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Posters

List of posters

abstract page

Confronting GRB prompt emission with a model for subphotospheric dissipation

Björn Ahlgren [KTH], Josefin Larsson [KTH] Tanja Nymark [KTH] Felix Ryde [KTH] Asaf Pe'er [University College Cork]

The origin of the prompt emission in gamma-ray bursts (GRBs) is still an unsolved problem and several different mechanisms have been suggested. Here we fit Fermi GRB data with a photospheric emission model which includes dissipation of the jet kinetic energy below the photosphere. The resulting spectra are dominated by Comptonization and contain no significant contribution from synchrotron radiation. In order to fit to the data we span a physically motivated part of the model's parameter space and create DREAM (*Dissipation with Radiative Emission as A table Model*), a table model for XSPEC. We show that this model can describe different kinds of GRB spectra, including GRB 090618, representing a typical Band function spectrum, and GRB 100724B, illustrating a double peaked spectrum, previously fitted with a Band+blackbody model, suggesting they originate from a similar scenario. We suggest that the main difference between these two types of bursts is the optical depth at the dissipation site.

Dust from impacts on exoplanets

Gianni Cataldi [Stockholm University, Department of Astronomy AND Stockholm University Astrobiology Centre], Alexis Brandeker [Stockholm University, Department of Astronomy AND Stockholm University Astrobiology Centre], Philippe Thébault [LESIA-Observatoire de Paris, Univ. Paris-Diderot, France], Engy Ahmed [Stockholm University, Department of Geological Sciences AND Stockholm University Astrobiology Centre], Göran Olofsson [Stockholm University, Department of Astronomy AND Stockholm University Astrobiology Centre], Kelsi Singer [Southwest Research Institute, Boulder, USA], Anna Neubeck [Stockholm University, Department of Geological Sciences AND Stockholm University Astrobiology Centre], Bernard Lammert de Vries [Stockholm University, Department of Astronomy AND Stockholm University Astrobiology Centre]

We investigate the possibility of detecting dust generated from an impact event on an exoplanet. Dust originating from an exoplanetary surface could potentially give information on its composition, geology, habitability or even hint to the presence of life. Indeed, certain minerals and rocks have been suggested as biosignatures. We first estimate the amount of escaping mass for different impact parameters (size and density of the impactor, size of the exoplanet, etc.). We then assess the collisional evolution of the resulting circumstellar debris belt with a simplified analytical model, giving information on its overall lifetime and fractional luminosity (the ratio of the dust luminosity to the stellar luminosity). Finally, we assess the detectability of the dust thermal emission and scattered light as well as spectral features of e.g. minerals such as calcite with present and future instruments.

Feedback in Massive Star Formation: e-MERLIN maser polarization observations

Daria Dall'Olio [Chalmers University, Onsala Space Observatory], Wouter Vlemmings [Chalmers University, Onsala Space Observatory], Gabriele Surcis [JIVE], Anita Richards [UK ARC Node, University of Manchester], Melvin Hoare [Univeristy of Leeds]

The new eMERLIN capabilities will soon allow for simultaneous continuum and maser polarization observations. This will allow the 3D reconstruction of magnetic field morphology using methanol and OH masers as part of the eMERLIN 'Feedback in Massive Star Formation' legacy project. In this project, we will observe a large sample of massive young stars spanning a range of evolutionary stages from sources deeply embedded in infrared dark clouds to mid-IR bright massive young stellar objects. In addition to the magnetic field observations, deep continuum imaging will determine when MHD driven jets turn on and when they give way to radiatively driven disc winds and over what mass range. This poster will present the maser sample and the current status of methanol maser polarization observations.

Optical interferometry over kilometer baselines: Stellar imaging with electronically connected telescopes

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Diffraction-limited optical imaging over kilometer baselines will reveal stellar surfaces, and perhaps even resolve the silhouettes of transiting exoplanets. This is becoming feasible by using arrays of air Cherenkov telescopes for intensity interferometry, a technique pioneered by Hanbury Brown and Twiss fifty years ago Being insensitive to atmospheric turbulence, this permits both very long baselines and observing at short optical wavelengths. The ongoing CTA project, Cherenkov Telescope Array, plans for some 100 telescopes spread over several square kilometers in Chile. Its first subset will be the Italian-led ASTRI sub-array of nine telescopes, the first of which is already constructed in Sicily. Experimental and theoretical preparations are in progress. In laboratory work, artificial stars have been observed over 180 optical baselines, leading to full two-dimensional image reconstructions. Night-time observing is currently planned in Sicily together with the Italian ASTRI consortium. The long-term aims are to realize optical aperture synthesis arrays equivalent to those currently operating at radio wavelengths.

Metallicity Measurements of Young Stellar Associations

Ramez Ghareeb [Stockholm]

We present preliminary results of an ongoing research for a Master's of science degree. We use multi-epoch high resolution spectroscopy to determine metallicities and other stellar parameters for five young (6- 100 Myr) nearby (<100 pc) co-moving groups and stellar associations. We investigate for potential variability in metallicity within each group and between groups. Another interesting question is if there are any outliers that could implicate a recent accretion event of a planet. From our preliminary results, we conclude that individual groups are homogeneous in metallicity. Furthermore, we don't find any outliers in metallicity, with in a group, due to contamination from planet engulfment.

On the accretion process in a high-mass star forming region - A multi-transitional THz Herschel-HIFI study of ammonia toward G34.26+0.15

M. Hajigholi, C.M. Persson, E.S. Wirström, J.H. Black, P. Bergman, A.O.H. Olofsson, M. Olberg, F. Wyrowski, A. Coutens, Å. Hjalmarson, K.M. Menten

A challenging issue in the understanding of massive star formation is to explain how a protostar can overcome its own radiation pressure in order to accumulate the amount of infalling mass necessary for its growth. We describe here a detailed analysis of the gas dynamics and radiation pressure in the early phase of the high-mass star forming protostar G34.26+0.15. In order to trace the dynamics of gas in the deeply embedded phase of star formation, we use resolved Herschel-HIFI observations of molecular emission and absorption line profiles, most importantly using seven ammonia transitions as a probe of the wide range of physical conditions involved. Ammonia is particularly useful since it is known to survive in the gas phase when other species freeze out onto cold dust surfaces; hence it is well suited for studies of massive star formation. Moreover, the transitions we have used in our study have a large range of critical densities, which made it possible to probe the kinematics of the different layers of G34.26+0.15. We used the Accelerated Lambda Iteration scheme (ALI) to deduce the clouds density, temperature, velocity gradients and abundance of molecules by solving the radiative transfer of ammonia in an spherically symmetric model cloud, with infall/outflow motions. The ammonia lines show mixed absorption and emission with inverse P-Cygni-type profiles that suggest infall onto the central source. The best-fitting ALI model reproduces the continuum fluxes and line profiles, but slightly under predicts the emission and absorption depth in the ground-state ortho line $1_0 - 0_0$. We find evidence of *two* gas components moving inwards toward the central region with constant velocities: 2.7 and 5.3 km s^{-1}, relative to the source systemic velocity. Attempts to model the inward motion with a single gas cloud in free-fall collapse did not succeed. The inferred mass accretion rates derived rises from 4.1 x 10^{-3} to 4.5 x 10^{-2} $M_\odot$ yr^{-1}, which is sufficient to overcome the expected radiation pressure from G34.26+0.15. References: M. Hajigholi et al., 2015, submitted to A&A

Benchmark stars for cross-calibration of Galactic stellar surveys

U. Heiter [Uppsala universitet], P. Jofré [Institute of Astronomy, Cambridge, UK], Bengt Gustafsson [Uppsala universitet], F. Thévenin [Observatoire de la Côte d'Azur], A. Korn [Uppsala universitet], C. Soubiran [Laboratoire d'Astrophysique de Bordeaux], S. Blanco-Cuaresma [Université de Genève]

Various Galactic stellar spectroscopic surveys are currently underway, and each is expected to achieve high internal accuracy in terms of stellar parameters and abundances. A number of questions related to the formation and evolution of the Galaxy may be addressed based on samples of stars observed within each survey. In addition, complementary samples of stars may be constructed by combining data from different surveys. The Gaia FGK Benchmark Stars provide the necessary link to bring the quantities measured from different spectra with different methods onto the same scale. We present and assessment of the quality of the fundamental determinations of effective temperature and surface gravity for the set of about 30 stars, and the currently recommended reference values for the atmospheric parameters.

Formation and evolution of intense bipolar structures in a helically forced stratified turbulent plasma

Sarah Jabbari [Nordita and Stockholm University], Axel Brandenburg [Nordita and Stockholm University], Dhrubaditya Mitra [Nordita]

We study a system of highly stratified turbulent plasma with dynamo generated initial magnetic field near the bottom. In such a system, when the density contrast is large enough and there is a background field of suit- able strength, a new effect will play a role in concentrating magnetic fields such that it leads to the formation of magnetic spots and bipolar regions. Our main aim now is to use this mechanism to explain the formation of active regions and sunspots. We perform direct numerical simulations (DNS) of isothermally forced two-layer turbulence using Pencil Code in both spherical and plane geometries. Turbulence is forced in the entire domain, but the forcing is made helical in the lower 30% of the shell (box), similar to the model of Mitra et al. (2014). This means we allow the magnetic field to be generated by an alpha squared dynamo at the bottom layer. Dynamo is known to be responsible for the solar large-scale magnetic field and to play a role in solar activity. Therefore, it is of interest to investigate its effect on formation of bipolar structures. We investigate cases with different density contrasts and other input parameters in both geometries. We apply vertical field boundary conditions in the r (z) direction. The results show that, when the stratification is high enough, intense bipolar regions form and expand as time passes. In the spherical case, these structures merge and create giant structures while at the same time, new structures appear at different latitudes. When the helical zone is thinner, or the forcing is weaker, the structures appear at a later time (Jabbari et al. 2015). In the case of plane geometry we study the effect of different magnetic Reynolds numbers and forcing amplitudes. We observe that as time goes on the structures become elongated and then disappear, but again new ones start forming and follow the same cycle again.

The National Committee for Astronomy

Dan Kiselman [National Committee for Astronomy]

The Swedish National Committee for Astronomy is briefly presented.

Astronomdagarnas historia

Dan Kiselman [Svenska astronomiska sällskapet]

The history of Astronomdagarna is presented.

The Institute of Solar Physics

Dan Kiselman et al. [Institute for Solar Physics, SU]

The Institute for Solar Physics is a national research infrastructure supported by the Swedish Research Council. It is managed as an independent institute by Stockholm University through its Department of Astronomy. The Institute operates the Swedish 1-m Solar Telescope on La Palma.

Dynamical consequences of adding additional planets in multi-planet systems

Giorgi Kokaia [Lund Obsevatory], Melvyn B. Davies [Lund Observatory] Alexander Mustill [Lund Observatory]

We investigate the dynamical effects of adding an extra planet in multiple planet systems. Thesystems investigated were discovered with the Kepler mission using photometry, therefore they haveshort periods (giving semi-major axes of ∼0.1 AU). The range of planets (masses and semi-majoraxes) that can be added so that the systems are still consistent with the observations is constrainedusing three different methods. 1) Having the planet nearby could scatter and destabilize the system,completely altering its architecture. 2) Interaction between the planet and the system could alter thetimes at which the planets in the system transit (Transit timing variations - TTVs). 3) If the planet ismutually inclined with respect to the system, it will induce higher inclinations which will change theratios of the numbers of transiting planets seen in the observations. Combining these three methodswill allow us to draw conclusions about the possibility of having more planets further out in thesemultiple planet systems. This is of interest because we know that the planets in these systems cannotform in situ. There are different models that attempt to explain the process that brought them thereand these models make different assumptions on the architecture of the planetary systems. Puttingconstraints on what else could exist in these systems will test the validity of the different models.

An investigation of the morphology and kinematics of the circumstellar envelope of the AGB star $\pi 1$ Gruis

D. D. Lam [Uppsala], S. Ramstedt [Uppsala], W. Vlemmings [Chalmers - OSO] and S. Höfner [Uppsala]

The S-type AGB star $\pi 1$ Gruis has a known companion at a separation of 400 AU. Previous observations of the circumstellar envelope (CSE) show strong deviations from spherical symmetry. We will present our results from the analysis of ALMA-ACA observations of $\pi 1$ Gruis. The images of the rotational line emission from CO J=2-1 and 3-2 provide good constraints for a model of the morphology and kinematics of the CSE. We model the source using SHAPE to derive the temperature, density and velocity distribution. The results are also compared with hydrodynamic simulations of binary interaction.

SPICA a cool satellite

Bengt Larsson, Göran Olofsson, Matthew Hayes [Stockholm]

SPICA is a future 2.5 m actively cooled telescope jointly proposed by European and Japanese astronomers. It will essentially be a spectrometric mission and cover the wavelength range 12 - 210 μm to fill the frequency gap between JWST and ALMA. Thanks to recent detector developments as well as the larger cooled telescope it will be 2 orders of magnitude more sensitive than Spitzer in the mid-IR and also 2 orders of magnitude more sensitive than Herschel/PACS in the far-IR. There is also a proposal for including an exoplanet transit spectrometer designed to reveal Earth-like atmospheres. The current plan is to compete for an ESA-M5 mission (in collaboration with JAXA and US).

A study of magnetic fields in Intermediate Mass T-Tauri Stars

Alexis Lavail [Uppsala University], Oleg Kochukhov [Uppsala University], Gaitee Hussain [ESO], Evelyne Alecian [Institut de Planétologie et d'Astrophysique de Grenoble], Gregory Herczeg [The Kavli Institute for Astronomy and Astrophysics], John Landstreet [The University of Western Ontario, Armagh Observatory,], Chris Johns-Krull [Rice University]

Intermediate Mass T-Tauri Stars (IMTTS) are the precursors of the pre-main sequence Herbig Ae/Be stars, themselves the likely precursors of the main sequence A/B stars. About 10% of A/B stars and also Herbig Ae/Be stars host strong and organised fossil magnetic fields which origin is uncertain. It is believed that they could either be the result of the galactic magnetic field being captured during stellar formation, or generated by dynamo processes during stellar formation. By studying magnetic fields in IMTTS, we intend to improve our understanding on the origin of these fossil magnetic fields. IMTTS possess convective envelopes and are at the transition between fully-convective and fully/partially radiative regimes. It is expected that IMTTS magnetic properties evolve with their age, and that they can present either dynamo fields (complex, rapidly evolving) or strong and stable organised fields. We use high-resolution infrared spectra in the H and K bands, acquired at the VLT with the CRIRES spectrograph to study a sample of 5 stars with effective temperatures ranging from roughly 4000 K to 6000 K. We aim to detect magnetic fields and determine their strengths using Zeeman broadening of magnetically sensitive spectral lines.

3D Models of Cool Giants

Sofie Liljegren [Uppsala Universitet], Bernd Freytag [Uppsala Universitet], Susanne Höfner [Uppsala Universitet]

Asymptotic Giant Branch(AGB) stars are evolved stars with low to medium mass. Although they are thought to be important for the galactic chemical evolution, they are poorly understood theoretically. A grid of models of AGB stars, based on 3D star-in-a-box simulations using CO5BOLD, has been calculated (see talk by Bernd Freytag). This poster examines the observable properties of the models and critically compares to observations and corresponding properties of 1D models.

Metallicity determination of M dwarfs from high-resolution IR spectra

Sara Lindgren [Uppsala University], Ulrike Heiter [Uppsala University] and Andreas Seifahrt [University of Chicago]

M dwarfs constitute 70% of the stars in the local Galaxy and are of increasing interest to the exoplanet community. With our research we aim to extend the current understanding of planet formation theory and explore the planet – host metallicity correlation for these cooler hosts. Unlike their solar-type counterparts, the metallicity of M dwarfs is difficult to determine. Their low surface temperature results in plenty of diatomic and triatomic molecules in the photospheric layers. Especially in the optical wavelength region these molecules give rise to a forest of millions of weak lines, making accurate spectroscopy nearly impossible. High-resolution spectrographs operating in the infrared have recently opened up a new window for investigating M dwarfs. In the infrared the number of molecular transitions is greatly reduced, allowing an accurate continuum placement, and in the J band a large number of unblended atomic lines are available. This enabled us to use similar methods as is standard for warmer solar-like stars, and determine the overall metallicity through synthetic spectral fitting. Our analysis is based on high-resolution spectra observed in the J band (1100-1400nm) with the CRIRES spectrograph, VLT. The reliability of our method was shown though the analysis of M dwarfs in binaries with FGK dwarf companions. The part of our sample presented covers subtypes M0-M4 and metallicities from slightly sub-solar to +0.3 dex. Additional observational data currently being analyzed will expand our sample to cover subtypes M0-M6 and a metallicity range of ±0.8 dex. From the entire sample we aim at deriving an accurate relationship between photometric colors and metallicity for M dwarfs down to subtype M6.

Measuring sizes of distant faint galaxies

Lukas Lindroos [Rymd of geovetenskap, Chalmers]

Using the great angular resolution of ALMA can be challenging for high-redshift galaxies, as the typical brightness is low. We have developed a new stacking algorithm that acts directly on the visibilities. Using this method it is possible to detect emission from high-redshift galaxies on much longer baselines than otherwise, and measure the typical sizes of populations of galaxies that would be otherwise unavailable to ALMA. I will present results from stacking galaxies in the ALESS (230 GHz survey in ECDF-S) and and the deep 1.4 GHz VLA map of the field. We have selected galaxies around z∼2 using near infrared photometry (ERO, DRG, and sBzK). We find that the typical sizes of these galaxies are large (∼1 arcsec) compared to SMGs which are typically more compact.

Dust coagulation in AGB-star atmospheres

Lars Mattsson [Nordita, KTH Royal Institute of Technology & Stockholm University], Joakim D. Munkhammar [Department of Engineering Sciences, Solid State Physics, Uppsala University]

Using a simplified mean-field model of a dust-driven wind, we present a first attempt to quantify the effect of coagulation on the grain-size distribution in AGB-star atmospheres.

Studies of Resolved Stellar Clumps in High-Redshift Galaxy Analogs

Matteo M. Messa [Stockholm University], Angela Adamo [Stockholm University], Goeran Ostlin [Stockholm University] Matthew Hayes [Stockholm University], Jens Melinder [Stockholm University] & the LARS team

The Lyman-alpha reference sample (LARS) is a sample of 14 local high-redshift analogues observed with the Hubble Space Telescope (HST). These local galaxies (z = 0.028 – 0.19) have been selected to have moderately high EW(Hα) to ensure the selection of star-forming systems and far UV luminosities ranging from log(LFUV)= 9.2 to 10.7 LSUN, comparable to those of high-redshift Lyα emitters and Lyman Break Galaxies. The survey is providing fundamental insights into Ly-alpha emission process, allowing the investigation of Ly-alpha radiation transport and photon escape. In this poster, we present the statistical study of the spatially resolved stellar cluster complexes and of the main star-forming regions of the LARS sample. The exquisite multiband HST coverage allows us to derive the physical properties of these stellar clumps, such as ages, masses, extinction, and sizes. Using the UV fluxes, we constraint which fraction of the current star formation is condensed in these compact regions. We try to quantify their contribution to the total feedback derived from total Hα fluxes. The properties of these cluster complexes are compared to clump properties detected in high-redshift galaxies.

Episodic jet activity in radio sources

Sumana Nandi [KTH Royal Institute of Technology, Stockholm]

Powerful extragalactic radio sources exhibit a wide range of linear sizes, ranging from the compact steep spectrum sources, which could be less than a few tens of parsecs, confined within the central regions of their parent galaxies, to the giant radio sources (GRSs). The GRSs, which are amongst the largest objects in the Universe, are defined to be those which have a projected linear size $\geq$1 Mpc. One important aspect of observations of these large radio sources is to understand the duration of the active phase of AGNs and their episodic nature. Double-double radio galaxies (DDRGs) can be characterized by a second phase of jet activity driven by the same AGN. The number of DDRGs reported so far is very limited, and it is important to identify more of these to make the physical scenario of this class statistically robust. In our recent study, we identified 23 sources which we believe to be good examples DDRG. Here we present our result of low-frequency study of these galaxies using Giant Metrewave Radio Telescope (GMRT) .

The role of hydrogen collisions in non-LTE abundance analyses of aluminium

Thomas Nordlander [Uppsala Universitet], Karin Lind [Uppsala Universitet; MPIA Heidelberg]

The abundance patterns of metal-poor stars contain crucial information on the early evolution of the Galaxy. Stellar abundances must however be inferred from spectrum synthesis, which hinges on the input physics. Stellar atmospheres are typically assumed to be one-dimensional, with the equation of state fully determined only by local properties (in LTE, local thermodynamic equilibrium). Although non-LTE has been studied for decades, there are still unsolved problems related primarily to collisional rates. Due to a lack of laboratory data at the low collisional energies typical of stellar atmospheres, Drawin's order-of-magnitude estimates based on Thomson electron scattering are typically applied to inelastic hydrogen collisions. We critically evaluate the influence of uncertainties in input data on non-LTE abundance determinations of aluminium in metal-poor stars. We execute these analyses using different sources for the atomic data, and update the classical collisional rates with modern, physically appropriate estimates.

Can we count the annual rings of a star? Supernovae Type IIn gives the answer

Anders Nyholm [Stockholm Observatory]

A core-collapse (CC) supernova (SN) of Type IIn is characterised by interaction between the ejecta of the SN and the circumstellar medium (CSM) left behind by the progenitor star before its explosion. SNe Type IIn spectra are distinguished by the narrow components of their Balmer lines, arising from the recombination of hydrogen ionised by radiation from the shock region where the SN ejecta hits the CSM. The light curves of Type IIn SNe can also display special features, not least at late times (> 100 days after explosion). The intermediate Palomar Transient Factory (iPTF), in which Stockholm Observatory takes part, has found and followed over 100 Type IIn SNe. This sample will be discussed here with respect to the late-time developments in the light curves of these SNe Type IIn. In particular, a Type IIn SN found by the iPTF showing a conspicous late time bump in its light curve will be discussed.

The chromosphere as imaged in O I 777.2 nm

Hiva Pazira [Stockholm University], Dan Kiselman [Stockholm University]

We have observed the strongest line in the IR triplet of neutral oxygen 777.2 nm using SST/CRISP. The aim is to better understand the formation of this line and its possible use for chromospheric diagnostics. We investigate the emission outside the solar limb. The observations are compared with synthetic spectra computed for different FAL atmospheric models using the RH code. So far, our results suggest that the off-limb emission follows the variations of the line opacity which is very temperature sensitive. Regions with low emission, like a dark gap often seen close to the limb, thus indicate cooler temperatures.

CRIRES+ - Upgrading the high-resolution near-infrared spectrograph at ESO VLT

N. Piskunov [UU], U. Heiter [UU], E. Stempels [UU], A. Lavail, O. Kochukhov and T. Marquart for the CRIRES+ Consortium

Earlier during 2015, the CRyogenic InfraRed Echelle Spectrograph (CRIRES) has been removed from the Very Large Telescope and shipped back to ESO in Garching for a major upgrade. The instrument will get a new cross-disperser unit that will increase the simultaneous wavelength coverage manyfold. Through a grant from the Knut & Alice Wallenberg Foundation, Uppsala astronomers are heavily involved in CRIRES+ and in charge of the new detectors and the data reduction pipeline. In addition, we design and manifacture a polarizing unit for both circular and linear polarization measurements. The main science cases for CRIRES+ are the search for super-Earths in the habitable zone of low-mass stars, the atmospheric characterisation of transiting planets and the origin and evolution of stellar magnetic fields.

The Virtual Atomic & Molecular Data Centre (VAMDC)

N. Piskunov [UU], U. Heiter [UU], E. Stempels [UU], T. Marquart [UU], and S. Regandell [UU] for the VAMDC Consortium

The Virtual Atomic & Molecular Data Center (VAMDC) is a distributed e-infrastructure that facilitates data retrieval and exchange from heterogenous data collections. VAMDC was initiated through EU FP7 grants and is now a self-sustaining consortium with Uppsala as one of the core members beside Paris Observatory, IoA Cambridge, UC London and Cologne university. Our involvement includes both our VALD database of atomic and molecular data, and the developement, implementation and maintenace of the VAMDC infrastrucure. The unique feature of VAMDC is that it defines universal standards for querying data and data transfer, thus allowing the development of tools that are not dependent on which source the data comes from. Currently $\sim$25 databases are part of VAMDC and offer a large range and variety of atomic and molecular data to scientists from many fields.

A search for pair halos around active galactic nuclei through a temporal analysis of Fermi-LAT data

D. A. Prokhorov [Linnaeus University], A. Moraghan [Academia Sinica Institute of Astronomy and Astrophysics]

We develop a method to search for pair halos around active galactic nuclei (AGN) through a temporal analysis of gamma-ray data. The basis of our method is an analysis of the spatial distributions of photons coming from AGN flares and from AGN quiescent states and a further comparison of these two spatial distributions. This method can also be used for a reconstruction of a point spread function (PSF). We found no evidence for a pair halo component through this method by applying it to the Fermi- LAT data in the energy bands of 4.5-6, 6-10, and >10 GeV and set upper limits on the fraction of photons attributable to a pair halo component. An illustration of how to reconstruct the PSF of Fermi-LAT is given. We demonstrate that the PSF reconstructed by using this method is in good agreement with that which was obtained by using the gamma-ray data taken by LAT in the direction of the Crab pulsar and nebula.

Bayesian methods for the astrometric detection of exoplanets

Piero Ranalli [Lund Observatory]

The first detection of the astrometric shifts of stars withplanets is expected in the near future thanks to the Gaia satellite, whichmeasures stellar astrometry with unprecedented precision. We exploreBayesian methods for fitting the orbital parameters of exoplanets, andassess their efficiency using simulations. We introduce information-basedcriteria to determine a detection's confidence level. Finally we compareour results with the current approach, which is based on least-squaresfitting and on the likelihood-ratio test.

Spectral Synthesis for protoplanetary disk models

Samuel Regandell [Uppsala University], Nikolai Piskunov [Uppsala University], Wladimir Lyra [California State University, USA]

Modern 3D hydrodynamical simulations of proto-planetary disks include the realistic treatment of effects such as self-gravity and magnetic fields. However, while recent advances have been made, such models have problems incoorporating detailed radiative transfer and chemistry and thus lacks in the realistic treatment of temperature structures, critical for reproducing observables. By contrast, lowering the model dimensionality allows for handling the radiation field but tend to introduce other simplifications such as disk axisymmetry. This work describes combining 3D hydrodynamic results with a 2D code featuring non-grey radiative transfer and chemistry in order to produce realistic temperature structures. This allows for high-resolution spectral synthesis for non-axisymmetric disks created by the formation planets.

Cluster–Void Degeneracy Breaking: Dark Energy, Planck and the Largest Cluster & Void

Martin Sahlén [Oxford], Inigo Zubeldia [Oxford], Joseph Silk [IAP/Oxford/JHU]

Combining galaxy cluster and void abundances breaks the degeneracy between mean matter density Ωm and power spectrum normalization σ8. We constrain Ωm and σ8 in a flat ΛCDM universe to be consistent with Planck, using extreme-value statistics on the claimed largest cluster and void. We make a two-object detection of dark energy independent of all other dark energy probes. Cluster–void studies offer complementarity in degeneracy, scale, density, and non-linearity – of particular interest for tests of modified gravity.

Saturation of the small-scale dynamo

Jennifer Schober [Nordita], Dominik Schleicher [Universidad de Concepcion], Ralf Klessen [Heidelberg University]

The origin of strong magnetic fields in the Universe can be explained by amplifying weak seed fields via turbulent motions on small spatial scales and subsequently transporting the magnetic energy to larger scales. This process is known as the turbulent small-scale dynamo and depends on the properties of turbulence. While the growth of the magnetic energy in the linear regime is known, the saturation level, i.e. the ratio of magnetic energy to turbulent kinetic energy that can be reached, is not known from analytical calculations. We present here a scale-dependent saturation model based on an effective turbulent resistivity which is determined by the turnover timescale of turbulent eddies and the magnetic energy density. With increasing field strength the effective magnetic resistivity increases and the peak of the magnetic energy spectrum moves to larger spatial scales. This process ends when the peak reaches a characteristic scale which is determined by the critical magnetic Reynolds number. The saturation level of the dynamo also depends on the type of turbulence and on the magnetic Prandtl number Pm. With our model we find saturation levels between 44 % and 1 % for large Pm and between 2 % and 0.1 % for small Pm, where the higher values refer to incompressible turbulence and the lower ones to highly compressible turbulence. These results are in agreement with saturation levels found in numerical simulations.

The August 13 fireball over western Sweden

Eric Stempels [Uppsala University], Steinar Midtskogen [Norsk Meteornettverk], Esko Lyytinen [Finnish Ursa Fireball Network], Anton Norup Sørensen [Dansk Ildkugle Netværk]

In the early hours of August 13, a bright fireball occurred over western Sweden. This night was also the peak of the Perseid meteor shower, so this fireball was seen by many observers across the country. Through a combined effort of the Swedish, Norwegian, Finnish and Danish fireball networks, we have been able to constrain the true path of the fireball, as well as its unusual orbit and possible impact area.

Comet 67P as seen by the ion composition analyser RPC-ICA

Gabriella Stenberg Wieser [Swedish Institute of Space Physics], Hans Nilsson [Swedish Institute of Space Physics], Etienne Behar [Swedish Institute of Space Physics] and the RPC-team

The ion composition analyser on board Rosetta is one of the Swedish contributions to the mission. The instrument is very similar to what is flown on Mars and Venus Express and measures positive ions in the energy range 10 eV-40 keV. It has a field of view of 90x360 degrees and it resolves solar wind ions and cometary ions in the water group. With the instrument we follow how the activity of the nucleus changes and how, prior to perihelion, an increasing amount of cometary ions massload the solar wind. We see how solar wind ions charge-exchange with the comet's atmosphere and how the fluxes of accelerate ions vary. This poster presents the both the instrument itself and some of its scientific highlights so far in the mission.

Stellar multiplicity in high-resolution spectroscopic surveys

Edita Stonkute [Lund Observatory], Ross Church [Lund Observatory], Sofia Feltzing [Lund Observatory] and Jennifer A. Johnson [Ohio State University]

We present our models of the effect of binaries on high-resolution spectroscopic surveys, in order to determine how many binaries will be observed, whether unresolved binaries will contaminate measurements of chemical abundances, and how we can use spectroscopic surveys to better constrain the population of binaries in the Galaxy.

Keck/Nirspec observations of red giants in the Galactic centre

Brian Thorsbro [Lund University], et al.

We present ongoing work on a project determining detailed abundances of cool red giant in the very Galactic centre based on Keck/Nirspec observations that we performed in April 2015. Due to optical extinction of up to 10 magnitude we observe in the K-band. New methodology is being developed to support these medium resolution observations (R=20000).

ALTO- a new wide-field very high-energy gamma-ray observatory in the southern hemisphere

Satyendra Thoudam [Linneaus University], Yvonne Becherini [Linneaus University], Michael Punch [Linneaus University; APC, CNRS]

The field of very high-energy gamma-ray astronomy has made enormous progress in recent years with the discovery of over 150 gamma-ray sources above 100 GeV by latest-generation Imaging Atmospheric Cherenkov Telescopes such as HESS, MAGIC and VERITAS. While these telescopes have a very good sensitivity and a small angular resolution of around 0.1 degree, they have the disadvantage of having a limited field of view (typically of 3-5° currently), thereby limiting studies to point or small angular-size sources, and limited duty cycle (of around 20%) as the observation is carried out only during clear and moonless (or low-moon) nights. These drawbacks are overcome in the HAWC experiment, a Water Cherenkov Detector Array (WCDA), with its all-sky field-of-view in the Northern hemisphere, and a duty cycle of almost 100%. We are working on the development of a similar WCDA experiment, ALTO, but in the southern hemisphere and with lower energy threshold, better angular resolution and better sensitivity than HAWC. The array is planned to be built at an altitude of 5.2 km above sea level, and will be augmented with a liquid-scintillator component. The array will complement the future CTA (Cherenkov Telescope Array, which itself will extend the field-of-view of its high-energy telescopes to 10°) in the study of high-energy gamma-ray sources. In this contribution, we will present the technical details of the experiment, and its current status.

Discs and stable orbits around the planet-hosting triple star 94 Ceti

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Debris discs are sign posts of planetary formation and provide important insights in the configurations and evolution of planetary systems. These are observed through the detection of excess emission at far-infrared wavelengths, attribution and interpretation of the measured excess is complicated by potential contamination from e.g. background galaxies or galactic cirrus. 94 Ceti is a triple star system hosting a circumprimary gas giant and was part of the Herschel (Pilbratt et al. 2010) key project DUNES (DUst around NEarby Stars, Eiroa et al. 2013). It was primarily observed at 100 and 160 micrometers, and we add here additional observations using APEX-LABOCA (the Atacama Pathfinder EXperiment) at 870 micrometers. DUNES detected an 15 sigma excess at 100 micrometers. However, the background is confusing and the inferred dust temperature would not correspond with stable orbits. Further modelling was required. With detailed modelling and radiative transfer simulations we find dynamically stable discs and evidence for a circumbinary dust disc around the two secondary stars, that would fit the observations. We also investigated the possibility that some of the confusing background is due to a circumtertiary ring. However, the evidence is inconclusive and we only set an upper limit.

Probability of meteorite impacts in Sweden since year 2000

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This work investigates the number of possible meteorite impacts in Sweden since the year 2000. Sweden did not until recently have any photographic monitoring of incoming meteorites, thus a search through media reporting observations from the public has been performed. A theoretical approximation, based on an established extra-terrestrial mass flux, gives the number of 210 possible meteorite impacts for this time period. All of these could have been fireballs, but by subtracting the daylight hours and bad weather conditions, only 47 fireballs could have been seen during the 15 years. All of the 210 events could also have dropped meteorites on the ground, but when subtracting areas where it is very unlikely to recover a meteorite, like large forest areas and lakes, the number of possible meteorites is 73. The newspaper articles published since 2000 regarding reball observations gives 37 plausible meteorites. The theoretical value and the number of observations are similar enough that the theoretical approximation is probable to be correct.

Mass models and the spiral arms of the Milky Way

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We are constructing a detailed model of the Milky Way's gravitational potential. This will allow us to learn about the dark matter content of the Milky Way, and to accurately predict the future motions of stars and gas within the Galaxy. We use recently and accurately measured positions and radial velocities of Galactic maser sources which make it possible to test our theoretical models of the influence of the spiral arms of the Milky Way. With Gaia, the astrometric satellite launched by the European Space Agency, due to provide a map of the positions & velocities of a billion stars in the Milky Way in the next 2 years. It is vital to ensure that our modelling techniques are able to cope with the effects of perturbations like spiral arms. The goal is to improve upon existing models of the gravitational potential of the Milky Way by adding effects of spiral structure and to investigate whether not doing so might have introduced systematic errors in previous models. This is achieved by a Bayesian statistical analysis (with priors from a variety of sources) using a Markov Chain Monte Carlo approach to investigate the parameter space of the models. The maser sources are modelled as being on near-circular orbits in a Galactic potential consisting of a disk, bulge, dark matter halo. This technique will allow us to investigate the effect of spiral structure.