (15 minutes)

Observations of the redshifted 21-cm signal of neutral hydrogen from the Cosmic Dawn and Reionization epochs promise to provide valuable insights into the (astro)physical processes that governed the structure formation in the early Universe. The AARTFAAC wide-field imager of the LOFAR telescope is an excellent instrument to measure the redshifted 21-cm signal on large angular scales from the Cosmic Dawn and Reionization. We commenced the AARTFAAC Cosmic Explorer (ACE) programme to measure the power spectrum of the 21-cm signal at redshift z˜18. Additionally, we proposed the AARTFAAC REionization Survey (ARES) programme as a part of the upgraded LOFAR2.0 large programmes. The ARES programme aims to map the low-frequency diffuse radio emission in the northern sky and 21-cm power spectrum measurement from the Epoch of Reionization with AARTFAAC-HBA. The talk will focus on the results and updates from the analysis of ACE data and an overview of the proposed ARES program.

Presenter: GEHLOT, Bharat Kumar (University of Groningen)

Session Classification: Plenary Session

Contribution ID: **27** Type: **not specified**

An X-ray of the cosmic dawn

Wednesday 1 June 2022 09:40 (20 minutes)

The first population of X-ray binaries are expected to affect the thermal and ionization states of the gas in the early Universe. Although these X-ray sources are predicted to have important implications for high-redshift observable signals, such as the hydrogen 21-cm signal from cosmic dawn and the cosmic X-ray background, their properties are poorly explored and theoretical models are lacking detail. In this talk I will present the first model a population of X-ray binaries arising from zero metallicity stars. We explore how properties of the first X-ray binaries depend on the adopted initial mass function (IMF) of primordial stars, finding a strong effect on their number and X-ray production efficiency. We also present scaling relations between XRBs and their X-ray feedback with the local star formation rate which can be used in sub-grid models to improve the X-ray feedback prescriptions.

Presenter: SARTORIO, Nina (Ghent University)

Session Classification: Plenary Session

Contribution ID: **28** Type: **not specified**

The Prevalence of Galaxy Overdensities Around UV-Luminous Lyman alpha Emitters in the Epoch of Reionization

Wednesday 1 June 2022 10:15 (15 minutes)

Before the end of the epoch of reionization, the Hydrogen in the Universe was predominantly neutral. This leads to strong attenuation of Lyman alpha lines of z>6 galaxies in the intergalactic medium. Nevertheless, Lyman alpha has been detected up to very high redshifts (z˜9) for several especially UV luminous galaxies. Here, we test to what extent the galaxy's local environment might impact the Lyman alpha transmission of such sources. We present an analysis of dedicated Hubble Space Telescope (HST) imaging in the CANDELS/EGS field to search for fainter neighbors around three of the most UV luminous and most distant spectroscopically confirmed Lyman alpha emitters at z_spec=7.73, 7.48, and 8.68, respectively. We combine the multi-wavelength HST imaging with Spitzer data to reliably select z˜7-9 galaxies around the central, UV-luminous sources. Our analysis reveals ubiquitous overdensities around luminous Lyman alpha emitting sources in the heart of the cosmic reionization epoch. Additionally, we compare our results to the expectations from simulation and show that they are in excellent agreement. Our results support the theoretical prediction that the first ionized bubbles preferentially formed in overdense regions.

Presenter: LEONOVA, Ecaterina (University of Amsterdam)

Session Classification: Plenary Session

Contribution ID: **29** Type: **not specified**

Probing the Mpc-scale environment of hyperluminous infrared galaxies

Tuesday 31 May 2022 18:30 (15 minutes)

Protoclusters are progenitors of galaxy clusters at the present day and are important for studying how halo mass and stellar mass assemble in the early universe. Tracing signposts that are expected to live in dense regions is a widely adopted method to identify protoclusters. Bright dusty star-forming galaxies (DSFG) are one of these signposts. Hyperluminous infrared galaxies (HLIRGs), which are extremely massive and show extreme levels of dusty star formation activity and/or black hole accretion, are expected to live in dense regions with massive halos. We study the small-scale environment of the largest HLIRG sample to date and investigate whether they predominantly live in overdense regions. We explore the surface density of Herschel-detected sources around HLIRGs and compare with that around random positions, in order to find out whether there exists an overdensity of star-forming galaxies in HLIRG environment. Then, we compare the spatial distribution of neighbours around HLIRGs with that around randomly selected galaxies using a deep IRAC-selected catalogue with good-quality photometric redshifts. We also use a redshift-matched quasar sample and submillimeter galaxy (SMG) sample to validate our method, as previous clustering studies have reported the clustering nature of these populations and measured the host halo mass. Moreover, we adopt Friends of Friends (FOF) algorithm to seek (proto)clusters which host our HLIRGs. We find that HLIRGs tend to have more star-forming neighbours within 100′′ projected radius than a random galaxy at a 2.3σ significance. HLIRG neighbours are brighter than random neighbours, with median 250 μm flux density of 10.9 mJy compared with 9.6 ± 0.3 mJy. We only find weak excess of HLIRG spatial neighbours compared with random galaxy neighbours, mainly influenced by photometric redshift uncertainty and survey depth. Finally, we select and present a list of 51 most promising protocluster candidates that are ideal as targets for future follow-up observations.

Presenter: GAO, Fangyou (University of Groningen)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **30** Type: **not specified**

SARIs : a new paradigm for turbulent accretion onto black holes

Wednesday 1 June 2022 11:00 (20 minutes)

During the last three decades, the astrophysical literature collected ever growing evidence that magnetic fields, however weak, play a decisive role in triggering turbulent flow in accretion disks. A process referred to by its acronym MRI, for magneto-rotational instability, provides a universally accepted explanation of why magnetized accretion disks turn turbulent at all. Magnetic fields and a rotation rate that decreases away from the central object, introduce a runaway process governed by conservation of angular momentum. However [1], the MRI diverts our attention to special (axisymmetric, i.e. with no variation about the disk center) natural eigenfrequencies of the disk. This focus on eigenfrequencies is physically sound, just like we appreciate music through the natural vibrations of a guitar string. Curiously enough, a rigorous mathematical analysis now reveals that we may as well go beyond these pure natural resonances, and look for any growing wave package that just needs a tiny amount of added energy (just like the guitar player does by plucking the string). This opens up an entire new window on what drives turbulence in accretion disks, with a decisive role for very localized wave packages that surf the disk at speeds larger than the Nobel-prize winning Alfvén speed. These Super-Alfvénic rotational instabilities - SARIs for short - are completely unprecedented, and since they no longer adopt artificial axisymmetry, may drive processes enhancing the magnetic field in-situ, acting as a dynamo. This new concept for turbulence in accretion disks truly represents a paradigm-shift, but required the solution of intricate mathematical equations, where singular behavior is key. Since singular behavior of mathematical equations gave birth to black holes, it is satisfying to discover that turbulent processes near black holes thrive on singularities as well [2]. [1] Hans Goedbloed & R. Keppens, 2022, ApJ Supplement Series 259, 65 (41pp), Full paper, doi:10.3847/1538-4365/ac573c [2] https://wis.kuleuven.be/CmPA/news/2022/SARI2022

Presenter: KEPPENS, Ronny (KU Leuven)

Session Classification: Plenary Session

Contribution ID: **31** Type: **not specified**

Coupling between the accreting corona and the relativistic jet in the microquasar GRS 1915+105

Monday 30 May 2022 15:50 (15 minutes)

Accreting black holes emit highly collimated radio jets expanding at speeds approaching light speed. Some of these jets appear to be expanding at superluminal speeds due to geometric effects. While magnetic fields are thought to be responsible for collimating the ejecta, the mechanism that accelerates the material in these jets remains unexplained. For the galactic black hole GRS 1915+105 with a superluminal radio jet, it has been proposed that thermal instabilities in the accretion disk lead to the ejection of the inner parts of the disk into the jet. Here we use X-ray and radio observations over a 10-year period to reveal a strong correlation between (i) the radio flux that comes from the jet and the flux of the iron emission line that comes from the disk and (ii) the temperature of the hard X-ray corona and the amplitude of a high-frequency variability component that comes from the innermost part of the accretion flow. At the same time, the radio flux and the flux of the iron line are strongly anti-correlated with the temperature of the X-ray corona and the amplitude of the high-frequency variability component. Our findings show that the energy that powers this black hole system can be directed in different proportions either mainly to the X-ray corona or to the jet. These facts, plus our modelling of the variability in this source, suggest that in GRS 1915+105 the X-ray corona turns into the jet.

Presenter: MENDEZ, Mariano (University of Groningen)

Session Classification: Parallel session

Contribution ID: **33** Type: **not specified**

The African extension to the Event Horizon Telescope: making movies of black holes

Monday 30 May 2022 14:50 (15 minutes)

In 2019 the Event Horizon Telescope (EHT) delivered the first image of a black hole shadow in the center of the giant elliptical galaxy M87 and is expected to also produce high-resolution images of the supermassive black hole at the center of our Galaxy, Sgr A. *The latter is more challenging to image, being a short time-scale variable source and affected by the interstellar scattering. An extension of the EHT will be needed to further improve the imaging capabilities and to produce reliable real-time movies of Sgr A* and M87*. In this talk, we introduce the Africa Millimetre Telescope (AMT), planned to be built in Namibia, and show synthetic dynamical reconstructions (i.e. movies) produced with the current EHT array plus additional sites in Africa. The AMT alone will already increase the east-west uv-coverage of the current configuration significantly. This gives us the chance to reconstruct images within the first hours of the observation and at least double the observing time yielding robust imaging information. Finally, we discuss the impact of adding more telescopes on the African continent, such as on Canary Island, on imaging gas and light dynamics near the event horizon.

Presenter: LA BELLA, Noemi (Radboud University Nijmegen)

Session Classification: Parallel session

Contribution ID: **34** Type: **not specified**

DISTURB: real-time solar radio burst detector

Monday 30 May 2022 14:35 (15 minutes)

ASTRON and S&T corporation are developing a detector of extreme solar radio bursts (SRBs). The aim is to provide real-time alerts and radio spectra from 3-3000MHz to KNMI and the Dutch military, so they can warn the Dutch vital economic sectors, as well as radio and radar operators of current radio interference due to the Sun. 70% of the first two phases of instrument development has been funded by the Dutch military. We'll present our design, plans for the future, as well as data recorded with the current state of our end-to-end demonstrator. Over the next 5 years we hope to create a global system with 24/7 monitoring of the Sun. Once operational, data and detections will be made available to the global scientific community no later than 30 minutes after they are recorded.

Presenter: BRENTJENS, Michiel (ASTRON)

Session Classification: Parallel session

Contribution ID: **35** Type: **not specified**

Gaia Data Release 3: a Preview

Tuesday 31 May 2022 09:20 (20 minutes)

On June 13 2022 Gaia Data Release 3 will be made public. This release will feature a major increase in the availability of astrophysical information on sources throughout the Milky Way, including stellar parameters and abundances (some 500 million sources), spectra for some 220 million sources, and parameters of variable and binary stars, among many other new data products. I will provide a preview of the release, highighting the contributions from Dutch and Belgian institutes, and provide pointers on how to prepare for the release itself.

Presenter: BROWN, Anthony (Leiden University)

Session Classification: Plenary Session

Contribution ID: **36** Type: **not specified**

The current status of JWST

Tuesday 31 May 2022 09:40 (20 minutes)

I discuss briefly the current status of JWST commissioning and the planning of the first cycle

Presenter: FRANX, Marijn (Leiden University)

Session Classification: Plenary Session

Contribution ID: **37** Type: **not specified**

NOVA optical infrared instrumentation program overview

Tuesday 31 May 2022 10:00 (15 minutes)

This presentation provides an overview of the NOVA instrumentation program for optical and infrared observations. It includes a review of the development of MIRI for the James Webb Space Telescope (JWST), the suite of instruments developed for the ESO Very Large Telescope (VLT), and the instruments currently being developed for the Extremely Large Telescope (ELT). NOVA contributions to other telescopes and instruments will be mentioned as well.

Presenter: NAVARRO, Ramon (NOVA)

Session Classification: Plenary Session

Contribution ID: **38** Type: **not specified**

Mitigating interference fringes in JWST MIRI Medium Resolution Spectrometer: supporting the Dutch community

Tuesday 31 May 2022 10:15 (15 minutes)

Presenter: CROUZET, Nicolas (Leiden University)

Session Classification: Plenary Session

Contribution ID: **39** Type: **not specified**

Evaluating the jet/accretion coupling of Aql X-1: probing the contribution of accretion flow spectral components

Wednesday 1 June 2022 11:20 (20 minutes)

The coupling between radio and X-ray luminosity is an important diagnostic tool to study the connection between the accretion inflow and jet outflow for low-mass X-ray binaries (LMXBs). Moreover, the comparison of NS- and BH-LMXBs provides useful information about the role of compact objects in launching jets. Interestingly, studies have shown discrepancies between the radio-X-ray coupling of NS- and BH-LMXB sources. The radio/X-ray correlation for individual NS-LMXB sources is scattered, whereas for individual BH-LMXBs a more consistent correlation is generally found. Furthermore, we observe jet quenching for both types of LMXBs, but it is unclear what exactly causes this, and if jets in NS-LMXBs quench as strongly as those in BH-LMXBs. While additional soft X-ray spectral components can be present for NS-LMXBs due to the presence of the neutron star's surface, disentangling the individual X-ray spectral components has thus far not been considered when studying the radio/X-ray coupling. In this talk, I will present our work on analysing eleven epochs of Swift/XRT observations matched with quasi-simultaneous archival radio observations of the 2009 November outburst of Aql X-1. In this study we decompose thermal and Comptonised spectral components in Swift/XRT spectra, discuss whether the presence of additional thermal emission affects the coupling of the radio/X-ray luminosity, and give recommendations for future research.

Presenter: FIJMA, Stefanie (University of Amsterdam)

Session Classification: Plenary Session

Contribution ID: **40** Type: **not specified**

Circumstellar discs around evolved post-AGB binary systems: a site for planet formation?

Wednesday 1 June 2022 11:40 (20 minutes)

Circumstellar discs are found at different evolutionary stages of stars. In this talk, I will focus on a class of evolved stellar systems that show stable circumbinary discs of gas and dust, namely post-asymptotic giant branch (post-AGB) binary systems. These circumbinary discs show remarkable, but unexpected, similarities with planet forming discs around young stellar objects. Using infrared interferometry to spatially resolve the emission from the very inner regions of these discs, we gain insight into both the dynamical disc-binary interaction and the physical conditions in the inner disc regions. In this talk, I will present the results of our thorough observing campaign using all the current VLTI instruments, PIONIER, GRAVITY, and MATISSE, to reveal the circumbinary disc around one such post-AGB binary system. I will show model results that reproduce the visibility data of all bands, providing strong implications on the inner disc properties and disc-binary interactions. I will discuss the importance of interferometric observations to further constrain the structure and evolution of these circumbinary discs and how we can get constrains on the possibility of second generation planet formation.

Presenter: CORPORAAL, Akke (KU Leuven)

Session Classification: Plenary Session

Contribution ID: **41** Type: **not specified**

Can Molecular Ratios be used as Diagnostics of AGN and Starburst activity? The Case of NGC 1068.

Monday 30 May 2022 15:50 (15 minutes)

The gas and dust present within galaxies, known as the Interstellar Medium (ISM), is not homogeneous; star formation, supernovae events, as well as AGN activities may all greatly alter the ISM. In particular, recent studies of nearby external galaxies have shown that the molecular ISM varies at kiloparsecs as well as at parsec scales, with evidence of different gas components traced by different molecular species or rotational transitions. Molecular line ratio diagnostics are often used to investigate the physics and chemistry of the ISM. For example, as the gas chemistry located in the central/nuclear regions of galaxies is believed to be dominated by X-rays emitted from the AGN, this is thus greatly affect the conditions of the ISM in the surrounding regions, especially compared to regions located in starbursts. Hence, line ratios of specific molecules have been proposed as indicators of certain energetic or physical processes e.g. HCN/HCO^+ as a tracer of AGNs; HCN/HNC as a 'thermometer', HCN/CO as a density tracer. In order to investigate these molecular line ratio diagnostics we perform a global investigation into the use of molecular line ratios as tracers particularly of AGN versus SB activity. We shall use the galaxy NGC˜1068 as a "laboratory" for this study. NGC 1068 is a Seyfert 2 barred spiral galaxy; it is also the archetypal composite AGN/SB galaxy. With the use of radiative transfer modelling we are able to both delve into the respective properties of these regions as well as testing the reliability of the ratios themselves.

Presenter: BUTTERWORTH, Joshua

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **42** Type: **not specified**

The Chemical and Thermal Structure of the Atmosphere of the Elliptical Glaxy NGC 5813

Tuesday 31 May 2022 16:45 (15 minutes)

We present a robust representation of the galaxy group NGC 5813's chemical and thermal structure analysing archival, deep X-ray observations of the group using up to date atomic line emission models and multi temperature spectral model. The selection of our target is motivated by the fact that NGC 5813 has a very relaxed morphology, making it a promissing candidate for the study of the AGN feedback's influence in hte intra-group medium (IGrM). Our results showcase a prominent, extended distribution of cold gas along the group's NE-SW direction, correlating with the direction along which the supermassive black hole in the group's central galaxy is known to interact with the IGrM. Our analysis indicates gas being uplifted from the group's centre as the probable origin of the cold gas distribution, although alternative scenarios, such as in-situ cooling can not be explicitly ruled out. Regarding the chemical structure of the IGrM, we find no evidence of an AGN feedback induced chemical enrichment, with the elemental abundance remaining Solar on average across the group. The distribution of elements appears to be independent of galactocentric radius, azimuth and the thermodynamics of the gas, suggesting that the IGrM has been efficiently mixed. The large scale uniformity of the abundance distribution implies the presence of complex dynamical processes in NGC 5813, despiute its overall relaxed morphology, with possible indications of sloshing and turbulence as the primary mechanisms behind it.

Presenter: CHATZIGIANNAKIS, Dimitris (Leiden University)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **43** Type: **not specified**

NGC 1068 MATISSE imaging and thermal map of the dust close t

Monday 30 May 2022 17:35 (15 minutes)

In the Unification Theory of AGNs the concept of "the torus"plays a crucial role to discern between Type-1 and Type-2 AGNs. Its emission, coming from hot and warm dust peaks at infrared wavelengths, which makes MATISSE an ideal instrument to observe it. The wide spectral coverage of the L, M and N bands, and the high spatial resolution that MATISSE offers, together with its capability to combine the beams of four telescopes to do interferometry, therefore generating closure phases, make the instrument a versatile tool for the study of AGNs. NGC 1068, being one of the closest AGNs, has been considered a key science case for MATISSE. In this talk I will present the first image reconstructions of the dusty heart of NGC 1068, and the thermal and extinction map derived through Gaussian modelling and aperture photometry. By cross-identifying this map with ALMA and VLBA maps and the water masers, we can determine the position of the super massive black hole. This analysis unveils an optically thick ring that is obscuring the central engine at parsec scales and a less optically thick disk extending to at least 10 pc. We find a striking similarity between the morphologies of the radio free-free emission and the thermal emission of the dust in both, the L and N bands. We also find that the cold obscuring dust is mainly formed by amorphous olivines and carbon grains.

Presenter: GAMEZ ROSAS, Violeta (Leiden University)

Session Classification: Parallel session

Contribution ID: **44** Type: **not specified**

The MBH - σ Relation of 105 Months SWIFT-BAT AGNs

Tuesday 31 May 2022 17:30 (15 minutes)

We present central stellar velocity dispersion measurements for 158 type 1 AGNs from the second data release of the Swift/BAT AGN Spectroscopic Survey (BASS DR2) with a redshift cut-off z < 0.08. A total number of 297 type 1 AGN spectra are fit for obtaining two independent measurements from the Ca II H+K + Mg I region (3880 - 5550°A) and the calcium triplet region (8350-8750 °A). The resulting σCaT estimates are found to be in the range: 73 ≤ σCaT ≤ 278 km s−1, whereas the σCaH+K+M gI estimates are found to be in the range: 82 ≤ σCaH+K+M gI ≤ 272 km s−1, for our AGN sample. We show that both σ estimates are very consistent with each other with an average difference of 0.03 dex. Using the BASS DR2 MBH archive and our σ measurements, we present one of the largest MBH - σ relation investigations for type 1 AGNs. We demonstrate that extinction in BLR causes under-estimation of black hole masses (MBH), accordingly, over-estimation of Eddington ratios (log λEdd). We do not find a significant trend between the offset from the MBH - σ relation versus star-formation and the core radio AGN luminosities. Interestingly, we report that AGNs with relatively higher log λEdd show higher offset implying that their super-massive black holes still need to grow to keep up with their host-galaxy growth. We conclude that the offset from MBH - σ relation is still strong for AGNs relative to elliptical/classical bulge-hosting galaxies, and using a specified AGN MBH - σ relation is a better approach for obtaining black hole masses of AGN populations.

Presenter: CAGLAR, Turgay (Leiden University)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **45** Type: **not specified**

Unveiling the Milky Way's early hot corona through the ram pressure stripping of Draco

Tuesday 31 May 2022 17:45 (15 minutes)

Relatively massive galaxies such as the Milky Way are expected from theoretical galaxy formation and cosmological simulations to contain a hot gas corona extending to roughly the virial radius. In the Milky Way the existence of this hot corona has been established mainly relatively close to the galactic disc through observations in absorption and X-ray emission. Most constraints on the density of the present day corona have been derived from the ram pressure stripping of satellite galaxies that have recently lost their gas. However, our knowledge of the evolution of this corona is very limited. Using GAIA proper motions for the Draco dwarf satellite galaxy we show that its first infall around redshift z=1.6 coincides with the steep decline in Draco's star formation history. Hence, this is consistent with Draco having been stripped by ram pressure from the early corona. We have simulated this first infall in 3D hydrodynamical simulations and are able to, for the first time, put a constraint on the density of the corona at high redshift. Our lower limit of n>8x10ˆ-4 cmˆ-3 in the outer part of the corona is consistent with an upper limit derived from the cosmic baryon fraction. Comparing to the constraints on the present day corona in the literature we find that the density in the outer part of the corona must have dropped by about a factor of 10 since z=1.6. This evolution agrees well with simple analytical estimates as well as predictions from cosmological zoom-in simulations.

Presenter: GROENNOW, Asger (University of Groningen)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **46** Type: **not specified**

Feeding an AGN: the low-column density ISM as revealed by MeerKAT

Tuesday 31 May 2022 18:00 (15 minutes)

The recent MeerKAT deep surveys in the nearby Universe opened a new era of investigation of the neutral atomic (HI) gas in nearby galaxies. By reaching high spatial and spectral resolution with short observations, along with a large field of view (˜1 degree), MeerKAT now enables us to investigate the presence of low-column density (˜1x10ˆ18 cmˆ-2) HI in all types of galaxies in different environments, from isolated objects to groups and clusters. For example, observing low-column density HI from the macro (hundreds of kpc) to the micro scale (a few kpc) in active galactic nuclei (AGNs) allows us to identify and trace not only signatures of AGN-feedback (i.e. gaseous outflows) but also phenomena of cold gas accretion. In this talk, I will show recent deep HI observations (˜1x10ˆ18 cmˆ-2) from different MeerKAT projects (i.e. Meerkat Fornax Survey, MHONGOOSE, open-time) of nearby radio AGNs (<100 Mpc) which allowed us to shed new light on the role of cold gas in the nuclear activity of galaxies. By using increasingly deeper MeerKAT observations I will focus on the impact of AGNs on the surrounding interstellar medium and on their triggering mechanisms, distinguishing between ’external’phenomena (i.e. mergers and interactions) and ‘internal’ones (i.e. cold chaotic accretion, secular events). For some sources, I will show how events of feeding and feedback in the multi-phase gas over different scales (from ˜500 pc to 6 kpc) appear to co-exist in space and time explaining the rapid life-cycle of AGNs.

Presenter: MACCAGNI, Filippo (ASTRON)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **47** Type: **not specified**

Direction dependently calibrating Low Frequency Array data with two algorithms: DDECal vs. SAGECal

Monday 30 May 2022 15:05 (15 minutes)

The detection of the faint 21-cm signal from the Epoch Reionisation (EoR) has been challenging due to strong foregrounds, ionospheric effects and radio frequency interference (RFI) etc. The precise calibration of data has been a key to the detection. Low frequency array (LOFAR) is a radio interferometer which is designed to detect the EoR. Over the years, the LOFAR-EoR team has been working on creating models for the non-signal effects and subtracting them during the calibration process. Due to a very wide field of view of LOFAR, LOFAR data need to be calibrated direction dependently to compensate for different errors from varying beams and ionospheric effects. This DD-calibration process has been performed only by SAGECal (Space Alternating Generalized Expectation Maximization Calibration) in LOFAR-EoR. In this work, we fully process one night raw observation of LOFAR using the standard DD-calibration algorithm SAGECal and a different calibration algorithm DDECal (Direction Dependent Calibration) on an unexplored flanking field of the North Celestial Pole (NCP). Further, we perform foreground removal and power spectrum estimation to compare the performance of two different DD-calibration algorithms. We will compare the results to the standard LOFAR-EoR pipeline to test whether different independent calibration algorithms yield comparable results on the LOFAR data.

Presenter: HYOYIN, Gan (University of Groningen)

Session Classification: Parallel session

Contribution ID: **48** Type: **not specified**

Modelling complex AGN media in full-3D with a new X-ray radiative transfer code

Tuesday 31 May 2022 18:15 (15 minutes)

Large amounts of gas and dust are found in the central regions of most active galaxies. These ambient media play a crucial role as they provide the accretion reservoir powering AGNs and reprocess the X-ray, UV and optical emission of the central engine. Yet, the detailed characteristics of these regions and the physics behind them remain unknown. Recent radiative transfer modelling suggests that circumnuclear media are complex with clumps and filaments, while MIR-observations hint towards polar extended structures of gas and dust, as opposed to the classical dusty torus paradigm. We present a new, high-performance Monte Carlo simulation code that can model X-ray radiation transport in arbitrary 3D geometries, which allows for intricate multi-phase media with complex distributions. Moreover, this code can self-consistently model SEDs over the full infrared to X-ray range. By exploiting the diagnostic power of reprocessed spectral X-ray features, we dissect the inner few parsecs of AGNs in unprecedented detail and differentiate between equatorial and polar extended geometries. Furthermore, we analyse the self-consistent model predictions for the combined infrared and X-ray bands and discuss their application to spectral fitting. Finally, we present mock observations demonstrating how geometry effects will appear in the fluorescent line shapes of current XMM-Newton and forthcoming XRISM and Athena observations.

Presenter: VANDER MEULEN, Bert (Ghent University)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **49** Type: **not specified**

The fall of css100217: a tidal disruption-induced low state in an apparently hostless active galactic nucleus

Monday 30 May 2022 15:35 (15 minutes)

CSS100217 was a nuclear flare in a Seyfert 1 galaxy, whose initial interpretation as a nuclear supernova is now debated between a tidal disruption event (TDE) and a flare from the active galactic nucleus (AGN). We discuss new evidence in favour of a TDE interpretation, mainly the marked difference in the optical quiescent flux before and after the outburst, as the post-outburst flux level is 0.4 mag fainter than before. The host galaxy of CSS100217 appears as a point source and is smaller and more compact than AGN host galaxies at comparable redshift. CSS100217 is not only a one-of-a-kind transient, it appears to lie in a one-of-a-kind host galaxy.

Presenter: CANNIZZARO, Giacomo (Radboud University Nijmegen)

Session Classification: Parallel session

Contribution ID: **50** Type: **not specified**

Determination of the elements making up ultra-high energy cosmic rays using the Auger Engineering Radio Array.

Monday 30 May 2022 15:20 (15 minutes)

The Auger Engineering Radio Array (AERA) is an array of 153 radio antennas spanning an area of 17 kmˆ2, currently the largest of its kind, that probes the nature of ultra-high energy cosmic rays at energies around the transition from galactic to extra-galactic origin. It measures the MHz radio emission of extensive air showers produced by cosmic rays hitting our atmosphere. The elemental composition of cosmic rays is a crucial piece of information in determining what the sources of cosmic rays are and how cosmic rays are accelerated. The composition can be reconstructed with likelihood analysis by comparing the measured radio footprint on the ground to an ensemble of footprints from Monte-Carlo Corsika air shower simulations. These simulations are also used to determine the resolution of the method and to validate the reconstruction by identifying and correcting for systematic uncertainties. I will present the method and show the results of the cosmic-ray composition reconstruction with AERA.

Presenter: PONT, Bjarni (Radboud University Nijmegen)

Session Classification: Parallel session

Contribution ID: **51** Type: **not specified**

Radiation pressure in 3D hydrodynamical simulations of companion-perturbed AGB outflows

Tuesday 31 May 2022 11:00 (15 minutes)

The cool and dusty circumstellar envelopes of asymptotic giant branch (AGB) have for a long time been modelled assuming a spherical symmetry. High spatial resolution observations of these stars have shown that their surroundings exhibit a variety of complex structures. Most of these structures are believed to originate from the interaction of the AGB wind with an obfuscated, nearby, orbiting stellar or planetary companion. Due to the inherent three-dimensional nature of these structures, a detailed understanding of these objects and the dominant wind-shaping mechanisms can therefore only be obtained from advanced three-dimensional treatments. Hydrodynamics simulations (with both particle- and grid-based codes) in the literature show that some of the observed morphologies can indeed be reproduced. However, due to the large computational cost a lot of critical physics has been strongly simplified, or even omitted. It is in this context that we present our work on upgrading the way in which attenuation of the stellar radiation field affects the effective radiation pressure on the dust by abandoning the widely adopted optically thin limit in calculating the dust acceleration. In this talk I will present my master thesis project where I coupled a ray-tracer with the smoothed-particle-hydrodynamics code Phantom to calculate the dust acceleration everywhere in the wind, and how to make it feasible for on-the-fly calculations. I will present the implications of this new treatment on the dynamics and morphology of the AGB outflows by means of three-dimensional AGB binary simulations.

Presenter: ESSELDEURS, Mats (KU Leuven)

Session Classification: Parallel session

Contribution ID: **52** Type: **not specified**

Analysing the SEDs of protoplanetary disks with machine learning

Tuesday 31 May 2022 11:15 (15 minutes)

A common method to determine the physical properties of protoplanetary disks is to analyse their spectral energy distributions (SEDs). However, the results are well-known to be degenerate. Running a full Bayesian analysis that can address this problem is challenging due to the high computational cost of full radiative transfer models. In my talk, I will show how we successfully train Neural Networks on sets of MCFOST single and two-zone models to predict SEDs. These predictions have a computational cost that is a factor of ˜10ˆ5 lower than the cost of the modelling software. We use this method to fit the SEDs of 30 well-observed protoplanetary disks using Bayesian analysis. Therefore, we get the uncertainties for all model parameters and can examine degeneracies. Additionally, we can analyse the influence of all model parameter on the SED and estimate how much information different flux measurements give about disk properties like the dust mass of the disk.

Presenter: KAEUFER, Till (University of Groningen)

Session Classification: Parallel session

Contribution ID: **53** Type: **not specified**

How flux rope heating models affect solar prominence formation.

Tuesday 31 May 2022 11:30 (15 minutes)

Prominences are cool, dense plasma clouds found in the optically thin solar corona, which makes them classical examples of condensations due to thermal instability. The levitation-condensation mechanism has been used in simulations to explain prominence formation in a flux rope, which is created through shearing and converging motions of coronal loop footpoints. These simulations employ two classes of background heating models for the solar corona: models based on scaling laws in which the heating rate depends on local parameters like density and magnetic field strength, and models with a steady background decaying exponentially with height. Two problems arise: heating based on local parameters only produces conditions favourable to in-situ condensations in case the flux rope is formed through anti-shearing motions, while an exponentially dropping heating rate ignores the complex flux rope structure consisting of field lines twisted around a central 'spine'. We present a parametric study of these two different heating prescriptions in 2.5D simulations of prominence formation through levitation-condensation with the code MPI-AMRVAC. Additionally, we propose a unified, new and dynamic heating model by identifying the flux rope during runtime and reducing the internal heating rate, as to mimic the 3D structure of the flux rope. The plane-projected flux rope structure is modelled as an ellipse centred in the flux rope centre, which is tracked using a method based on magnetic field curvature. It turns out that the two classes of heating models lead to morphologically distinct prominences. Furthermore, flux ropes with reduced heating rates produce considerably larger and more massive condensations, an essential ingredient to bridging the gap between simulation and observation. Finally, a look at the evolution of the phase space distribution provides insight in the condensation process and subsequent recovery of force balance.

Presenter: BRUGHMANS, Nicolas (KU Leuven)

Session Classification: Parallel session

Contribution ID: **54** Type: **not specified**

Black Mirror: The impact of rotational broadening on the search for reflected light from exoplanet atmospheres with high resolution spectroscopy

Tuesday 31 May 2022 11:45 (15 minutes)

The extreme contrast ratios between stars and their planets at optical wavelengths make it challenging to isolate light reflected by exoplanet atmospheres. Yet, these reflective properties reveal key processes occurring in the atmospheres, and also span wavelengths that include potential O2 biosignatures. High resolution cross-correlation spectroscopy (HRCCS) offers a robust avenue for detecting exoplanet reflection spectra, where it is boosted by the addition of the numerous lines that the exoplanet reflects from its host star. Here, we report the deep contrasts achieved by our search for the reflected light spectrum of the non-transiting hot Jupiter 51 Peg b, using ground-based optical HRCCS from HARPS & HARPS-N on 3.5 metre telescopes. We have made specific adaptations to techniques originally designed to remove tellurics from infrared HRCCS to instead remove optical stellar lines. Importantly, we demonstrate that the so far neglected impact of broadening due to the difference between the stellar rotation and the planet's orbital velocity can significantly impact the recovery of reflected light spectra. We detect no significant reflected light from 51 Pegasi b, in line with predictions, achieving deep, ground-based upper limits on the contrast ratio of 76 ppm (7.60 x 10ˆ-5) when including broadening, and 24 ppm (2.40 x 10ˆ-5) without. These upper limits stringently rule out radius and albedo combinations of previously claimed detections for reflected light from 51 Peg b. We find that broadening significantly hinders HRCCS in extracting the reflected light spectra of most hot Jupiters as well as Earth-size planets in the traditional habitable zones of some M-dwarfs and thus must be accounted for when determining the contrast ratio, radius, and albedo of the planet. Finally, we suggest that using synthetic, rather than observed templates in reflection HRCCS, enables greater exploration of the properties of the exoplanet atmosphere, including abundances and dynamics.

Presenter: SPRING, Eleanor (University of Amsterdam)

Session Classification: Parallel session

Contribution ID: **55** Type: **not specified**

Chemical composition of the young massive cluster NGC 1569-B

Tuesday 31 May 2022 12:00 (15 minutes)

We present a detailed chemical abundance analysis of the YMC NGC 1569-B. The host galaxy, NGC 1569, is a dwarf irregular starburst galaxy located 3.4 Mpc away. We derive abundances of the α, Fe-peak, and heavy elements. Abundance ratios were determined from the analysis of an optical integrated-light spectrum of NGC 1569-B, obtained with the HIRES echelle spectrograph on the Keck I telescope. The derived composition of NGC 1569-B resembles the stellar populations of the YMC NGC 1705-1, located in a blue compact dwarf galaxy. The two YMCs agree in α-elements and the majority of the Fe-peak elements except for Sc and Ba, which are extremely super-solar in NGC 1569-B and higher than in any YMC studied so far. The blue part of the optical spectrum of a young population is still a very challenging wavelength region to analyse with IL spectroscopic studies. This is due to the uncertain contribution to the light from blue supergiant stars, which can be difficult to disentangle from turn-off stars even if resolved photometry is available. We suggest that the comparison of model fits at different wavelengths offers a route to determining the red-to-blue supergiant ratio from IL spectroscopy.

Presenter: GVOZDENKO, Anastasia (Radboud University Nijmegen)

Session Classification: Parallel session

Contribution ID: **56** Type: **not specified**

Detection of OH in the ultra-hot Jupiter WASP-76b

Tuesday 31 May 2022 12:15 (15 minutes)

Ultra-hot Jupiters have dayside temperatures at which most molecules are thermally dissociated. The dissociation of water vapour results in the production of the hydroxyl radical (OH). We report on the detection of OH in the atmosphere of the ultra-hot Jupiter WASP-76b using high-resolution transmission spectroscopy with CARMENES. Our detection shows that water is indeed being thermally dissociated on the limbs of this planet, and may thus explain the relatively weak water features observed for similar ultra-hot Jupiters. The observed signal is blueshifted with -13 km/s and we find a somewhat puzzling offset in the derived orbital velocity. Both may be explained by a limb asymmetry and the presence of strong winds in the upper atmosphere of WASP-76b.

Presenter: LANDMAN, Rico (Leiden University)

Session Classification: Parallel session

Contribution ID: **57** Type: **not specified**

The impact of time-dependent stellar activity on exoplanet atmospheres

Tuesday 31 May 2022 16:30 (15 minutes)

M-dwarfs are thought to be hostile environments for exoplanets. Stellar events are very common on such stars. These events might cause the atmospheres of exoplanets to change significantly over time. It is not only the major stellar flare events that contribute to this disequilibrium, but the smaller flares might also affect the atmospheres in an accumulating manner. In this study, we aim to investigate the effects of time-dependent stellar activity on the atmospheres of known exoplanets (GJ 876c, GJ 581c, and GJ 832c). We simulate the chemistry of the atmospheres that go from H-dominated to N-dominated atmospheres using observed stellar spectra from the MUSCLES-collaboration. We make use of the chemical kinetics code VULCAN and implement a flaring routine that stochastically generates synthetic flares based on observed flare statistics. Using the radiative transfer code petitRADTrans we also simulate the evolution of emission and transmission spectra. We investigate the effect of recurring flares for a total of 11 days covering 515 flares. Results show a significant change in abundance for some relevant species such as H, OH, and CH4. We find a maximum change of ˜12 ppm for CH4 in transmission spectra on GJ 876c. These changes in the spectra remain too small to observe. We also find that the change in abundance and spectra of the planets accumulate throughout time, causing permanent changes in the chemistry. We conclude this small but gradual change in chemistry arises due to the recurring flares.

Presenter: LOUCA, Amy (Leiden University)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **58** Type: **not specified**

Chemistry around AGB stars: a theoretical sensitivity study

Tuesday 31 May 2022 16:45 (15 minutes)

Asymptotic giant branch (AGB) stars are known to lose a significant amount of mass. Besides being interesting dynamical environments, the resulting outflows are rich astrochemical laboratories; close to a 100 chemical species and about 15 newly formed dust grains have been detected so far. They host interesting and unique chemical regimes thanks to the large gradients in temperature and density throughout the outflow. Moreover, chemistry and dynamics are closely linked throughout the outflow, making the study of molecules especially interesting to retrieve the specific physical conditions within AGB outflows. In this talk I will present the results of the first sensitivity study of chemistry in AGB outflows, using a 1D chemical kinetics framework. More specifically, we investigated the effect of the dynamics of the outflow, given by its density and temperature profile, on the chemistry of both C-rich and O-rich environments. I will focus on the envelope extents of parent species and compare to relations from the literature resulting from observational studies. We find that specific combinations of chemical species can help constrain the temperature profile throughout the AGB outflow in observations, an often uncertain parameter.

Presenter: MAES, Silke (KU Leuven)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **59** Type: **not specified**

The Mass and Composition of the LkCa 15 disk

Tuesday 31 May 2022 17:00 (15 minutes)

The total disk gas mass and elemental C, N, O composition of a protoplanetary disk are crucial ingredients for our understanding of planet formation. Measuring the gas mass is complicated as we lack the far-IR facilities necessary to observe HD, and the elemental abundances with respect to hydrogen are degenerate with gas mass in all disk models. We determined the gas mass and elemental abundances of C/H and O/H in the transition disk around LkCa 15, one of the few disks for which HD data are available, combining as many chemical tracers as possible. Using a grid of 60 azimuthally symmetric thermo-chemical Dust And LInes models, we translate the observed fluxes to elemental abundances and constrain the best fitting parameter space. The molecules that constrain the gas mass and carbon abundance the most are C(17)O, N2H+ and HD, but all other molecules are consistent with these values. We find that the gas mass of LkCa 15 is an order of magnitude lower than previously assumed. The C/O ratio is found to be close to unity, which is consistent with literature values of water depletion in the disk. The low level of carbon depletion in LkCa 15 is consistent with the young age of the disk, but contrasts with the higher depletions seen in older cold transition disks. This contrast suggests that long carbon depletion timescales contribute to the evolutionary trend seen in the level of carbon depletion among disk populations, rather than evolving temperature effects and presence of dust traps alone.

Presenter: STURM, Ardjan (Leiden University)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **60** Type: **not specified**

Irradiated but not eclipsed, the case of PSR J0610-2100

Tuesday 31 May 2022 17:15 (15 minutes)

In this talk, I will discuss results from radio timing observations of the black widow binary pulsar J0610-2100 and optical observations of its binary companion. The radio timing observations extend the timing baseline to 16 yr and reveal a marginal detection of the orbital period derivative, but they show no significant evidence of orbital variations such as those seen in other black widow pulsars. Furthermore, no eclipses are seen in the observations at observing frequencies ranging from 310 to 2700 MHz. The optical VRI light curves were modulated with the orbital period, reaching maximum brightness of V=26.8, R=25.4, and I=23.8 at superior conjunction of the companion, confirming irradiation of the companion by the pulsar. Modelling the light curves indicates that the companion is likely not filling its Roche lobe, while having a moderate inclination (i > 54 degrees). We find an unusually low temperature and a low irradiation for the irradiated hemisphere of the companion. We investigate the absence of radio eclipses in PSR J0610-2100 and in other black widow systems in relation to their binary, pulsar, and companion properties. We also discuss the suitability of PSR J0610-2100 for pulsar timing array observations aimed at detecting nano-Hertz gravitational waves.

Presenter: VAN DER WATEREN, Emma (ASTRON)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **61** Type: **not specified**

New insights into the Galactic magnetar population

Monday 30 May 2022 17:50 (15 minutes)

The nature and origin of magnetars is a key question across a range of research areas, from fundamental physics to transient astrophysics, where they have been invoked as the engines of a variety of transients including fast radio bursts. It is currently unclear whether magnetars are a common outcome of core-collapse events - only appearing rare due to their short active lifetimes - or if their formation requires an unusual progenitor pathway. In this talk, we present the discovery of new magnetar near-infrared (NIR) counterpart candidates from deep Hubble Space Telescope imaging. We characterise the Galactic magnetar population in terms of their NIR colours and magnitudes, identifying at least one bound companion candidate through comparison with population synthesis predictions. The remainder of the genuine NIR counterparts likely have their emission dominated by either magnetospheric processes or dust disk emission. We then present predictions for the photometric properties and velocities of unbound (runaway) companions to natal neutron stars, and finish by discussing applications, including Galactic magnetar runaway companion searches with proper motion surveys. Understanding the companions, systemic velocities and natal environments of magnetars at a population level is key to unveiling their origins.

Presenter: CHRIMES, Ashley (Radboud University Nijmegen)

Session Classification: Parallel session

Contribution ID: **62** Type: **not specified**

Indication of a Pulsar Wind Nebula in SN 1987A

Tuesday 31 May 2022 17:45 (15 minutes)

Since the day of its explosion, supernova (SN) 1987A has been closely monitored to study its evolution and to detect its central compact relic. In fact, the formation of a neutron star is strongly supported by the detection of neutrinos from the SN. However, besides the detection in the Atacama Large Millimeter/submillimeter Array (ALMA) data of a feature that is somehow compatible with the emission arising from a proto-pulsar wind nebula (PWN), the only hint for the existence of such elusive compact object is provided by the detection of hard emission in NuSTAR data up to 20 keV. I will discuss on the simultaneous analysis of multi-epoch observations of SN 1987A performed with Chandra, XMM and NuTAR. I will show comparison of the observations with a state-of-the-art 3D magnetohydrodynamic (MHD) simulation of SN 1987A. A heavily absorbed power-law, consistent with the emission from a PWN embedded in the heart of SN 1987A, is needed to properly describe the high-energy part of the observed spectra. The spectral parameters of the best-fit power-law are in agreement with the previous estimate, and exclude diffusive shock acceleration as a possible mechanism responsible for the observed non-thermal emission. The information extracted from our analysis are used to infer the physical characteristics of the pulsar and the broad-band emission of its nebula, in agreement with the ALMA data. Analysis of the synthetic spectra also show that, in the near future, the main contribution to Fe K emission line will originate in the outermost shocked ejecta of SN 1987A..

Presenter: GRECO, Emanuele (University of Amsterdam)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **63** Type: **not specified**

Dust properties in the Crab nebula: constraints from infrared emission polarisation

Tuesday 31 May 2022 18:00 (15 minutes)

For its numerous effects on the evolution of a galaxy, dust has been studied in detail ever since its discovery. Visible in emission in the infrared regime, its spectral energy distribution is a powerful tracer of many properties, when fit by physical dust models. There remains however a property of dust grains that has not yet been poked at extensively, potentially retaining some crucial information: the polarisation of light from scattering off dust grains. In this talk, we will present our latest results using SOFIA/HAWC+ C and D polarisation measurements of the Crab supernova remnant (SNR). Using radio synchrotron measurements, we remove the contaminating contribution of synchrotron polarisation, and derive supernova dust-only polarisation fraction and angle. From these new observations, we constrain the fraction of carbon grains, dust composition, temperature and mass of silicate- and carbon-rich grains, in the Crab Nebula. Constraining the dust composition and grain size in SNRs is vital to estimate the net SN dust production rate and to gauge their importance in building up galactic dust budgets.

Presenter: CHASTENET, Jeremy (Ghent University)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **64** Type: **not specified**

Water ice in the era of JWST - bridging laboratory work and astronomical observation

Tuesday 31 May 2022 18:15 (15 minutes)

Water ice has been found to be ubiquitous in quiescent molecular clouds and star-forming regions. It is formed on the surface of tiny dust grains located in cold environments (˜10K). Satellite missions have concluded that water enters protoplanetary disks mostly as ice, and may later be delivered to planets. This emphasizes the need of knowing the basic properties of water ice, which will be observed without precedent spectral resolution and sensitivity with the James Webb Space Telescope (JWST). Since the ‘90s the Laboratory for Astrophysics in Leiden has dedicated many studies to understanding the water ice properties. Most recently, an intrinsic property of water-ice, the temperature-dependent UV-vis refractive index was derived. These values are important to quantify scattering and absorption efficiencies when building ice-grain models to interpret the protostellar spectra. However, the results obtained in Leiden are substantially different from what has been used so far in the literature. In this work, we will present a brand-new water ice refractive index at different temperatures and also cover the mid-IR range, which is crucial for JWST. When these new values are used to construct ice-coated dust grains, we promptly see that old refractive index values may hide important water ice features, and consequently lead to a misinterpretation of the astronomical observations of the protostellar spectrum. The results presented here will be essential to also interpreting archival data of previous satellite and ground-based telescopes, as well as can be used in future projects targeting water ice in space.

Presenter: MONTEIRO ROCHA, Will Robson (Leiden University)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **65** Type: **not specified**

The (absence of) UV afterglows in Supernovae

Tuesday 31 May 2022 18:30 (15 minutes)

Recently an unexpected UV afterglow was reported for the Fast Blue Optical Transient AT2018cow. The most supported explanation for this event is currently a peculiar supernova, although other theories cannot be ruled out. Supernovae are expected to become redder over time, and not much research has gone into potential UV afterglows of such events. We investigate whether there are UV afterglows for more supernovae, potentially strenghtening the case for AT2018cow being a supernova.

Presenter: INKENHAAG, Anne (Radboud University Nijmegen / Leiden University)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **66** Type: **not specified**

Probing the highest-energy FRB repeater bursts using thousands of hour observing campaigns

Monday 30 May 2022 18:05 (15 minutes)

The burst energy distributions of repeating fast radio burst (FRB) sources are an important diagnostic of the emission process. To date, burst energy distributions have only been studied for a few active repeaters, and are limited both by telescope sensitivity (for the weakest and most common bursts) and on-sky time (for the brightest and rarest bursts). Though there is evidence for a characteristic lowest energy scale in the case of FRB 20121102A, the upper-limit to the burst energies of repeaters is poorly constrained. FRB 20201124A is one of the most active repeaters known, and it produces bursts that are easily detectable even with a modest 25-m radio telescope. We observed FRB 20201124A for more than 3500 hours over the last year, using multiple European radio dishes in Onsala, Stockert, Torun and Westerbork. We detected more than 50 high-fluence bursts (>10 Jy ms). All these bursts were detected at 1.4 GHz and showed no counterpart in simultaneously recorded 350-MHz or 5-GHz observations (in the cases when multi-frequency coverage was available). Our sample of detected bursts consists of some the brightest FRBs ever observed, with fluences ˜1 kJy ms. I will present this sample and show how it constrains the high-energy burst distribution of this source.

Presenter: OULD-BOUKATTINE, Omar (University of Amsterdam / ASTRON)

Session Classification: Parallel session

Contribution ID: **67** Type: **not specified**

Microsecond-duration bursts of FRB 20121102A

Monday 30 May 2022 16:35 (15 minutes)

Fast radio bursts (FRBs) are bright transient flashes of radio waves originating from extragalactic distances with an unknown origin. The FRBs observed to date typically last for order milliseconds. Bursts from FRB 20200120E, however, can be as short as 50 microseconds, and some of these bursts show sub-structure down to 60 nanoseconds. Probing FRB emission timescales constrains emission models. Motivated by the microsecond structure seen from some FRBs, we re-searched archival Green Bank Telescope data that targeted FRB 20121102A, the first-known repeater, at 4-8 GHz. Temporal broadening due to scattering is expected to be negligible at these high observing frequencies. Previous analyses of these data (see, e.g., Gajjar et al. 2018) detected close to one hundred bursts, with typical durations of 700 microseconds. We used the voltage data available through the Breakthrough Listen project to coherently dedisperse and search these data at 2 microsecond time resolution. We also employed a systematic subband search across the 4.5 GHz of available bandwidth. These searches have led to the discovery of multiple new bursts, some of which are extremely short in duration, with their entire burst envelope lasting only 5 microseconds. I will present an analysis of these bursts at 341 nanosecond time resolution, including an investigation of dispersion measure variations. This work demonstrates that there is a population of ultra-fast radio bursts that are undetectable by standard searches, and motivates us to further explore the transient phase space at microsecond time resolution.

Presenter: SNELDERS, Mark (ASTRON)

Session Classification: Parallel session

Contribution ID: **68** Type: **not specified**

A linear relation between outer galaxy radius and virial mass for galaxies 7 billion years ago from LEGA-C

Tuesday 31 May 2022 11:00 (15 minutes)

The relation between half-light radius and galaxy stellar mass has in recent years been studied extensively using large photometric surveys. This scaling relation has been found to be different for early types and late types, with different logarithmic slopes and zero points, and to evolve with time. While it provides important clues as to the assembly history of galaxies, the interpretation is limited without direct observations of the surrounding dark matter halo. And while the stellar mass of a galaxy is expected to be related to the total mass of its halo, the exact relationship is unclear due to the effect of local processes affecting star formation. A more direct link to the halo can be found from the observed virial mass derived from the dispersion of the motions of stellar bodies. I will present for 3000 galaxies the relation between the radius encapsulating 80% of a galaxy's light, and the virial mass, obtained from the LEGA-C survey. LEGA-C is the first spectroscopic survey combining sufficient depth and area to allow such a study for large numbers of galaxies looking back 7 billion years into the history of the universe. I will show that unlike for the well known half-light - stellar mass relation, both early types and late types lie on the same linear relationship.

Presenter: STRAATMAN, Caroline (Ghent University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **69** Type: **not specified**

The extreme dark matter haloes of gas-rich ultra-diffuse galaxies

Tuesday 31 May 2022 11:15 (15 minutes)

The formation of ultra-diffuse galaxies is one of the most actively discussed subjects in extra-galactic astronomy during the last years. Yet, no clear consensus has been reached regarding their evolutionary pathways, with a number of simulations producing UDG-like galaxies using very different feedback prescriptions and even with different dark matter haloes properties. In order to test such simulations it is necessary to improve the current observational constraints on UDGs; obtaining resolved kinematic measurements can be a powerful tool to such end. I will present results regarding recent HI interferometric observations on a sample of isolated gas-rich UDGs. Robust kinematic modelling shows that the galaxies have very low circular speeds for their baryonic mass, making them outliers of the baryonic Tully-Fisher relation and seemingly have very high baryon fractions relative to the cosmological average. Through the rotation curve decomposition of the galaxies, we find that their dark matter fractions are very low in scales as large as 10 kpc. Within the context of CDM, the only way to explain our observations is if UDGs have extremely low concentration parameters. Interestingly, we find that a tail of low-concentration haloes exists in the IllustrisTNG-50 simulations. Moreover, those haloes host significant gas reservoirs and have high baryon fractions, in resemblance to our observed gas-rich UDGs. Such haloes have on average higher spin parameters and later assembly times than haloes with normal concentrations, which could explain some of the observed properties of UDGs. However, while the simulated haloes have comparable densities to the observations within 8 kpc, they are systematically overdense within the inner 2 kpc. Potential solutions to reduce this problem include strong feedback (which might however be at odds with the high baryon fractions and late assembly times) or invoking self-interacting dark matter particles.

Presenter: MANCERA PIÑA, Pavel E. (University of Groningen)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **70** Type: **not specified**

Multi-band image simulations to unite the shear and redshift calibrations for weak lensing surveys

Monday 30 May 2022 18:05 (15 minutes)

Weak gravitational lensing, the deflection of light rays caused by the inhomogeneous matter distributions, has been a powerful tool for observational cosmology. While promising in the application, it is demanding to measure the weak lensing signals to the desired accuracy in practice. With the ever-growing statistical powers of weak lensing surveys, it is critical to address any potential systematic uncertainties for reliable outcomes. In this proposed talk, I will present some recent developments in the calibration techniques we conducted in the kilo-degree survey. Specifically, I will introduce the multi-band image simulations we built to calibrate both shear and redshift measurements.

Presenter: LI, Shun-Sheng (Leiden University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **71** Type: **not specified**

Implications for galaxy formation models from observations of Globular Clusters around Ultra-Diffuse Galaxies

Tuesday 31 May 2022 11:30 (15 minutes)

While the general properties of the very low surface brightness galaxies with large effective radii (recently been dubbed ”Ultra Diffuse Galaxies” or ”UDGs”) were once thought to be a challenge for the existing models of galaxy formation, the triumph of recent models in reproducing these properties erases most of the raised concerns in our understating of galaxy formation and evolution in the low-mass regime. However, the role and contribution of each model and process (i.e. stellar feedback and tidal interactions) in shaping the observed population of UDGs are not clear yet. In this regard, the globular clusters (GCs) of UDGs provide an avenue for discriminating among UDG formation/evolution models proposed in the literature. In this talk, I present an analysis of Hubble Space Telescope observations of GCs in UDGs in the Coma cluster, a sample that represents UDGs with large effective radii. I eliminate two significant sources of systematic uncertainty in studying GCs by using sufficiently deep observations that (i) reach the turnover of the GC luminosity function and (ii) provide a sufficient number of GCs with which to measure the GC number radial distribution. Using this data, I investigate the GC properties such as their luminosity function and spatial distribution around host galaxies, in a regime that these properties are highly uncertain. At the end of the talk and after presenting my main findings, I discuss why the observed GC properties, specifically the GC number and GC distribution around these six UDGs, pose challenges for several of the currently favoured UDG formation models.

Presenter: SAIFOLLAHI, Teymoor (University of Groningen)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **72** Type: **not specified**

Seeing the forest and the trees : a radio investigation of the ULIRG Mrk 273

Monday 30 May 2022 17:05 (15 minutes)

Galaxy mergers have been observed to trigger nuclear activity by feeding gas to the central supermassive black hole. One such class of objects are Ultra Luminous InfraRed Galaxies (ULIRGs), which are mostly late stage major mergers of gas-rich galaxies. Recently, large scale (~100 kpc) radio continuum emission has been detected in a handful of ULIRGs, all of which also harbour powerful AGNs. This hints at the presence of large scale radio emission being evidence for nuclear activity. Exploring the origin of this radio emission and its link to nuclear activity requires high sensitivity multi-frequency data. We present such an analysis of the ULIRG Mrk 273. Using the International LOFAR telescope (ILT), we detect spectacular large scale arcs in this system. This detection includes for the first time, a giant ~190 kpc arc in the north.We propose these arcs are fuelled by a low power radio AGN triggered by the merger.We also identify a bright ~ 45 kpc radio ridge, which is likely related to the ionised gas nebula in that region. We combine this with high sensitivity data from APERture Tile In Focus (Apertif) and archival data from the Very Large Array (VLA) to explore the spectral properties. The ILT simultaneously allows us to probe the nucleus at a resolution of ~0.3″, where we detect three components, and, for the first time, diffuse emission around these components. Combining this with archival high frequency VLA images of the nucleus allows us to detect absorption in one component, and a steep spectrum radio AGN in another. We then extrapolate from this case study to the importance of investigating the presence of radio emission in more ULIRGs and what it can tell us about the link between mergers and the presence of radio activity.

Presenter: KUKRETI, Pranav (University of Groningen)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **73** Type: **not specified**

The Atomic-to-Molecular Transition in IllustrisTNG: Exploration of HI Maps using Realistic UV Fields

Tuesday 31 May 2022 17:15 (15 minutes)

The state of the neutral interstellar medium critically affects the galactic star formation process and baryon cycle. Cosmological simulations which emulate galaxy evolution for a statistical sample of galaxies typically do not consider the transition of atomic to molecular hydrogen in the cold neutral medium. To compare the simulation output to observations, the atomic and molecular fractions are calculated via postprocessing recipes. Since ultraviolet radiation photodissociates molecular hydrogen these recipes usually depend on the local UV field, which is not tracked in cosmological simulations. In this work we improve upon previous dust-free UV field calculations by applying the dust radiative transfer code SKIRT to the TNG50 simulation of the IllustrisTNG suite at redshift zero. With these realistic UV fields and the high-resolution TNG50 simulation we compute maps of atomic hydrogen for a statistical sample of 12'000 synthetic galaxies. We compare the simulated maps to data from the WHISP survey via non-parametric morphologies and the HI column density distribution function. While the overall agreement is very robust, residual discrepancies mostly in the concentration and M20 indices remain. We conclude that the high spatial resolution achieved by TNG50 is integral to reproduce the atomic gas observed in nearby galaxies.

Presenter: GEBEK, Andrea (Ghent University)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **74** Type: **not specified**

Dust and nebular emission from star-forming regions: A new template library in SKIRT

Tuesday 31 May 2022 16:30 (15 minutes)

The current state-of-the-art cosmological simulations do not treat dust physics. Given the significant impact of dust on the observables, this is done at a post-processing stage. A number of post-processing studies using the SKIRT radiative transfer code have shown that the UV broadband fluxes and IR colors are a source of tension with observational data. Various reasons have been attributed to this mismatch, e.g., the limited resolution of the post-processed simulations could be in part responsible for inadequate dust heating. At the same time, it is very likely that some inadequacies stem from the sub-grid physics employed. The UV flux and dust heating are strongly impacted by the treatment of star-forming regions in the post-processing radiative transfer simulations, for which SKIRT currently employs the MAPPINGS-iii set of templates. In the present work, we explore a new template library for star-formation regions in SKIRT aimed at improving the shortcomings of the previously used templates. An effort has been put to make these templates physically motivated. We take into account stellar feedback due to mechanical luminosity and radiation pressure, as well as the gravitational force on the gas around the stellar clusters. In this talk, we present the results obtained using the new library. We use the Auriga zoom simulation suite as our test-bed and discuss global SEDs, resolved MIR-FIR colors, and the multi-wavelength morphology of these galaxies vis-à-vis MAPPINGS-iii.

Presenter: KAPOOR, Anand Utsav (Ghent University)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **75** Type: **not specified**

Star + black hole = neutrino?

Monday 30 May 2022 16:50 (15 minutes)

The origin of most high-energy neutrinos is unknown. They have thus far been observed in coincidence with time-variable emission from three different types of accreting black holes: a gamma-ray flare from a blazar, an optical transient following a stellar tidal disruption, and an optical outburst from an active galactic nucleus. I propose a unified explanation for the latter two of these sources: accretion flares that reach the Eddington limit. A signature of these events is a luminous infrared reverberation signal from circumnuclear dust. Using this property, we construct a sample of similar sources, revealing a third event coincident with a PeV-scale neutrino. This sample of three accretion flares is correlated with high-energy neutrinos at the 3-sigma level.

Presenter: VAN VELZEN, Sjoert (Leiden University)

Session Classification: Parallel session

Contribution ID: **76** Type: **not specified**

Nonparametric consistency test between observations and astrophysical models

Monday 30 May 2022 14:10 (15 minutes)

The common practice of model validation in statistical methods is not as widespread in astronomy. Too often, models are assumed to describe observations even when there is no agreement between the two. To improve this, we propose a practical framework for assessing the consistency between observations and astrophysical models in a model-independent manner. The consistency test uses a combination of nonparametric methods and distance measures to obtain a test statistic that evaluates the closeness of the astrophysical model to the observations; hypothesis testing is then performed using a bootstrap sample. The ultimate goal of this project is to build an easy-to-use consistency test for multiple scenarios such as density models and regression models.

Presenter: STOPPA, Fiorenzo (Radboud University Nijmegen)

Session Classification: Plenary Session

Contribution ID: **77** Type: **not specified**

The MICADO Atmospheric Dispersion Corrector

Tuesday 31 May 2022 17:30 (15 minutes)

Atmospheric dispersion, the wavelength dependent differential refraction of light passing through the atmosphere, will cause severe degradation of image quality and contrast on the upcoming Extremely Large Telescope (ELT). Although the effect is the most severe at short wavelengths and low observing altitudes, the high resolution of the ELT causes atmospheric dispersion to be a problem well into the near-infrared. To counteract this adverse effect, MICADO will employ an Atmospheric Dispersion Corrector (ADC), which aims to reduce the dispersion to below 2.5 milli arcseconds. In this presentation, I will provide an overview of this component, including the design and the present status. I will also discuss a new method that will be used to validate the performance at the milli arcsecond level as soon as on-sky observations start at the end of 2027.

Presenter: VAN DEN BORN, Joost (University of Groningen)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **78** Type: **not specified**

Constraining the Galactic Centre environment with hypervelocity stars in Gaia

Tuesday 31 May 2022 17:00 (15 minutes)

Following a close dynamical encounter with Sgr A, *stellar binaries in the Galactic Centre (GC) can be tidally separated. One member star remains bound to Sgr A* and the other is ejected as a hypervelocity star (HVS) with a velocity beyond the escape speed of the Milky Way. The abundance and properties of these objects can provide insight into still-uncertain aspects of the stellar environment in the inner parsec of the Galaxy. We perform a suite of simulations ejecting HVSs from the GC, focusing on those which would appear in current and/or future data releases from the Gaia space mission with precise astrometry and measured radial velocities. We show that the current known lack of confident HVS candidates in Gaia Early Data Release 3 places competitive constraints on the shape of the stellar initial mass function in the GC and the ejection rate of HVSs from the GC, complementing existing constraints. These constraints will improve further as more HVS candidates are unearthed in future Gaia data releases. This work represents the first time constraints have been obtained on the GC stellar environment using Gaia data alone.

Presenter: EVANS, Fraser (Leiden University)

Session Classification: Parallel Session: Extreme Astrophysics / Galaxies & Cosmology

Contribution ID: **79** Type: **not specified**

Stellar streams in the solar neighbourhood

Tuesday 31 May 2022 12:15 (15 minutes)

Gaia eDR3 (and soon DR3) has revealed a number of kinematic groups in the solar neighbourhood. Some of these are now well know major accretion events such as Gaia-Enceladus-Sausage and Sequoia. Other smaller groups have been identified and their nature is not fully understood. Here I will present a method to extend the local spectroscopic sample by extrapolating the orbits of less-prominent groups identified in velocity space. This methods allows for the identification of potential new members of such groups using only tangential velocities and parallaxes alone i.e. without the need of additional radial velocities. This technique can enable the targeted follow-up of potential members of cold stellar streams that happen to cross the solar neighbourhood. As a test case, I will present the results for one small group of stars, clustered in velocity space, that is likely a unreported cold stellar stream.

Presenter: BALBINOT, Eduardo (University of Groningen)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **80** Type: **not specified**

Importance of stable mass transfer and stellar winds for the formation of gravitational waves sources

Monday 30 May 2022 17:20 (15 minutes)

The isolated formation channel is one of the most studied formation scenarios for stellar mass black hole binary (BBH) mergers detected by LIGO and Virgo. Focusing on the effects of uncertain stellar and binary physics, we investigate this BBH formation channel using the rapid binary population synthesis code SeBa. Regardless of our assumptions, the two must common formation path within the isolated binary scenario involves (i) a stable mass transfer followed by a common envelope evolution or (ii) two stable mass transfers. I will show that uncertainties in the first stable mass transfer can have a significant effect on the relative importance of these two channels. Based on a number of model variations that I simulated, I will show that merger rate of the channel with two stable mass transfers can change an order of magnitude depending on what we assume about the angular momentum lost from the system and the mass accretion efficiency during the first mass transfer phase. At the same time, the merger rates of the common envelope channel can be significantly lower than previously predicted, if we update our models based on recent developments on the mass transfer stability criteria with giants with radiative donors and predictions about at what stage the star develops a deep convective envelope.

Presenter: DOROZSMAI, Andras (University of Amsterdam / University of Birmingham)

Session Classification: Parallel session

Contribution ID: **81** Type: **not specified**

Constraining the Milky Way Galactic Center properties with hypervelocity stars

Tuesday 31 May 2022 11:45 (15 minutes)

I will present my group's work on exploiting ongoing Gaia data releases to constrain the hardly observable properties of our own Galactic Center exploiting rare unbound stars, that are ejected from the vicinity of SgrA* and travel on unbound orbit through the Milky Way Halo.

Presenter: ROSSI, Elena Maria (Leiden University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **82** Type: **not specified**

Willem de Graaffprijs

Monday 30 May 2022 20:00 (20 minutes)

Session Classification: Prize Ceremonies & Reception

Contribution ID: **83** Type: **not specified**

New approach to planetesimal formation: clusters of heavy particles in two-dimensional Keplerian turbulence

Planetesimal formation in protoplanetary disks is still one of the major open questions in planet formation theory. It is known that solids can't grow up to asteroid size relying on sticking after pairwise collisions only, due to the fragmentation barrier and the drift barrier. A possible solution is to form dense particle clumps, with low velocity-dispersion, that can then collapse under self-gravity. Streaming instability is the most popular mechanism for concentrating dust particles and it can be seen as a turbulent mechanism. Turbulence in disks is then critical for planetesimal formation. In this context, we want to study the dynamics of particles in turbulent flows with Keplerian rotation and shear. To treat this astrophysical problem we use fluid-dynamics methods, trying to provide innovative perspectives on this challenging question. We perform 2D direct numerical simulations using the shearing box approach and we explore various values of the rotation frequency Ω and the solid stopping time ts, a parameter related to the particle size. We then analyse the results using tools borrowed from the study of dynamical systems. In particular, the Lyapunov dimension dL is calculated for each run to characterize the dust dynamics in the flow. This quantity gives an estimation of the fractal attractor dimension in the phase space. We find three different regimes. For low values of Ω and large values of ts we obtain dL > 2, therefore the inertial particles fill the whole space. Focusing instead on intermediate values of ts, for small rotation rates the particles are expelled from the eddies and form fractal structures, while they tend to concentrate inside the anticyclones for larger Ω. Particles eventually form a pointwise cluster for dL = 0. We have identified promising tools for the understanding of planetesimal formation.

Presenter: GEROSA, Fabiola Antonietta (University of Cote d'Azur)

Session Classification: Parallel Session: Compact objects, Stars, & Planets

Contribution ID: **84** Type: **not specified**

The dynamical state of star forming molecular gas as viewed by PHANGS

Monday 30 May 2022 14:50 (15 minutes)

The kinematics of molecular gas on cloud scales are a sensitive probe of the boundary conditions for star formation. Until recently, such measurements were only available for cloud populations within the Local group (including our own MW). But now, new survey capabilities are expanding our view of gas motions to a greater diversity of galactic environments, providing unprecedented constraints on the process of star formation in prototypical 'star forming main-sequence' galaxies. These observations hold the key to building a full picture for the characteristic inefficiency of star formation. I will summarize results from the PHANGS/ALMA survey that suggest a more dynamic view of the star-forming medium than the idea of cold, dense gas organized into discrete virialized objects. Strong deviations from approximate virialization consistently occur in environments with high shear, short orbital times and deep stellar potential wells, indicating that the gas in these regions is strongly coupled to the galactic potential.

Presenter: MEIDT, Sharon (Ghent University)

Session Classification: Parallel Session: Galaxies & Cosmology

Contribution ID: **85** Type: **not specified**

MESSIER Surveyor

Monday 30 May 2022 18:20 (15 minutes)

Presenter: VALLS-GABAUD, David (Observatoire de Paris)

Session Classification: Parallel Session: Galaxies & Cosmology