# Abstracts – Talks

Jens Jasche, SU OKC

**Large-scale dynamics of the Universe**

Joel Johansson, Uppsala university

**Four ways of looking at a supernova: resolving the multiple images of iPTF16geu**

iPTF16geu is the first gravitationally lensed type Ia supernova with resolved multiple images. Being a standard-candle supernova, with well-known intrinsic brightness and color, we can use it to probe the foreground lensing galaxy and constrain models of the lensing. I will present results from our recent series of papers on this object; measuring its spectral and photometric light-curve evolution, differential dust extinction, time delays and lensing magnifications for the individual SN images. To conclude, I will discuss the role of substructures in the lensing galaxy and implications for observations of future strongly lensed SNe.

Mattia Bulla, Stockholm University (Nordita from Oct 1, 2019)

**Electromagnetic counterparts of gravitational-wave events: linking models to observations**

The detection of an electromagnetic counterpart to the gravitational-wave source GW 170817 marked year zero of the multi-messenger gravitational-wave era. This event was generated by the merger of two neutron stars and gave rise to an electromagnetic transient, dubbed a kilonova, which was intensively monitored with all the main ground-based and space-borne facilities. Kilonovae will be routinely discovered in the coming years and our progress in multi-messenger astronomy will therefore be hampered by our ability to connect future observations to available hydrodynamical models. In this talk, I will show how radiative transfer calculations can provide such connection, predicting synthetic observables - as light curves, spectra and polarization - that can be used to both interpret data and place constraints on models. In particular, I will present my Monte Carlo radiative transfer code POSSIS and show predictions for some multi-dimensional kilonova models available in the literature.

Ana Sagués Carracedo, The Oskar Klein Centre, Stockholm University

**Detectability of Kilonovae with Zwicky Transient Facility**

Gravitational wave (GW) detections have revolutionized physics and astronomy by probing the theory of General Relativity. In August 2017, the observation of the kilonova (KN) AT2017gfo, as the electromagnetic counterpart of GW170817, produced by a binary neutron star merger opened a new era in multi-messenger astronomy. The electromagnetic identification and follow-up of future detections are crucial for understanding the underline physics of these events. The Zwicky Transient Facility (ZTF) survey plays a vital role in the localization and identification of electromagnetic counterpart of GWs. In order to perform efficient searches for KN candidates, it is essential to study the sensitivity and limitations of ZTF regarding the observation of KNe. In this talk, I will show the results of survey simulations of KNe based on theoretical models, and I will discuss the optimal searching strategy.

Dennis Alp, KTH Royal Institute of Technology

**X-Ray and Gamma-Ray Emission from Core-collapse Supernovae**

During the first few hundred days after the explosion, core-collapse supernovae (CCSNe) emit down-scattered X-rays and gamma-rays originating from radioactive line emissions, primarily from the 56Ni to 56Co to 56Fe chain. I will describe how the high-energy emission propagates through the ejecta and what we can learn from high-energy observations. This is connected to the explosion mechanism of CCSNe and has been an active research field for several decades. Recent progress allows us to investigate self-consistent 3D explosion models for the first time. We find that the current frontrunner, the delayed neutrino-heating mechanism, is consistent with available data and that high-energy emission constrains progenitor models. Finally, we look toward the future and find promising possibilities with the NuSTAR hard X-ray telescope.

Sofia Ramstedt, Uppsala universitet

**Binary interaction in evolved stars studied with ALMA**

Sara Bladh, Uppsala University

**Mass loss in metal-poor AGB stars**

Mass loss plays a key role for the evolution during the Asymptotic Giant Branch (AGB) phase; for estimating the lifetime of individual AGB stars, but also for evaluating how much these stars contribute to the dust production and the enrichment of heavier elements in the interstellar media. Wind models that can predict accurate mass-loss rates are therefore crucial for understanding the stellar evolution on the AGB phase. This is especially important at lower metallicities, where it is still an open question how much AGB stars contribute to the interstellar dust production. Studies of the wind mechanism in AGB stars have up till now almost exclusively been focused on wind models at solar metallicity. In this talk I will present recent results from state-of-the-art wind models of carbon stars and OH/IR stars at sub-solar metallicities, showing how properties such as mass-loss rates, grain sizes and dust-to-gas ratios are affected by a decrease in metallicity.

Andreas Korn, Uppsala universitet

**New abundances for old stars**

The theoretical notion that long-lived late-type stars like the Sun suffer from atmospheric elemental depletion is decades old. Such effects, collectively referred to as atomic diffusion, have bearing on a wide range of topics in stellar astrophysics, from the solar modelling problem to cosmological lithium. Observational evidence for the reality of this effect was first published in 2006. We have since then systematically explored atomic diffusion at various metallicities, with 100s of hours of observing time at the VLT. The picture that emerges is that one of the main tracers of Galactic chemical evolution - turnoff-point stars - cannot straightforwardly be used to study the Galaxy, especially at low metallicities. Correcting stellar compositions, and to a lesser extent isochrone ages, for atomic diffusion is at present hampered by our incomplete knowledge of counteracting mixing effects at the bottom of the convective envelopes of these stars. How can the situation be remedied?

Torbjörn Sundberg, FOI
**Space Situational Awareness in the Era of Mega-Constellations**

Carlos José Díaz Baso, Institute for Solar Physics, Dept. of Astronomy, Stockholm
**UniversityDeep Learning in Solar Physics**

During the last decade, deep learning has emerged as a powerful tool to extract the relevant information from observations. Using very deep and complex neural networks one can improve the performance of specific tasks, which are much better that the classical algorithms. Here, I will present some examples of how we have successfully applied deep learning to several problems in Solar Physics and highlight our results related to fast image reconstruction, 3D inversion of the Stokes parameters, and noise reduction in observational data.

Dan Kiselman, Inst. f. Solar Physics, Dept. of Astronomy, Stockholm University
**The European Solar Telescope**

The European Solar Telescope, EST, is a planned 4-m solar telescope. EST will be optimised to study the magnetic coupling between the layers in the solar atmosphere: from the deep photosphere to the upper chromosphere. This will require diagnostics of the thermal, dynamics, and magnetic properties of the solar plasma over many scale heights. To achieve these goals, the EST must use a suite of instruments that can simultaneously and efficiently produce 2D spectropolarimetric data with high spatial and temporal resolution. EST will be located on one of the Canary Islands of La Palma and Tenerife. EST is included in the Road Map of the European Strategy Forum on Research Infrastructures (ESFRI). EST is promoted by EAST – The European Association for Solar Telescopes which has 26 scientific institutes from 18 European countries as members. I will review the EST project, its scientific background, and the latest political developments.

Karin Lind, SU
**Modelling the CaII NIR triplett in stellar spectra**

The near-infrared CaII triplet lines are of central importance to ongoing and future million-star surveys of Milky Way. Its importance for radial velocity, fundamental parameter and abundance determination of stars has long been recognised, but we have also identified severe shortcomings of traditional 1D LTE photospheric formation. In this talk I will demonstrate how 3D non-LTE modelling improves the situation and the potential impact on Galactic archaeology studies.

Sara Rezaei Kh., Chalmers / MPIA
**3D map of the dust distribution towards the Orion-Eridanus superbubble with Gaia DR2**

We present a study of the 3D distribution of dust towards the Orion-Eridanus superbubble, a nearby expanding structure that spans more than 1600 square degrees in the sky. We use Gaia DR2 photometry and parallax together with photometry from 2MASS and WISE to get distances and extinctions for stars towards this region. We have developed a new method of mapping the dust distribution in 3D that considers neighbouring correlations using the Gaussian Processes, using which we derive the probability distribution of dust density at any arbitrary point towards the Orion-Eridanus region. Using the resulting maps, we examine the

relation of the inferred 3D structure with the gas dynamics and the magnetic field morphology observed toward this prototypical object.

Tanja Nymark / Urban Eriksson, Vetenskapens Hus / Högskolan i Kristianstad

**The Star-Spotting Experiment – Measuring Light Pollution**

In order to increase public awareness of light pollution, while at the same time inspiring young people to greater interest in astronomy, the citizen science project "The star-spotting experiment" was launched in February in collaboration with the organization Public and Science. In the Star-spotting experiment the public, and in particular school classes, are invited to contribute to research on light pollution by observing the sky and reporting the number of stars that they can see by their naked eye. By collaborating with school classes from all over Sweden we are able to gather a large number of observations which will help us create a map of the variation in light pollution across the country. At the same time the teachers get access to new pedagogical material, while the children get a hands-on insight into the scientific method. In this talk we will present the background to the project, demonstrate the observing method, and present the results from the first collecting period.

Carina Persson, CTH

**On exoplanets and the CHEOPS mission**

Michiel Lambrechts, Lund University

**How the radial pebble flux determines a terrestrial-planet or super-Earth growth mod**

Around 1/3 of all solar-like stars host super-Earths, planets with sizes between Earth and Neptune. We argue that these planets did not only grow through mutual accretion of planet embryos, as previously advocated. Instead, we numerically show that super-Earths can form by a combination of pebble accretion, type-I migration and N-body gravity between embryos. Typically, planets are in the 10 Earth-mass range, bounded by the pebble isolation mass. In the subsequent dynamical evolution of these compact systems after disc dissipation, instabilities generally trigger additional merging events that dislodge the system from resonant chains. If the pebble flux is too low for the formation of super-Earths, by a factor two, we instead find a terrestrial-planet formation mode where, after disc dissipation, Mars-mass embryos form Earth-like planets. We will highlight promising aspects of this model with respect to understanding our exoplanet sample, but also cover outstanding challenges.

Alexander Mustill, Lund Observatory

**White dwarfs and dead planetary systems**

White dwarfs provide a crucial insight into the lives and deaths of planetary systems. Around 50% have detectable heavy elements in their atmospheres from the recent or ongoing accretion of planets or asteroids: this permits a comparison of the bulk compositions of extra-Solar planets and asteroids with the planets and asteroids of our own Solar System. This material is thought to arrive at the white dwarf through dynamical interactions with other planets in the system, and goes through tidal disruption, pulverisation and vaporisation---evidenced by dust and gas discs observed around many white dwarfs---before its eventual accretion. In this talk, I discuss the physical nature of the asteroids, dust, and gas discs orbiting white dwarfs (Izquierdo,..., Mustill et al, 2018, MNRAS; Manser,..., Mustill et al, 2019, Science), and dynamical pathways for the delivery of this material to the region close to the white dwarf from distant asteroid belts (Mustill et al 2018, MNRAS).

E. S. Wirström, P. Bjerkeli, Chalmers

**Water on the Galilean moons as observed with JUICE/SWI: 3D radiative transfer predictions**

The icy Galilean moons all have tenuous atmospheres. While direct observations of them are scarce, water is likely one of the main components, especially close to the sub-solar point (SSP) where water ice readily sublimates. Plumes of volatile sub-surface material may also contribute to the atmospheric composition. The Submillimeter Wave Instrument (SWI) on ESAs JUICE mission will observe rotational transitions of atmospheric water at spatial resolutions ranging from several moon radii down to one km. However, well-established radially symmetric non-LTE radiative transfer models are not able to predict and interpret spectral line profiles in observations where properties vary within the beam, as around the SSP. We have adapted the fully 3D, non-LTE line radiative transfer code LIME to planetary scales. Here we present modelled water line properties for a set of distances and viewing angles relevant for the JUICE mission and discuss implications on SWI data interpretations.

Katrin Ros, Lund University

**Icy pebble growth at the water ice line in protoplanetary discs**

An important step towards planet formation in protoplanetary discs is the growth from micrometre-sized dust to centimetre-sized pebbles. At ice lines, radii where a volatile goes from vapour to solid form, particles can grow by vapour deposition. However, the presence of dust may hinder growth to large sizes, as vapour is spread over the combined dust surface area. We model particle growth by deposition at the water ice line in a local dynamical model, and implement experimental results showing that a higher water vapour pressure is needed for nucleation of the first ice layer on dust particles, as compared to continued deposition on already ice-covered particles. This leads to the inhibition of nucleation on bare dust grains, while deposition of vapour on icy grains is efficient, resulting in two particle populations: micrometre-sized bare dust grains diffusing out over the disc, and fast-growing icy pebbles reaching centimetre-sizes in a few thousand years close to the ice line.

Emiliya Yordanova, IRF-U

**On space weather**

Simona Pirani, LU

**The early migration of Jupiter**

Brian Thorsbro, Lund Observatory

**Clues to galaxy formation from chemical abundances of stars in the Galactic center**

We report the first high spectral resolution study of 20 M giants kinematically confirmed to lie in the Galactic Nuclear Stellar Cluster within a few parsecs of the Galactic Center, using R = 24,000 spectroscopy from Keck/NIRSPEC and a new line list for the infrared K band. We consider their luminosities and kinematics, which classify these stars as members of the older stellar population and the central cluster. We show their metallicities to be super solar and present their interesting alpha abundances. We connect these results to chemical evolution models and show how they can provide clues to the formation of our Galaxy.

Jouni Kainulainen, Chalmers University of Technology

**Towards a new generation of star formation rate models**

Understanding star formation in the interstellar medium (ISM) is one of the central themes in explaining the assembly of the universe as we know it. Despite its importance, a holistic picture of star formation remains fundamentally lacking. As a consequence, the most commonly used star formation laws today are empirical relations—not models based on gas physics. However recently, key advances have been made in our ability to probe the physical processes relevant for star formation, covering a wide range of relevant scales from micro- to macrophysics of star formation. In this contribution, I will describe how these advances are expected to enable progress in developing physically-motivated, observationally-constrained star formation rate models. I summarise the work of our newly-established group at Chalmers in this field, especially concentrating in studies of the ISM structure in the Milky Way and the link between that structure and star formation.

Jonathan C. Tan, Chalmers

**Formation of Supermassive Black Holes in the Early Universe**

The origin of supermassive black holes (SMBHs) is one of the major unsolved problems of astrophysics. I discuss a scenario of formation from supermassive Pop III.1 stars. These are primordial composition first collapse objects unaffected by any external influence from other astrophysical sources. The key process that can allow growth of the stars to ~10^5 Msun is dark matter annihilation heating, which replaces nuclear fusion as the means of support. For this mechanism to be effective places constraints on the dark matter particle and also requires colocation of the protostar with the dark matter density peak - a situation which only occurs in Pop III.1 minihalos. Key features of the model are: (1) it naturally explains the minimum mass scale of SMBHs and the dichotomy of this scale from those of normal stars; (2) it is simple, with just one main parameter, (3) and is thus predictive, i.e., to form all SMBHs in this way requires them to all form at z~30 with low levels of clustering.

# Abstracts – Posters

Alexis Lavail, Uppsala University
**Magnetic fields of T Tauri stars**

Magnetic fields play a crucial role throughout the entire lifetime of cool stars. In the pre-main-sequence, particularly, stellar magnetism influences or rules many processes and mechanisms. Yet, our understanding of cool stars, magnetism - even of solar magnetism - is far from complete. An outstanding open question concerns the origin of the magnetic fields of main-sequence A/B type stars and pre-main-sequence Herbig Ae/Be stars, which seem to be inherited from an earlier evolutionary phase: likely the T Tauri phase. I will present results from observations of low-mass and intermediate-mass T Tauri stars with high-resolution near-infrared spectroscopy and our efforts to characterize their surface magnetic fields.

Ivalu Barlach Christensen, Lund University
**Abundances of Giant Stars in the Local Disk: Manual Analysis of Infrared APOGEE Spectra**

I will present the ongoing work to determine elemental abundances using giants in the local disk. Abundance of the elements Na, Mg, Si, S, Ti, Ni, Cu, Ce and P have been determined so far using Spectroscopy Made Easy (SME) by synthesizing a spectrum compared to the observed spectrum with line of interest. The abundance determination of these elements are compared to APOGEE and previously determined optical abundances of the same stellar sample. Investigating the abundances through the evolution of the Milky Way allows to put constraints the Galactic chemical evolution models. Elemental abundances are great tracers of the Galactic chemical evolution. The stellar sample consist of 187 giants in the local disk from APOGEE with a high resolution of ~22 500 and signal-to-noise of above ~100. The stellar parameters of these stars have been determined in the optical in order to be as independent from APOGEE as possible.

Andri Spilker, Chalmers
**Resolving scaling relations of star formation**

A crucial aspect in interpreting the scaling relations relevant for star formation,Äîthe Kennicutt-Schmidt relation and the Larson relations,Äîis how those relations depend on the size-scale. This is especially so when comparing relations derived from unresolved, extra-Galactic data to those derived from resolved, Galactic data. We present an experiment in which the Solar neighborhood (distance < 2 kpc) is examined from the outside, with the aim to unveil the connection between the true, "resolved" properties of star-forming regions and their beam-averaged, "unresolved" properties. To do so, we examine the velocity, density, and star formation statistics in the Solar neighborhood and determine how they appear when viewed through apertures of various sizes. We employ the CO molecular cloud data identified by Gaussian decomposition by Miville-Deschenes et al. (2016), and density statistics and star formation rates of individual molecular clouds from the literature. In this way, we connect

Sandra Patricia Treviño Morales, Chalmers University of Technology

**Evolutionary sequence of high line-mass filaments**

The study of filaments is undergoing a revolution, thanks to the unprecedented high angular resolution and sensitivity that ALMA provides. We have performed a sensitive fragmentation and dynamical study of two high line-mass filaments in different evolutionary states. The dense integral-shape filament (ISF) in Orion A, and the quiescent infrared-dark cloud G357. For the ISF, we identify fragmentation and clustering in different scales, with cores strongly grouped along the filament. We find a lower number of fragments in G357. These fragments do not seem to be grouped but have similar intensities/masses as those found in the ISF. G357 also show complex kinematics, where it is possible to identify gas infalls/outflows associated with different fragments, suggesting different stages of star formation. The comparison of the fragmentation and dynamics of G357 and the ISF provide the first observational constraints for the evolutionary sequence of fragmentation in massive filaments.

Malcolm Druett, Stockholm University

**Using tracer particles to study the density variations of fibrils**

We present 3D radiation-MHD simulations of the Sun, from the corona to the convection zone, using the Bifrost code with the new "corks" module to address the question, "what are the physical mechanisms that supply the solar chromosphere with mass?" These passive tracer particles allow us to follow the experiment from a Lagrangian frame, alongside the Cartesian. Corks are injected and pruned from the simulation in order to avoid voids and gluts of corks that result from compressing and expanding flows. We select the tracer particles in a number of fibrils at a given timestep, then trace forward and backward in time. This displays the origins and destinations of the plasma elements, as well as the changes to mass density, height, and temperature over time. The forces and agents responsible for these changes are inferred. This highlights the differing degrees to which fibrils can be used as a proxy of horizontal and vertical magnetic field components.

Carmen Toribio, Onsala Space Observatory

**The Onsala Space Observatory support for Swedish astronomers**

Onsala Space Observatory (OSO), the Swedish National Infrastructure for Radio Astronomy, provides full support for Swedish scientists to use several radio telescopes around the world: ALMA, EVN, APEX, LOFAR, the future SKA, as well as local facilities (20-m telescope, 25-m telescope). I will give an overview of all the support provided at OSO and particularly on the support for ALMA users provided by the Nordic ARC node. Our mission at the Nordic ARC node is to fully support all ALMA users, primarily in the Nordic and Baltic countries, from proposal development and submission, to observation preparation, and data reduction and analysis, as well as support of ALMA archival science. In addition, we also offer specialist scientific and technical expertise. This includes imaging techniques such as multi-frequency synthesis and polarimetric imaging, optimised self-calibration and astrometry, and the development of dedicated analysis software tools.

Nirmal Iyer, KTH

**Balloon borne focusing X-ray polarimeters X-Calibur and XL-Calibur**

Hard X-ray polarimetric observations of neutron stars, magnetars, and black holes can give qualitatively new information about the geometry and properties of the X-ray emission regions, and can test fundamental laws of physics in regimes that cannot be probed in terrestrial laboratories. Sensitive balloon-borne polarimeters are playing a key role in advancing this field. Recently, the X-Calibur mission made the first ever X-ray polarisation measurements of an accreting X-ray pulsar GX 301-2, during a ballon flight conducted from Antarctica. This presentation will summarise these results on GX301-2 and highlight how such observations can be further improved upon through a series of planned balloon flights in 2021-2024 with a next generation hard X-ray polarimeter XL-Calibur. XL-Calibur is conducted as a collaboration between the X-Calibur team and the PoGO+ team who previously conducted hard X-ray polarimetric observations of the Crab and the black-hole binary Cygnus X-1.

Christer Sandin, Nordita

**Effects of drift in state-of-the-art models of C-rich AGB star winds**

We present results of state-of-the-art radiation hydrodynamic models of dust-driven winds of C-rich asymptotic giant branch stars, which include effects of gas-to-dust drift. Because of modeling complexity when including drift in such models, effects of drift were up to now assumed unimportant. Using unprecedented models in both physical detail and numerical accuracy - we calculate new models using frequency-dependent radiative transfer at high spatial resolution. In comparison to existent results of other stellar wind models of a different origin, our model values show significant to drastic shifts of physical properties that suggest modified interpretations of observations.

Dainis Dravins, Lund Observatory

**Stellar Atmospheres behind Transiting Exoplanets**

Spatially resolved, high-resolution spectra across stellar disks are obtained using transiting exoplanets as probes. During a transit, successive stellar surface portions become hidden and differential spectroscopy between various transit phases provide spectra of temporarily hidden surface segments. Such spectra have been retrieved for HD209458 (G0 V) and HD189733A (K1 V), with additional targets expected from ongoing exoplanet searches. Line-profile changes from disk center toward the limb reflect atmospheric fine structure and are modeled with 3D hydrodynamics. Knowing the gradually changing stellar background spectrum along the transit path is required for any more precise atmospheric studies of transiting exoplanets.

Dan Kiselman, Svenska astronomiska sällskapet

**Astronomdagarna**

The classic poster on the history of the Astronomdagarna event will be brought up to date.

Jon Grumer, Theoretical Astrophysics, Uppsala University

**Kilonovae and the origin of the r-process elements: Atomistic non-LTE spectral modelling**

The cosmic origin of elements beyond iron in the periodic table is a long-standing puzzle. One of the main astrophysical highlights of the last decade is thus without doubt the indication of rapid neutron-capture (r-process) nucleosynthesis of heavy elements in the kilonova ejecta following the neutron-star merger gravitational-wave event detected in 2017. The indications that the late-time light is dominated by high-opacity, r-process-element-rich ejecta introduces new demands on fundamental atomic data as input to the collisional-radiative spectral modelling, particularly of the infrared spectral region in largely uncharted territories of the periodic table. In this contribution we will discuss the complexity of the elements contributing highest opacity, outline our approach to the spectral modelling and present some new results based on atomic data determined with state-of-the-art atomic structure methods.

Lars Mattsson (on behalf of the Nordita Astrophysics group), Nordita, Stockholm University

**Astrophysics @ Nordita**

The Nordita astrophysics group is mainly devoted to research in theoretical astrophysics, numerical simulations and big-data methods (e.g. applications of machine learning). A fraction of the group consists of Nordita fellows, which often have independent projects and therefore contributes to a broad and dynamic research environment. Current research topics include magneto-hydrodynamic (MHD) turbulence, particles in flows, solar/stellar physics, compact objects and accretion disks, ISM and cosmic dust as well as primordial magnetic fields and gravitational waves from the early Universe. Here we briefly present nine current projects within the group.

Eero Vaher, Lund Observatory

**Finding siblings of alpha Persei with traceback computations of Gaia DR2**

We use Gaia Data Release 2 (Gaia DR2) as input for traceback computations to search for stars born together with the alpha Persei cluster. The computations reveal the presence of an extended population of stars that were in the immediate vicinity of the cluster a few tens of millions of years ago but have dispersed since. The likely member candidates form a coherent sequence in the HR diagram. The work demonstrates the usefulness of the method and the quality of Gaia DR2.

Madeleine Burheim, Lund Observatory

**Spectroscopic investigation of Al I for astrophysical applications**

Recent advances in resolution and spectral range of astronomical spectrographs imply that accurate atomic data is greatly required for reliable interpretation and modelling of astrophysical spectra. Correctly interpreted, stellar spectra allow for precise abundance analysis, making it possible to study the galactic formation and evolution. To meet this demand, we perform studies on neutral aluminum, Al I. Aluminum is found in young, massive stars and thus a key element for tracing ongoing nucleosynthesis throughout the Galaxy. The near-infrared wavelength region is of particular importance, since the extinction is lager for optical wavelengths, making it a better probe for e.g. regions close to the galactic center. In this study we aim to provide f-values of improved accuracy for Al I lines in the near-infrared and optical regions. Measurements have been performed using a hollow

cathode discharge lamp and a Fourier transform spectrometer, to record the high resolution spectra.

Terese Olander, Uppsala Universitet

**Stellar parameters of M dwarfs: a comparison between two studies**

In the search for exoplanets M dwarfs are attractive targets. To be able to assess the habitability of planets around M dwarfs, the parameters of the host star need to be accurately determined as well as abundances of individual chemical elements. This can be done by observing M dwarfs in the near-infrared and fit the observed spectra with a synthetic one. Such methods have recently been applied by Lindgren et al (2016, 2017) and Passegger et al (2018, 2019). We present a comparison of stellar parameters derived by Lindgren and Passegger for 11 different stars. For 65% of the stars the two studies agree within given uncertainties while we find significant differences for the remaining stars. By comparing synthetic spectra created using the derived stellar parameters given in the two studies to the observed spectra, we investigate the reasons for the diverging results. The aim is to validate and improve the method of fitting synthetic spectra to observed spectra for M dwarfs.

Mohanraj Senniappan, Linnaeus University

**Monitoring the energetic Universe with ALTO/COMET**

ALTO is a project for a Very High Energy (VHE) gamma-ray observatory at high altitude in the Southern hemisphere with a large field-of-view (more than 2 steradians). Water Cherenkov detectors reconstruct the shower's direction and energy, while liquid scintillators detect muons for background discrimination. The successful first phase of the ALTO prototyping has two full ALTO units continuously taking data in Växjö (Sweden), for long-term verification. Monte Carlo simulations of the proposed full Southern array are still ongoing, and preliminary performance studies and responses to typical gamma-ray source spectra will be presented. The next steps are to complete the prototype while reducing the unit cost and to investigate the advantage of integrating HiSCORE air-Cherenkov stations during darkness. HiSCORE stations should be an excellent tool for energy evaluation cross-calibration. A summary of the ALTO experiment, together with the future steps of the project will be presented.

Dhrubaditya MITRA, NORDITA

**Gone with the headwind : planetesimals on eccentric orbits erode rapidly**

The first stages of planet formation take place in protoplanetary disks that are largely made of gas. Understanding how the gas affects the planetesimals in the protoplanetary disk is therefore essential. We estimate that the shear-stress generated by the headwind around a planetesimal on an eccentric orbit is strong enough to erode it. From theory and numerical simulations (using Lattice Boltzman method) of erosion in flows we find that the volume of the planetesimals decreases rapidly, approximately as a power-law in time. However, the headwind is, on average, not strong enough to erode planetesimals at distances more than 1AU even if they are on eccentric (but not too eccentric) orbits. Thus we conclude that any planetesimal on a orbit closer than 1AU will be found on circular orbits.

Emir Karamehmetoglu, Stockholm University

**A slow-motion Type Ibn SN with a massive progenitor**

The core collapse of massive stars into a helium rich circumstellar environment is thought to give rise to a very rare type of supernova (SN), called Type Ibn SN. Most examples of this class are rapidly evolving, making them very difficult to detect and study in detail. OGLE-2014-SN-131 is a record-holding exception. It had an unprecedented rise-time of over 40 days, more than 4 times longer than that of the average Type Ibn SN, and remained visible for months. Additionally, unlike most core-collapse SNe, it was located in a very faint galaxy that we could not detect even with deep imaging. We studied the lightcurve and spectra of this extraordinary event and favored a scenario with a very high-mass progenitor (40 to 60 times the mass of the sun) exploding into a dense shell of helium rich circumstellar material. Such massive stars are primarily thought to form blackholes instead of exploding as SNe, making OGLE-2014-SN-131 a challenge for current models to explain.

Tomas Bylund, Linnéuniversitetet

**Study of a distant Blazar with the H.E.S.S. telescopes**

Imaging Atmospheric Cherenkov Telescopes (IACT) are among the most sensitive instruments available to study the very high energy non-thermal sky, and the High Energy Stereoscopic System (HESS) is the largest such system operating in the world. This makes HESS an excellent tool for probing the extreme environment of Blazar jets. Here I report recent results on the very distant BL Lac KUV 00311-1938.

Sofie Liljegren, Stockholm Universitet

**Molecules in supernovae**

Supernovae (SNe) are the explosions of dying stars, and during the violent end of their lives much, if not all, of the stellar matter is expelled into the surrounding space. After the initial explosion the SNe ejecta will expand and cool, and molecules and dust form. We are currently implementing a new chemistry module (which includes molecular formation) in the SNe spectral modelling code SUMO. By comparing results from our new models with future observations we hope to provide unique tools to constrain the SNe chemistry and further our understanding of the nucleosynthesis yields of different types of supernovae.

Law Chi Yan, Chalmers University of Technology

**The links between magnetic field and filamentary clouds**

Recent observational evidence of magnetic field regulated star formation efficiency is illustrated with data from nearby Gould belt molecular clouds (Li et al. 2017). The study suggests that the effects of magnetic field on star formation have already taken place by shaping the global cloud properties. Here we report studies on the linear mass distribution an the cumulative functions (MCFs) versus column densities for 13 molecular clouds within 500 pc. We find that molecular clouds with long axes close to parallel with the magnetic field tend to have more uneven mass distributions and shallower MCF slopes. The results mean that globally parallel clouds, in general, contain a higher portion of high-density gas and less evenly distributed. This studies imply that the consequences of field-regulation at the cloud scales have already affected the star formation through regulating the efficiency of gravitational concentration of the cloud gas.

Chia-Jung Hsu, Chalmers University of Technology

**Simulating deuterium fractionation in massive pre-stellarcores**

The degree of deuterium fractionation is thought to be an important indicator of the chemical ages of pre-stellar cores. The physical properties and the timescale required to reach a high deuterium fraction of N2H+ are under debate. Due to the complexity of chemical networks, it is challenging for us to simulate the hydrodynamics and chemical reactions at the same time. Here we utilize KROME and ENZO to couple a sophisticated chemical network, which includes over 3000 reaction, with three-dimensional turbulent, magnetized pre-stellar core simulations. The results help us further understand the fluid dynamic influences to deuterium fractionation and explore the distribution of a variety of species.

Margareta Malmort, Rymdblick

**Och jorden hon snurrar / The Earth turns**

I utställningen "Och jorden hon snurrar" finns det rikligt med tillfällen att begrunda jordens rörelser och dess effekter. I stämningsfyllda tittskåp ser man stjärnhimlen vid olika tider på dygnet och året. Det finns många möjligheter att lära sig olika stjärnbilder och hur man orienterar sig på stjärnhimlen. Solen, månen och planeterna finns representerade i utställningen på flera olika sätt.  Vårt motto är lustfyllt lärande. Skolprogrammen stämmer väl överens med mål i kursplanen i NO och fysik för årskurs 1- 6. De är en inspirationskälla och ett värdefullt komplement till undervisningen. Det finns program för särskoleklasser och förskolegrupper. Vi som har designat "Och jorden hon snurrar" har valt innehållet med omsorg och utformningen med didaktiska förtecken. Våra program är upplevelsebaserade. Vi samtalar, berättar, studerar modeller, ritar, sjunger och dansar. Med en eller flera uppgifter gör barnen/eleverna på upptäcktsfärd genom utställningen. Det finns mycket att utforska.