21st-26th August

University of Exeter

Programme

Contents

Local Organising Committee (University of Exeter)

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John Monnier, University of Michigan, USA

	Monday 22 August **Molecular clouds**	**Tuesday 23 August** **Protostellar cores**	**Wednesday 24 August**	**Thursday 25 August** **Protostars & clusters**	**Friday 26 August** **Discs**
08:30	Coffee/tea & mini pastry		Coffee/tea & mini pastry	Coffee/tea & mini pastry	
08:50	**Tim Harries & Chris Brunt** Welcome address	**Tim Harries & Chris Brunt** Notices & updates	Splinter sessions will take place from 0900 – 12:00. **Kraus** (Planet Formation Imager) *Forum seminar room 4* **Bell** (The ages of young stars) *Forum seminar room 6* **Hatchell** (Measuring temperatures and densities in star-formation regions) *Forum seminar room 10* **Goodwin** (Computational star formation) *Forum seminar room 5* **Brunt** (Early-career researchers) *Alumni Auditorium, The Forum*	**Tim Harries & Chris Brunt** Notices & updates	**Tim Harries & Chris Brunt** Notices & updates
0900	**Stefanie Walch** (University of Cologne) Theory review	**Kengo Tomida** (University of Osaka) Theory review		**Nick Wright** (University of Keele) Observational review	**Catherine Espaillat** (Boston University) Observational review
0940	**Nicolas Peretto** (University of Cardiff) Observational review	**Anaëlle Maury** (CEA/Saclay) Observational review		**Stella Offner** (UMass Amherst) Theory review	**Richard Alexander** (University of Leicester) Theory review
1020	**Masato Kobayashi** (Nagoya University) Evolutionary Picture of Giant Molecular Cloud Mass Functions on Galactic Scales	**Vera Könyves** (CEA/Saclay) A census and properties of dense cores and filaments in the Aquila and Orion B cloud complexes		**Richard Parker** (Liverpool John Moores University) The initial conditions of star formation from spatial and kinematic substructure	**Tim Naylor** (University of Exeter) A Dynamic Colour-Magnitude Diagram for the Orion Nebula Cluster
1040	**Andrea Bracco** (CEA, Saclay) The relative orientation between magnetic fields and filamentary density structures from the diffuse ISM to molecular clouds	**Alana Rivera-Ingraham** (ESA) Extreme Star Formation in the Galaxy: The Herschel View		**Isabelle Baraffe** (University of Exeter) Consistent models of accretion history and multi-dimensional structure of accreting young stars.	**Kenny Wood** (University of St. Andrews) A Model for (Quasi-) Periodic Multi-wavelength Photometric Variability in Young Stellar Objects
1100	Coffee break			Coffee break	

	Monday 22 August Molecular clouds	Tuesday 23 August Protostellar cores		Thursday 25 August Protostars & clusters	Friday 26 August Discs
1150	**Simon Glover** (Heidelberg University) Hunting for observational signatures of molecular cloud formation	**Isabelle Ristorcelli** (IRAP / CNRS UPS Toulouse) A statistical analysis of polarized dust emission in the environment of Planck Galactic cold clumps	Packed lunches will be available for collection from Holland Hall at 12:00.	**Laura Venuti** (INAF) Variety of accretion regimes in the young open cluster NGC 2264	**Gilles Chabrier** (NS-Lyon & Exeter) Formation of proto-stellar and proto-planetary disks in star formation: the key roles of different physical mechanisms
1210	**Ana Duarte Cabral** (University of Exeter) Observing simulations: Molecular clouds and their journey in the Galaxy	**Jenny Hatchell** (University of Exeter) Taking the temperature of local star-forming clouds with the JCMT Gould Belt survey		**Alicia Aarnio** (University of Michigan) Assessing Magnetospheric Accretion in Herbig Ae/Be Stars	**Alvaro Ribas** (Boston University) Protoplanetary disk lifetimes in nearby star-forming regions
1230	**Eric Keto** (Harvard-Smithsonian Center for Astrophysics) A simple description of the energy budget in molecular clouds and their atomic envelopes	**Sarah Sadavoy** (MPIA) Dust Emissivity in OMC 2/3: Linking the Diffuse Cloud to the Dense Cores	**Coaches for the afternoon excursions will leave Holland Hall promptly at 13:00**.	**Carlo Manara** (ESA/ESTEC) Disk evolution in young clusters: accretion, winds, and dynamical properties of young stars and their disks	**Melissa K. McClure** (ESO) T Tauri disk gas masses measured from hydrogen deuteride
1250	**Volker Ossenkopf-Okada** (University of Cologne) Column density PDFs as a diagnostic tool	**Chris Wright** (UNSW) Magnetic fields via thermal infrared polarimetric imaging		**Philip Lucas** (University of Herts) A population of eruptive variable protostars in VVV	**Stefan Kraus** (University of Exeter) Resolving the disc structure of FU Orionis stars
1310	Lunch			Lunch	

	Monday 22 August Molecular clouds	Tuesday 23 August Protostellar cores	Wednesday 24 August	Thursday 25 August Protostars & clusters	Friday 26 August Discs
1440	**Seamus Clarke** (Cardiff University) Fragmentation of accreting filaments	**Benoît Commerçon** (CRAL ENS Lyon) Outflows and disks formation in massive cores collapse	Excursions: • Jurassic Coast • Pebblebed vineyard • Dartmoor hike	**Matthew Bate** (University of Exeter) The dependence of stellar properties on metallicity	**Katharine Johnston** (University of Leeds) A Keplerian-like disc around the forming O-type star AFGL 4176
1500	**Jouni Kainulainen** (Max-Planck-Institute for Astronomy) Fragmentation of the Integral Shaped Filament in Orion A as viewed by ALMA	**Yusuke Aso** (University of Tokyo) ALMA observations of Keplerian disks around protostars		**Tom Megeath** (University of Toledo) Low Mass Star Formation in the DIverse Environments of Orion: Result from the Herschel Orion Protostar Survey	**James Owen** (Princeton) Vortices from low-mass planet formation in transition discs
1520	**Kate Pattle** (UCLAN) First results of the JCMT BISTRO survey: The magnetic field of Orion A	**Ben Lewis** (University of Exeter) Shaken and stirred - the role of turbulence, magnetism and radiation in the formation of protostars.		**Jan Forbrich** (University of Vienna) The Orion Radio All-Stars: new perspectives in stellar radio astronomy	**Michael Ireland** (ANU) High Angular Resolution Mid-Infrared Imaging of Transitional Disks
1540	**Huei-Ru Vivien Chen** (National Tsing Hua University) Filamentary Accretion Flows in the IRDC M17 SWex	**Neil Vaytet** (University of Copenhagen) A grid of 1D low-mass star formation collapse models: not all dense clouds form first Larson cores		**Nadia Murillo** (Leiden University) Do siblings always form and evolve at the same time? Coevality of multiple protostellar systems with Herschel	**Pablo Loren-Aguilar** (University of Exeter) Toroidal vortices as a solution to the dust migration problem
1600	Tea break			Tea break	

	Monday 22 August Molecular clouds	Tuesday 23 August Protostellar cores		Thursday 25 August Protostars & clusters	Friday 26 August Discs
1650	**Jonathan Henshaw** (Liverpool John Moores University) Seeding the Galactic Centre gas stream: initial conditions for the formation of Young Massive Clusters	**Yusuke Tsukamoto** (RIKEN) Bimodality of Circumstellar Disk Evolution Induced by the Hall Current		**Megan Reiter** (University of Michigan) Powerful jets driven by intermediate-mass protostars in the Carina Nebula	**Giovanni Rosotti** (University of Cambridge) What is the minimum planet mass that creates observable signatures in proto-planetary discs?
1710	**Joao Alves** (University of Vienna) Blue Streams and local star formation	**Oliver Lomax** (University of Cardiff) Core fragmentation and protostellar multiplicity		**Guido De Marchi** (ESA) The Tarantula of low-mass stars	**Eiji Akiyama** (NAOJ) Differential Grain Growth in the Spiral Structure of the LkHa 330 Disc
1730	**Emily Drabek-Maunder** (Imperial College London) The JCMT Gould Belt Survey: Understanding the influence of molecular outflows on Gould Belt clouds	**Joana Oliveira** (University of Keele) Herschel Spectroscopy of Massive Young Stellar Objects in the Magellanic Clouds		**Lee Hartmann** (University of Michigan) Mass functions of star clusters and the upper mass stellar IMF.	**John Monnier** (University of Michigan) GPI observations of Herbig Ae/Be stars
1750	**Enrique Vazquez-Semadeni** (RyA-UNAM) Core structure and evolution in globally collapsing molecular clouds	**Joseph Mottram** (MPIA) Fragmentation and disk formation in high-mass star formation		**Philippe André** (CEA/Saclay) The role of interstellar filaments in the origin of the stellar initial mass function	Conference summary **Lee Hartmann** (University of Michigan)

Social Events

Sunday 21st August	**Welcome drinks reception and buffet**, Holland Hall	19:00
Monday 22nd August	Poster session and drinks reception, The Forum	18:10 – 19:00
Tuesday 23rd August	**Barbeque**, Holland Hall One free drink ticket for all delegates A cash bar will be available (credit/debit cards will not be accepted)	19:00
Wednesday 24th August	**Afternoon excursions** Packed lunches will be available for collection at Holland Hall from 12:00 • *Jurassic Coast Tour* (2 coaches) • *Dartmoor Hiking Tour* (2 coaches) • *Pebblebed Vineyard*	Coaches leave from Holland Hall at **13:00 prompt**
Thursday 25th August	**Conference dinner**, the Great Hall Starting with a drinks reception and followed by a three course meal. After the meal we will be entertained by the Soul Traders with a mix of soul, funk and rock 'n' roll. A cash bar will be available (credit/debit cards will not be accepted).	19:00
Friday 26th August	**Public Talk**, Alumni Auditorium, The Forum Mark McCaughrean: ESA's Big Year in Space Science 2016 *The talk will be preceded at 18:10 by drinks and nibbles for delegates on the Forum mezzanine*	19:00

Monday 22nd August

Molecular Clouds

Talk Abstracts

Time of talk: Monday 09:00

Name: Stefanie Walch

Organisation: University of Cologne

Title: Theory review

Abstract:

Molecular clouds condense out of the warm interstellar medium (ISM) on scales of several 100 pc and host filamentary substructures on sub-pc scales. Furthermore, molecular clouds (MCs) consist of molecular hydrogen (H2), which can only be traced indirectly in observations, mostly by means of CO line and dust extinction measurements. Since they are observed to host large non-thermal line widths, the cloud sub-structure seems to be shaped by supersonic turbulence. The crux, however, is that supersonic turbulence is expected to decay in a crossing time unless it can be sustained by some physical process, e.g. stellar feedback. Since the turbulent dynamical state has been observed, the idea of short-lived, dynamically evolving MCs is widely accepted. It is thus likely that the turbulent, internal sub-structure of MCs is imprinted already during their formation process. In this talk I will review the current theoretical understanding of molecular cloud formation and evolution. A 30-minute review of molecular clouds from a theoretical perspective.

Time of talk: Monday 09:40

Name: Nicolas Peretto

Organisation: Cardiff University

Title: Observational review

Abstract:

The past few years have seen a great deal of spectacular large-scale surveys of star-forming regions across the Galaxy with unprecedented sensitivity and angular resolution. Combined with state-of-the-art interferometric follow-up observations, these surveys are transforming our view and understanding on how interstellar matter is transferred from large diffuse atomic clouds to compact protostellar objects. In this talk, I will review some of the key observational results of the past five years, focussing on the formation, evolution, and fragmentation of interstellar filaments into cores. Tightly related issues such as the formation of molecular clouds, the star formation efficiency, and the importance of feedback will be briefly addressed.

Time of talk: Monday 10:20

Name: Masato Kobayashi

Organisation: Nagoya University

Title: Evolutionary Picture of Giant Molecular Cloud Mass Functions on Galactic Scales

Abstract:

We formulate and compute the time evolution of giant molecular cloud mass functions on galactic disks. In our model, a network of expanding supernova remnants and HII regions drives the giant molecular cloud formation and evolution. Such a network provides (i) giant molecular cloud formation and self-growth through multiple episodes of warm neutral medium compression, (ii) giant molecular cloud self-dispersal by radiation from massive stars that are born within those clouds, and (iii) cloud-cloud collisions. Our formulation reflects these three phenomena by coarse-graining them typically over 10 Myrs. We successfully reproduce the observed variation of giant molecular cloud mass functions between arm and inter-arm regions (e.g., M51 by Schinnerer

et al. 2013; Colombo et al. 2014a). Our results suggest that the mass function slope is controlled by the ratio of giant molecular cloud formation timescale over its dispersal timescale, whereas the massive end is controlled by cloud-cloud collisions. Future large radio observations with finer spatial resolution and higher sensitivity can observe giant molecular clouds with much lower mass than before, which may put unique constraints on the giant molecular cloud formation/dispersal timescales in different environment on galactic scales. In addition, our results also suggest that some amount (typically a few per cent) of dispersed gas is consumed to form a newer generation of giant molecular clouds. Therefore, we insist that, obtaining a complete picture of gas recycling processes in interstellar medium requires the understanding of the fate of dispersed gas such as CO-dark clouds and optically thick HI gas, which thus needs massive magnetohydrodynamics simulations. In this contribution, we would like to present our results and discuss this new unified picture of giant molecular cloud mass function evolution throughout galactic disks.

Time of talk: Monday 10:40

Name: Andrea Bracco

Organisation: CEA, Saclay

Title: The relative orientation between magnetic fields and filamentary density structures from the diffuse ISM to molecular clouds

Abstract:

Investigating the dynamics of the interstellar medium (ISM) is key to gaining insight into the formation of star-forming filaments in molecular clouds (MCs). A plethora of numerical and analytical models associate the origin of this filamentary structure to the interplay between self-gravity and magnetohydrodynamical (MHD) turbulence in the ISM. However, only few observational constraints exist to favor one specific scenario. Despite the great effort of observers in the last decades, interstellar magnetic fields (MFs) still represent an important unknown in filament formation. Polarized thermal emission at sub-millimeter and far-infrared wavelengths from interstellar dust grains is the most suitable technique to investigate the density-weighted MF-structure in the ISM. Only very recently, the Planck satellite has completed the first all-sky maps of dust polarization at 850 microns, allowing us to probe the correlation between the MF geometry and the filamentary density structure with unprecedented statistics. In this talk I will present results on the relative orientation between the MF and the density structure in the ISM, from the diffuse medium to MCs. The probe of the MF properties in MCs and in their diffuse surroundings is crucial to understand the initial conditions relevant for the formation of star-forming filaments. In the Planck data, filaments seen in total intensity are observed statistically aligned with the MF orientation in the diffuse ISM, while they become statistically perpendicular to the MF in denser regions in MCs. I will discuss the implications of this correlation in the context of filament formation.

Time of talk: Monday 11:50

Name: Simon Glover

Organisation: Institute for Theoretical Astrophysics - University of Heidelberg

Title: Hunting for observational signatures of molecular cloud formation

Abstract:

In order to better understand how molecular clouds form in the galactic interstellar medium, we would like to be able to map the structure and kinematics of the gas flows responsible for forming them. However, it is not immediately obvious which observational tracers we should use in order to do this. CO, the workhorse molecule for studies of molecular clouds, is a poor choice, as it traces only relatively dense gas in those portions of the clouds that have already assembled and tells us little about the surrounding gas flows. Numerical simulations

suggest that these flows are composed of a mixture of HI and CO-dark H2 and allow us to study the properties of the emission that we expect to detect from them. In this talk, I will present results from a series of recent numerical simulations of cloud assembly and will discuss what these simulations can teach us about the best observational strategies to use when searching for signatures of cloud formation.

Time of talk: Monday 12:10

Name: Ana Duarte Cabral

Organisation: University of Exeter

Title: Observing simulations: Molecular clouds and their journey in the Galaxy

Abstract:

Stars form within molecular clouds, which are formed as a result of the interchange and evolution of gas through a wide range of densities and scales. Therefore, to understand the global processes that lead to star formation, it is crucial to understand the hierarchical organisation of the molecular component of the interstellar medium. However, defining and extracting clouds is not an easy task: molecular clouds are not a discrete well-defined entity - instead, they are part of a continuum of gas that travels through the galaxy, and often a mix of different fractions of atomic and molecular gas components, and different abundances of molecular species such as CO. Moreover, Milky Way studies suffer from yet another issue: a severe line of sight confusion that complicates the identification of “real” individual GMCs. Here I will present our recent work trying to grasp some of these issues, by studying the population of GMCs from a simulation of a portion of a spiral galaxy. We have used a new algorithm (SCIMES) to extract GMCs from both the physical 3-dimensional space, and from an observer’s perspective on CO emission datacubes. I will present the results from comparing the properties of clouds retrieved from the different extractions, as a means to understand the biases inherited from the perspective, resolution and tracer used. I will also explore how different galactic environments can affect GMC properties, namely by following the clouds as they travel from the shear-dominated inter-arm regions into and through spiral arms.

Time of talk: Monday 12:30

Name: Eric Keto

Organisation: Harvard-Smithsonian Center for Astrophysics

Title: A simple description of the energy budget in molecular clouds and their atomic envelopes

Abstract:

The energy budget of molecular clouds and their atomic envelopes is one of radiative equilibrium. For use in 3D numerical hydrodynamics, we develop the simplest possible description of this equilibrium leading to gas temperature. I will describe the model for gas and dust heating and cooling and how the model is benchmarked with observations. The chemical model for the abundances of the major gas coolants, CO, C+, and O, is checked by comparison with spectral line observations made with the Herschel satellite and with the IRAM 30m. The model for the dust is checked against multifrequency observations of submm dust emission also made with Herschel. This model for radiative equilibrium and the gas temperature has recently been incorporated into a 3D SPH code with applications for star formation (Bate and Keto, MNRAS 2015) and the first results, comparison with other more complex models, are described.

Time of talk: Monday 12:50

Name: Volker Ossenkopf-Okada

Organisation: University of Cologne

Title: Column density PDFs as a diagnostic tool

Abstract:

The most simple statistics to characterize the structure seen in maps of interstellar clouds is given by counting the observed intensity or column density values. The resulting probability distribution functions (PDFs) have a characteristic shape determined by the physical processes driving structure formation in the clouds.

Measuring these functions is, however, not trivial due to observational limitations. Careful corrections can eliminate the effects of observational noise and line-of-sight contamination. The selection of the map edges is already critical and it turns out that ALMA observations are basically unusable to obtain a reliable statistics. Column density PDFs from dust cover a much larger dynamic range than any molecular-line based PDF, but only the latter ones allow to fully avoid line-of-sight confusion.

The major part of the PDFs, usually described by a log-normal function, is often attributed to turbulence, but in fact, the statistics is often insufficient for this assignment. The power-law tail commonly found in the PDFs is caused by the gravitationally driven collapse of filaments and clumps. Different collapse geometries lead to different exponents that are directly measurable. Infrared dark clouds exhibit the same PDF features as more nearby, actively star-forming clouds, proving the same nature of both types of clouds. For a small number of clouds we find, moreover, clear signatures of the phase transitions between atomic and molecular hydrogen and for the impact of radiative feedback on the column density statistics.

Time of talk: Monday 14:40

Name: Seamus Clarke

Organisation: Cardiff University

Title: Fragmentation of accreting filaments

Abstract:

We use smoothed particle hydrodynamic simulations to investigate the growth of perturbations in infinitely long, initially sub-critical but accreting filaments. The growth of these perturbations leads to filament fragmentation and the formation of cores. Most previous work on this subject has been confined to the growth and fragmentation of non-accreting equilibrium filaments and has found that there exists a preferential fragmentation length scale which is roughly 4 times the filament's diameter. Our results show a more complicated dispersion relation with a series of peaks linking perturbation wavelength and growth rate. These are due to gravo-acoustic oscillations along the longitudinal axis during the sub-critical phase of growth, when the filament is far from equilibrium. The positions of the peaks in growth rate have a strong dependence on both the mass accretion rate onto the filament and the temperature of the gas. When seeded with a multi-wavelength density power spectrum there exists a clear preferred core separation equal to the largest peak in the dispersion relation. Our results allow observers to estimate a minimum age for a filament which is breaking up into regularly spaced fragments, as well as a maximum accretion rate. We apply the model to recent observations by Tafalla & Hacar (2015) of fragmenting sub-filaments in Taurus and find accretion rates consistent with those estimated by Palmeirim et al. (2013).

Time of talk: Monday 15:00

Name: Jouni Kainulainen

Organisation: Max Planck Institute for Astronomy

Title: Fragmentation of the Integral Shaped Filament in Orion A as viewed by ALMA

Abstract:

High line-mass filaments are birthplaces of high-mass stars and star clusters and thus important for Galactic scale star formation. However, description of their fragmentation and collapse process is yet fundamentally lacking. We have performed the most sensitive fragmentation study of a high line-mass filament to date: we have used ALMA 3 mm continuum data to characterize fragmentation of the Integral Shaped Filament in Orion A down to 1 000 AU scales. The dense cores detected in the data indicate a two-mode fragmentation picture: periodic fragmentation into groups of cores and further fragmentation within those groups. Any current gravitational fragmentation models do not predict such pattern; we discuss possible processes leading to it. We also compare the spatial distribution of dense cores to protostars and stars with disks. The protostars are grouped similarly with the dense cores, while stars with disks have clearly different distribution. This indicates that the maternal grouping of dense cores is retained over the protostar lifetime, but not over the lifetime of stars with disks. This in turn suggests that the distribution of stars loses the memory of its origin rapidly after stars decouple from gas.

Time of talk: Monday 15:20

Name: Kate Pattle

Organisation: University of Central Lancashire

Title: First results of the JCMT BISTRO survey: The magnetic field of Orion A

Abstract:

We present the first results from the BISTRO (B-Fields in Star-Forming Region Observations) Survey. BISTRO is using the newly-commissioned POL-2 polarimeter on the JCMT to map the submillimetre emission from high-column-density regions of nearby star-forming clouds to unprecedented depth in polarised light. BISTRO is producing a large and homogeneous polarisation data set, mapping the magnetic fields in star-forming regions on scales as small as 1000 AU, allowing investigation of some of the most important questions in star formation, particularly the relative importance of magnetic fields and turbulence to the energy balance and evolution of star-forming regions. As a demonstration of the science which BISTRO will achieve, we present early results of observations of the Orion A molecular cloud. We present maps of the magnetic field structure of the OMC 1 star-forming region, along with estimates of magnetic field strengths determined through synthesis with carbon monoxide data taken as part of the JCMT Gould Belt Survey using the Chandrasekhar-Fermi method. We show that the field in the centre of the Orion BN-KL region shows an 'hourglass' morphology, with field lines running approximately perpendicular to the central filament. We discuss the consistency of these observations with the recently-proposed model of filament growth in which material is funnelled onto filaments along magnetic field lines, and discuss the interaction between the Orion BN-KL outflow and the local magnetic field. We further show that the polarisation vectors around the Orion Bar are consistent with the Orion Bar being wrapped by a helical magnetic field, and discuss the contribution of magnetic energy to the energy balance of both the Orion BN-KL and Orion Bar regions.

Time of talk: Monday 15:40

Name: Huei-Ru Vivien Chen

Organisation: National Tsing Hua University

Title: Filamentary Accretion Flows in the IRDC M17 SWex

Abstract:

Although filamentary structures are ubiquitous in molecular clouds, basic observational constraints are needed to clarify the role of filaments in the mass assembling process. We have observed with ALMA the N2H+ and HNC emission in the filamentary accretion flows in the remarkable IRDC complexes, M17 SWex, where a delayed onset of massive star formation was reported in the two hubs at the convergence of multiple filaments of parsec length. We derived the kinematics with the N2H+ emission and found the line widths are smaller than those of ammonia, suggesting a transonic nature of dense gas in the filaments. Slow infall motions are detected along the filaments. Multiple velocity coherent substructures are present in both hubs, likely not yet reaching virial equilibrium.

Time of talk: Monday 16:50

Name: Jonathan Henshaw

Organisation: Liverpool John Moores University

Title: Seeding the Galactic Centre gas stream: initial conditions for the formation of Young Massive Clusters

Abstract:

The Central Molecular Zone of the Milky Way contains some of the most massive and dense molecular clouds and star clusters in the Galaxy, offering an important window on star formation under extreme conditions. Star and cluster formation in this extreme environment may be closely linked to the orbital dynamics of the gas, the three dimensional distribution of which has been subject to intense scrutiny for several decades. One of the most striking features of the CMZ, noted from the earliest studies, is the complex gas distribution in position-position-velocity (PPV) space. In this contribution, I will present our new systematic approach to studying the kinematics of dense gas in the central 250pc of the Galaxy, demonstrating how this has helped to accurately describe the {l,b,v} structure of the CMZ. I will demonstrate how this analysis can help to distinguish between the three geometries commonly cited within the literature to describe the 3-D structure of the CMZ. Finally, I will present the recent discovery of intriguing oscillatory patterns in the kinematic structure of the dense gas. Perhaps an observational sign-post of gravitational instabilities within the gas, this has, if confirmed, significant implications for understanding the formation of some of the most massive and dense molecular clouds within the Galaxy and may represent the earliest phases in a directly observable (absolute) time sequence for star formation.

Time of talk: Monday 17:10

Name: Joao Alves

Organisation: University of Vienna

Title: Blue Streams and local star formation

Abstract:

We construct a 3D map of the spatial density of OB stars within 500 pc from the Sun using the Hipparcos catalogue and find three large-scale stream-like structures that allow a new view on the solar neighborhood.

The spatial coherence of these blue streams and the monotonic age sequence over hundreds of parsecs suggest that they are made of young stars, similar to the young streams that are conspicuous in nearby spiral galaxies. The three streams are 1) the Scorpius to Canis Majoris stream, covering 350 pc and 65 Myr of star formation history, 2) the Vela stream, encompassing at least 150 pc and 25 Myr of star formation history, and 3) the Orion stream, including not only the well-known Orion OB1abcd associations, but also a large previously unreported foreground stellar group lying only 200 pc from the Sun. The well-known nearby star-forming low-mass clouds, including the nearby T and R associations Lupus, Cha, Oph, CrA, Taurus, and various low-mass cometary clouds in Vela and Orion, appear in this new view of the local neighborhood to be secondary star formation episodes that most likely were triggered by the feedback from the massive stars in the streams.

We find no evidence of an elliptical structure such as the Gould Belt, a structure we suggest is a 2D projection effect, and not a physical ring. We present Herschel data on Ophiuchus where we find that all protostars in Ophiuchus (97%) can be readily associated with a particular source of feedback in the region and that the Ophiuchus filaments (up to 20 pc long) are also formed by the feedback from massive stars, in contrast with the currently accepted filament formation scenario of colliding flows orthogonal to the filament axis. Finally, we do not find N-PDFs to be log-normal, but power-laws.

Time of talk: Monday 17:30

Name: Emily Drabek-Maunder

Organisation: Imperial College London

Title: The JCMT Gould Belt Survey: Understanding the influence of molecular outflows on Gould Belt clouds

Abstract:

Using James Clerk Maxwell Telescope (JCMT) Gould Belt Survey data from CO J=3-2 isotopologues, we present a meta-analysis of the outflows and energetics of star-forming regions in several Gould Belt clouds. The majority of the regions are strongly gravitationally bound. There is evidence that molecular outflows transport large quantities of momentum and energy. Outflow energies are at least 20 per cent of the total turbulent kinetic energies in all of the regions studied and greater than the turbulent energy in half of the regions. However, we find no evidence that outflows increase levels of turbulence, and there is no correlation between the outflow and turbulent energies. Even though outflows in some regions contribute significantly to maintaining turbulence levels against dissipation, this relies on outflows efficiently coupling to bulk motions. Other mechanisms (e.g. supernovae) must be the main drivers of turbulence in most if not all of these regions.

Time of talk: Monday 17:50

Name: Enrique Vazquez-Semadeni

Organisation: RyA-UNAM

Title: Core structure and evolution in globally collapsing molecular clouds

Abstract:

After a brief motivation for the scenario that molecular clouds are in a state of global and hierarchical gravitational collapse, consisting of collapses within collapses, I will discuss the evolution and structure of clumps and dense cores in numerical simulations of cloud formation within this scenario. The clumps exhibit a scaling relation of the form sigma_v^2/R ~ Sigma, where sigma_v is the velocity dispersion, R is the cloud ""radius"", and Sigma is the column density. This relation is similar to that observed for GMCs and massive star-forming clumps, suggesting that the global-collapse scenario correctly describes their internal structure. Concerning the evolution of dense cores, I will also discuss numerical simulations of the prestellar collapse of near-Jeans-mass

cores embedded in a multi-Jeans-mass initially uniform background medium. The evolution of these cores closely traces the locus of both low- and high-mass observed dense core ensembles in an M_c/M_BE vs. M_c diagram introduced by Lada et al. (2008), where M_c is the core mass and M_BE is the Bonnor-Ebert mass at the mean density and temperature of the cores. The collapse proceeds in an outside-in fashion, which implies that infall speed estimates based on blue-excess line profiles may underestimate the actual velocities arising in the core.

Tuesday 23rd August

Protostellar Cores

Talk Abstracts

Time of talk: Tuesday 9:00

Name: Kengo Tomida

Organisation: Osaka University

Title: Theory review

Abstract:

In this talk I review recent progress in theoretical studies of formation and evolution of stars and disks in collapsing molecular cloud cores. I start from classical problems in the early phase of star and disk formation (i.e. until early Class 1 phase), such as the angular momentum problem, the magnetic flux problem, the magnetic braking catastrophe, the fragmentation crisis, driving of outflows, and so on. In particular, while the angular momentum problem and the magnetic braking catastrophe are now reconciled qualitatively, but they still remain as qualitative problems. Then I move to the later phase of star formation and discuss outstanding topics such as the luminosity problem, episodic accretion, and regulation mechanisms of star formation efficiency in the small scale in different mass regimes, among other things. Also, if time permits, I briefly review recent efforts on theoretical modeling and synthetic observations that enable us to directly compare theories and observations especially using ALMA. At the end I would like to summarize the remaining (and new) problems, (near) future directions, and (quite personal) perspectives.

Time of talk: Tuesday 9:40

Name: Anaëlle Maury

Organisation: CEA/Saclay

Title: Observational review

Abstract:

While the physical processes regulating the formation and evolution of star-forming cores are believed to largely determine the properties of the resulting young stars, their study has been mostly limited to shallow- and low-resolution observations. The advent of Herschel and large (sub-)millimeter interferometers (ALMA, NOEMA) recently allowed to over-come these limitations, and carry out detailed and/or statistical studies of the cores physical structure and chemical composition, to finally unravel the complex interplay of processes at work to form stars from these cores. I will review recent observational results, showing how the combination of high angular resolution and unprecedented sensitivity allow to finely characterize critical properties such as the angular momentum content, infall rates, pristine disk properties and multiplicity fraction of the youngest star-forming cores.

Time of talk: Tuesday 10:20

Name: Vera Könyves

Organisation: CEA/Saclay

Title: A census and properties of dense cores and filaments in the Aquila and Orion B cloud complexes

Abstract:

One of the main scientific goals of the Herschel Gould Belt survey (http://gouldbelt-herschel.cea.fr) is to elucidate the physical mechanisms responsible for the formation and evolution of prestellar cores in molecular clouds. Based on Herschel/SPIRE-PACS photometric data, we have recently identified a large sample of such cores in the Aquila (Könyves et al. 2015) and Orion B (Könyves et al., in prep.) molecular clouds.

Our Herschel observations also provide an unprecedented census of filaments in the nearby clouds and suggest an intimate connection between these filaments and the formation process of prestellar cores.We will compare and contrast some properties of the dense cores in the Aquila and Orion B complexes, such as their distributions in the filamentary background, masses, lifetimes, and formation thresholds.

In summary, our Herschel findings support a filamentary paradigm for the early stages of star formation, where the cores result primarily from the gravitational fragmentation of marginally supercritical filaments (cf. André et al. 2014, PPVI).

Time of talk: Tuesday 10:40

Name: Alana Rivera-Ingraham

Organisation: ESA

Title: Extreme Star Formation in the Galaxy: The Herschel View

Abstract:

The Herschel Space Observatory has provided extensive datasets of unprecedented quality and coverage. The Archive covers regions in a wide range of physical and star-forming conditions across the Galaxy. Here we introduce the latest results from an ongoing large-scale project focused on investigating the processes driving star formation in the most extreme conditions. Compact sources and filamentary structures have been identified and extracted from Herschel maps targeting the most active and densest regions of the Galactic Plane, comprising vigorous, high-mass star and cluster formation. Each structure was characterised according to its physical and environmental properties, ongoing star formation and evolutionary state. The star-forming conditions of these fields have been compared with those derived from the most diffuse, high-galactic latitude fields with none or weak star forming events. Our extensive study provides new evidence in favour of the critical role of external and environmental factors in the overall star formation process, and how these factors contribute to explaining the radically different star formation events in our Galaxy, from isolated low-mass star formation to massive clusters. This evidence will be summarised and discussed in context with theoretical models of cloud evolution.

Time of talk: Tuesday 11:50

Name: Isabelle Ristorcelli

Organisation: IRAP/CNRS-UPS Toulouse

Title: A statistical analysis of polarized dust emission in the environment of Planck Galactic cold clumps

Abstract:

Magnetic fields are considered one of the key physical agents that regulate star formation, but their actual role in the formation and evolution of dense cores remains an open question. Polarized dust continuum emission is particularly well-suited to probe the magnetic field structure in the dense, cold interstellar medium. Such observations also provide tight constraints on the efficiency of dust alignment along magnetic field lines, which are needed to properly infer the magnetic field properties from observations. With the Planck all-sky survey of dust submillimetre emission in intensity and polarization, we can investigate intermediate spatial scales in the hierarchy of star formation, between global molecular cloud measurements and studies of individual prestellar cores. Planck further enables a statistical analysis of the polarization properties of clumps. We have recently built the first all-sky catalogue of Galactic Cold Clumps (PGCC, Planck collaboration XXVIII 2015), a fraction of which we have studied in detail with our Herschel Key Programme 'Galactic Cold Cores'. The sources cover a broad range in physical properties and correspond to different evolutionary stages in the star formation process,

from quiescent starless clumps and nearby cores to young protostellar objects. I will present new results from our analysis of the polarized 353GHz Planck data for the PGCC sources. In particular, we have studied the variation of the polarization fraction and angle, and the relative orientation between the B-field and the clump elongations. We have also analysed the magnetic field morphology and compared it to structures (filaments, striations) traced at higher resolution with Herschel in the environment of PGCC sources, searching for evolutionary signatures. Finally, I will present a comparison of our results with predictions from MHD simulations that include radiative transfer and the dust radiative torque alignment mechanism.

Time of talk: Tuesday 12:10

Name: Jennifer Hatchell

Organisation: University of Exeter

Title: Taking the temperature of local star-forming clouds with the JCMT Gould Belt survey

Abstract:

Radiative heating by recently-formed (or forming) stars potentially provides a regulatory mechanism for star formation, reducing fragmentation and increasing protostellar masses. I will report on work carried out by the JCMT Gould Belt survey team on the contribution that SCUBA-2 data makes to measuring dust temperatures, on its own and in combination with Herschel measurements.

Time of talk: Tuesday 12:30

Name: Sarah Sadavoy

Organisation: Max Planck Institute for Astronomy

Title: Dust Emissivity in OMC 2/3: Linking the Diffuse Cloud to the Dense Cores

Abstract:

Planck observations have found relatively uniform values for the dust emissivity index of beta ~ 1.8 for diffuse cloud material. Nevertheless, stars form within smaller-scale, denser environments where the dust grains are expected to grow in size, form icy mantles, and subsequently have distinct dust emissivities compared to the diffuse cloud. To explore this expected dust grain evolution, we combined Herschel observations with long-wavelength 2 mm data across a ~ 2 pc long, continuous section of OMC 2/3 at 15000 AU (0.08 pc) resolution. We determine beta and reconstruct simultaneously the filtered-out large-scale emission at 2 mm in this analysis. We find that beta ~ 1.7-1.8 provides the best fit across most of OMC 2/3 with only one protostellar core showing significantly lower values of beta (~1.4). The consistency in beta between the cloud-scale Planck data and our core-scale analysis for OMC 2/3 supports the common assumption of fixed beta indices used ubiquitously in the conversion of (sub)millimeter emission to mass in dense star forming regions. If this consistency is demonstrated in other clouds, then significant changes to dust grain properties may only be apparent on smaller (sub core) scales.

Time of talk: Tuesday 12:50

Name: Christopher Wright

Organisation: UNSW Canberra

Title: Magnetic fields via thermal infrared polarimetric imaging

Abstract:

Aligned dust grains within a magnetic field can induce polarization of thermal infrared radiation via emission, absorption or both. The position angle of polarization is directly related to the magnetic field projected on to the plane-of-the-sky. We will present new sub-arcsecond polarimetric imaging observations of embedded Young Stellar Objects made with the CanariCam mid-IR camera/spectrometer on the 10.4 m Gran Telescopio Canarias. By obtaining images across the 10 micron silicate band we can separate emissive and absorptive components of polarization and thus obtain two magnetic field directions, i.e. those within 'warm' and 'cold' regions of the target. For sources which are also extended we can then obtain a 3-d picture of the magnetic field.

Time of talk: Tuesday 14:40

Name: Benoît Commerçon

Organisation: CRAL ENS Lyon

Title: Outflows and disks formation in massive cores collapse

Abstract:

Discs and outflows are observational features of star formation. While discs and outflows formation is becoming increasingly constrained thanks to radiation magnetohydrodynamics models and observations in the context of low-mass star formation, it is not the case for massive star formation. I will present results of massive magnetized dense core collapse simulations including radiative feedback and ambipolar diffusion. We use the adaptive-mesh-refinement code RAMSES (Teyssier 2002) which includes resistive MHD (Fromang et al. 2006, Masson et al. 2012) and radiative transfer (Commerçon et al. 2011, 2014). I will show how magnetic fields and radiative feedback work together to launch outflows. I will study the formation and properties (early evolution and fragmentation) of the disc around the massive protostars, comforting the standard accretion-discs scenario in the context of magnetised core collapse. Last I will also highlight the limits of ideal MHD with respect to magnetic flux redistribution and outflow formation.

Time of talk: Tuesday 15:00

Name: Yusuke Aso

Organisation: The University of Tokyo

Title: ALMA observations of Keplerian disks around protostars

Abstract:

Keplerian disks around young stars play essential roles in star and planet formation. Even though disks around T Tauri stars have been studied well in the last two decades, the disk formation process prior to T Tauri phase is still not well understood. This is because observations of disks around embedded protostars have been limited. Such a situation, however, has been undergoing a dramatic transformation in the ALMA are.

To understand the disk formation around protostars in detail, we have been observationally studying 8 protostars (6 Class 0 and 2 Class I) with ALMA in mainly C18O (J=2-1) line and 1.3 mm continuum emissions at

sub-arcsec resolutions. All the sources show velocity gradients in C18O and detailed analyses using PV diagrams revealed that 4 of them show Keplerian rotation, which is clearly distinguished from rotation of the envelopes. Class 0 protostars tend to have less detectable disks, with lower specific angular momenta. It would be, therefore, suggested that our series of ALMA observations witness disk formation and growth during the protostellar evolution although the results are not statistically significant yet. Dynamical stellar masses estimated from the identified Keplerian rotation are compared with infall motions in their envelopes, finding that some of the infall velocities are significantly slower than the free-fall velocities yielded by their dynamical stellar masses.

The continuum visibility of L1527 IRS, which has an edge-on disk, is fitted by modified disk models without any annulus averaging. This analysis is particularly important for non-axisymmetric structures, such as a disk. The best model suggests that the density of dust is discontinuously enhanced at the boundary between the disk and the envelope. Additionally, the scale height of the disk can be explained by hydrostatic equilibrium. These results clearly demonstrate that ALMA observations can not only search for but also characterize in detail disks around protostars.

Time of talk: Tuesday 15:20

Name: Benjamin Lewis

Organisation: University of Exeter

Title: Shaken and stirred - the role of turbulence, magnetism and radiation in the formation of protostars.

Abstract:

Expanding on Lewis, et al (2015) and (2016, submitted), which considered only an ideal MHD simulations of the collapse of molecular cloud cores without turbulence, we now use radiation magnetohydrodynamical calculations to explore how the physics of turbulence, magnetism and radiation influence the formation of protostars. We find that the gravitational collapse proceeds in a very different manner in cores with transonic turbulence compared to those with subsonic turbulence across a variety of field geometries and structures. Transonic (i.e. ~ Mach 1) cores are highly disrupted by the turbulent motion which also suppresses the formation of bipolar jets from the first hydrostatic core. Cores with subsonic turbulence still contain a jet, albeit without the symmetry previously seen in non-turbulent calculations and, depending on the magnetic field strength, form pseudo-discs. The inclusion of radiative transfer into the calculations promotes the formation of large discs, compared to the very small and dense discs produced by the MHD only calculations.

Time of talk: Tuesday 15:40

Name: Neil Vaytet

Organisation: Niels Bohr Institute, University of Copenhagen

Title: A grid of 1D low-mass star formation collapse models: not all dense clouds form first Larson cores

Abstract:

Stars form within large turbulent molecular clouds from density fluctuations which become gravitationally unstable. Numerical simulations of star formation are becoming ever more sophisticated, incorporating new physical processes in increasingly realistic setups. These models are being compared to the latest observations through state-of-the-art synthetic renderings that can identify the different chemical species present in the protostellar systems. The chemical evolution of the interstellar and protostellar matter is a very active field of research, with more and more chemical databases and reaction solvers becoming available online to the community.

Time of talk: Tuesday 16:50

Name: Yusuke Tsukamoto

Organisation: RIKEN

Title: Bimodality of Circumstellar Disk Evolution Induced by the Hall Current

Abstract:

We investigate the effect of the Hall current term on the formation of the circumstellar disk using three-dimensional simulations. In our simulations, all non-ideal effects, as well as the radiation transfer, are considered. We found that the size of the disk is significantly affected by a simple difference in the inherent properties of the prestellar core, namely whether the rotation vector and the magnetic field are parallel or anti-parallel. In the former case, only a very small disk (\lt 1 {AU}) is formed. On the other hand, in the latter case, a massive and large (\gt 20 {AU}) disk is formed in the early phase of protostar formation. Since the parallel and anti-parallel properties do not readily change, we expect that the parallel and anti-parallel properties are also important in the subsequent disk evolution and the difference between the two cases is maintained or enhanced. This result suggests that the disk size distribution of the Class 0 young stellar objects is bimodal. Thus, the disk evolution can be categorized into two cases and we may call the parallel and anti-parallel systems Ortho-disk and Para-disk, respectively. We also show that counter-rotating envelopes against the disk rotation appear with a size of $\gtrsim$ 200 {AU}. We predict that the counter-rotating envelope will be found in the future observations.

Time of talk: Tuesday 17:10

Name: Oliver Lomax

Organisation: Cardiff University

Title: Core fragmentation and protostellar multiplicity

Abstract:

Using an ensemble SPH simulations, we follow the evolution of prestellar cores as they collapse and fragment into protostars. The initial conditions for these simulations are constructed to match the observed properties of the cores in Ophiuchus. The protostars that form match the statistics of observed young protostars (IMF and multiplicity statistics, including triples, quadruples, quintuples and sextuples) but only if (i) radiative feedback from protostars is episodic, and (ii) the turbulent velocity field has a significant solenoidal component. A majority of protostars are attended by significant discs, but in multiple systems these discs are often poorly aligned with one another and/or the binary orbit, reflecting the stochastic nature of the accretion flows that feed material into the centre of a core. We also present synthetic spectra and images of multiple systems embedded in protostellar cores. These are calculated using a new Smoothed Particle Monte Carlo Radiative Transfer algorithm.

Time of talk: Tuesday 17:30

Name: Joana Oliveira

Organisation: Keele University

Title: Herschel Spectroscopy of Massive Young Stellar Objects in the Magellanic Clouds

Abstract:

As the nearest gas-rich galaxies, the Large and Small Magellanic Clouds (LMC and SMC) offer the exciting opportunity to bridge the gap between star formation processes on large galaxy-wide scales and on the small

scales of individual Young Stellar Objects (YSOs). These metal-deficient galaxies also provide an invaluable window into the star formation process at low metallicity, a region in the parameter space that remains relatively unexplored. I present the results of spectroscopic observations obtained with PACS and SPIRE/FTS onboard the Herschel Space Observatory. The sample of massive SMC and LMC YSOs is well characterised at near- and mid-IR wavelengths, and includes both deeply embedded sources and compact HII regions. The strengths of key gas-phase cooling species ([OI], [CII], H2O, CO, OH) are measured as probes of the physical conditions of the gas surrounding the YSOs. This analysis directly probes the potential metallicity effect, since it quantifies the relative luminosities of the species that promote envelope cooling and thus constrain the cooling budget of the YSO envelopes. The results indicate that while [OI], [CII] and CO are easily and widely detected, H2O and OH may be weak or absent in most YSOs. When compared with massive Galactic YSOs, the Magellanic YSOs clearly exhibit higher photoelectric efficiency (measured by the ratio of line emission to total IR flux), while showing similar [OI]/[CII] ratios; in terms of standard PDR models this suggests a lower G_0/n ratio. The CO ladder is used to constrain the density and temperature of the emitting gas. The spatial extension and morphology of the main emission lines is used to explore the interplay and feedback of the massive YSOs with their environments. I will place such results in context by comparing SMC, LMC and Galactic samples, in order to constrain potential metallicity effects on the star formation process.

Time of talk: Tuesday 17:50

Name: Joseph Mottram

Organisation: Max Planck Institute for Astronomy

Title: Fragmentation and disk formation in high-mass star formation

Abstract:

How do the composition and kinematics of massive star forming environments affect the properties of the high-mass protostars that are forming in them? How is the degree of fragmentation and mass on disk-like scales related to the larger reservoir of dust and gas that they reside in? Are the 10^-4 Msol/yr and higher mass accretion rates and/or flattened envelope structures required by many current theories to form the most massive stars seen in real systems? Does feedback have more of an impact on large or small scales and what is the size (and shape) of the mass reservoir systems forming massive stars? These are all key questions to developing a full, comprehensive and prescriptive theory of how the most massive stars form. What is more, answering them requires multi-scale observations of both the continuum and molecular lines. I will present early results from the CORE NOEMA large program, which is designed to answer such questions by combining observations with multiple PdBI configurations and the IRAM 30m of 20 high-mass star forming regions with L> 10^4 Lsol. As such we have one of the largest datasets to date of high mass star forming regions with sensitivity to emission on spatial scales from ~0.4 pc to <1000 AU, ideal for tackling these fundamental questions.

Wednesday 24th August

Splinter Sessions

Early Career Researchers Session (Alumni Auditorium, The Forum)

Organisers: Chris Brunt and Tim Harries

This session is devoted to talks by early career researchers whose abstract submissions were highly ranked by the SOC.

09:00 Sam Geen (CEA Saclay)
Feedback in molecular clouds

09:15 Jan Orkisz (IRAM/LERMA)
Turbulence versus star formation efficiency in Orion B

09:30 Gwen Williams (University of Cardiff)
What can filament dynamics tell us about core formation?

09:45 Joseph Booker (University of Toledo)
HST Scattered Light Imaging of Orion Protostars: Do Outflows Halt Infall?

10:00 Bilal Ladjelate (CEA Saclay)
Star-formation in the Ophiuchus Molecular Cloud: Similarities and diversity

10:15 Coffee break

10:45 Josefa Grossschedl (University of Vienna)
Resolved maps of Star Formation Rate and Efficiency in Orion A

11:00 Steve Mairs (University of Victoria)
How Do Protostars Assemble Mass? A Sub-Millimetre (JCMT) Variability Survey of Deeply Embedded Protostars

11:15 Dominika Boneberg (University of Cambridge)
The midplane conditions of protoplanetary discs

11:30 Julia Roquette (Universidade Federal de Minas Gerais)
Near-Infrared variability of disk-bearing stars in Cygnus OB2

Planet Formation Imager Session (Forum Seminar Room 4)

Organiser: Stefan Kraus

Among the most fascinating and hotly-debated areas in contemporary astrophysics are the means by which planetary systems are assembled from the large rotating disks of gas and dust which attend a stellar birth. Although important work is being done both in theory and observation, a full understanding of the physics of planet formation can only be achieved by opening observational windows able to directly witness the process in action. The key requirement is then to probe planet-forming systems at the natural spatial scales over which material is being assembled. By definition, this is the so-called Hill Sphere which delineates the region of influence of a gravitating body within its surrounding environment. The Planet Formation Imager project has crystallized around this challenging goal: to deliver resolved images of Hill-Sphere-sized structures within candidate planet-hosting disks in the nearest star-forming regions. Solving the riddle of planetary formation has profound and far-reaching implications beyond astronomy, for it helps inform our place in the universe and expectations for life on other worlds.

09:00 John Monnier (University of Michigan)
Introduction to Planet Formation Imager Project

09:15 Stefan Kraus (University of Exeter)
The Science Vision for PFI

09:40 Mike Ireland (ANU)
A Baseline Design and Technical Roadmap for the PFI

10:05 Catherine Espaillat (University of Boston)
Detecting and characterising protoplanets with PFI

10:40 Coffee break

10:50 Johan Olofsson (MPIA)
Late stages of planetary system formation investigated with PFI

11:25 Sebastian Hoenig (University of Southampton)
Extragalactic science with PFI

Computational Star Formation Session (Forum Seminar Room 5)

Organiser: Simon Goodwin

The focus of this session is numerical simulations of star formation. There are talks on both numerical methods and recent results. The last part of the session will be devoted to a discussion of future directions for computational star formation.

09:00 Daniel Seifried (University of Cologne)

09:15 Munan Gong (Princeton)

09:30 Rachel Spowage (University of Cardiff)

09:45 Rajika Kuruwita (ANU)

10:00 Claire Esau (University of Sheffield)

10:30 Coffee break

11:00 Duncan Forgan (University of St. Andrews)

11:20 Discussion: Where next for computation?

Ages and timescales of young stars (Forum Seminar Room 6)

Organiser: Cameron Bell

A predictive theory of the formation and evolution of stars and planets is one of the fundamental goals of modern astronomy, however our understanding hinges upon the ability to assign *precise* and *reliable* ages to young stars. These ages are crucial to constraining any potential theory by providing timescales with which to study the time-dependent physical processes occurring in young stars.

This splinter session aims to bring together scientists in the star formation community to discuss recent developments related to the ages of young stars, and how to combine these improved ages with ancillary data to further our understanding of star cluster formation in general. We will also focus on second-order effects such as the local environment in which these stars from.

09:00 Mark Pecaut (Rockhurst University)
Advances and limitations in determining the ages and timescales of young stars

09:30 Justyn Campbell-White (University of Kent)
Classifying HII regions using shape analysis of IR bubbles

09:50 Christine Koepferl (University of St. Andrews)
Insights from synthetic star-forming regions: star formation rates and dust properties

10:10-
10:15 Poster pop-up

10:15-
10:40 Coffee break

10:40 Rob Jeffries (Keele University)
Ages from lithium depletion in young stars

11:00 Mario Guarcello (INAF - Osservatorio Astronomico di Palermo)
Photoevaporation and close encounters: how the environment around Cygnus OB2 affects the evolution of protoplanetary disks

11:20 Sami Dib (Niels Bohr Institute)
Feedback-regulated star formation: dual constraints on the star formation efficiency and the age spread of stars in clusters

11:40 Dirk Froebrich (University of Kent)
Photometric monitoring of nearby young clusters as a Citizen Science Project

Measuring temperatures and densities in star forming regions (Forum Seminar Room 10)

Organiser: Jenny Hatchell

Rationale: Star formation theories predict temperatures and densities for clouds, filaments and cores. Neither temperature nor density is a direct observable. This session aims to bring together researchers interested in extracting these physical properties from observations (e.g. continuum surveys or molecular lines) to discuss useful datasets and methodology (e.g. Bayesian model fitting, radiative transfer models).

09:00-
10:30 Short talks, each finishing with a summary slide showing the main result(s) and a 'wish list' - what the speaker would like to be able to do with his/her method/data/region but doesn't know how to achieve. Questions at this point will be limited to clarifications.

09:00 Jenny Hatchell (University of Exeter)
Introduction

09:10 Yao-Lun Yang (University of Texas)
Modeling the Structure of a Class 0 Protostar, BHR71, with 3-D Dust Radiative Transfer Simulations

09:25 Fernando Olguin Choupay (University of Leeds)
The physical properties of the prototypical MYSO GL 2591

09:40 Jared Keown (University of Victoria)
The Green Bank Ammonia Survey

09:55 Jorge Abreu-Vicente (MPIA Heidelberg)
Fourier-space combination of Planck and Herschel images

10:10 Nadia Murillo (Leiden University)
The role of temperature and gas heating in multiple stellar system formation

10:30 Coffee break

11:00-
12:00 2-minute presentations of 'wish lists' from relevant main session talks (Joe Mottram, Katherine Johnstone, Emily Drabek, Jan Forbrich, & Jenny Hatchell), followed by open discussion based on the issues raised.

Thursday 25th August

Young Clusters & Protostars

Talk Abstracts

Time of talk: Thursday 9:00

Name: Nick Wright

Organisation: Keele University

Title: Observational review

Abstract:

Over the last few decades our understanding of the properties of young stars and clusters has changed dramatically thanks to many wide-field observations and surveys across the electromagnetic spectrum. Infrared, X-ray and emission-line surveys have greatly increased our census of known pre-main-sequence stars, allowing us to study their distribution and clustering, measure the initial mass function and multiplicity in different environments, and study the ages and star formation histories of different regions. The rise in time domain surveys has also improved our view of episodic accretion and variability in pre-main-sequence stars, while high-resolution imaging has allowed us to study jets and outflows from such objects that exert feedback on their surroundings. In this talk I will review the current observational picture of the properties of young stars and clusters, with a particular focus on how wide-field surveys have contributed to our understanding of this critical phase of stellar lives.

Time of talk: Thursday 9:40

Name: Stella Offner

Organisation: UMass Amherst

Title: Theory review

Abstract:

Star formation is governed by the complex interplay of various physical forces, including turbulence, gravity and magnetic fields. In addition, neighboring stars greatly influence each other and their natal cloud by injecting energy into their surroundings ("feedback"). This interaction creates strong coupling between physical processes acting over a broad range of scales. Numerical simulations play an essential role in investigating the complex, nonlinear physics of star cluster formation. In this talk, I will summarize the current state-of-the-art in numerical simulations. I will discuss how numerical results have shaped our understanding of star formation and how different processes impact fundamental quantities like the stellar initial mass function, stellar multiplicity and star formation efficiency.

Time of talk: Thursday 10:20

Name: Richard Parker

Organisation: Liverpool John Moores University

Title: The initial conditions of star formation from spatial and kinematic substructure

Abstract:

One of the largest uncertainties in star formation is the initial density and velocity structure of young (1 - 10 Myr) star-forming regions, clusters and associations. Quantifying the initial or maximum density of a region is crucial; a dense region will disrupt the orbits or destroy planetary systems and stellar binaries, and photoevaporate or truncate protoplanetary discs through interactions with massive and low-mass stars. However, the present-day density does not strongly constrain the initial density due to two-body relaxation, which causes a region to rapidly expand and lowers the density by several orders of magnitude within a few

Myr. In this talk, I will show that a range of structural diagnostics can constrain both the initial density, and the initial virial ratio of a star-forming region. I will finish by demonstrating the further constraints that Gaia and associated ground-based surveys (e.g. GES) will place on this problem in the near future.

Time of talk: Thursday 10:40

Name: Isabelle Baraffe

Organisation: University of Exeter

Title: Consistent models of accretion history and multi-dimensional structure of accreting young stars.

Abstract:

I will present new results for pre-Main sequence and early brown dwarf evolutionary models accounting for the effect of early accretion history. First, I will present self-consistent numerical simulations fully coupling numerical hydrodynamics models of collapsing prestellar cores and evolutionary models of the central protostar or proto-brown dwarf. I will in particular analyse the main impact of consistent accretion history on Li depletion and present a new result regarding the effect of accretion on Li depletion. I will also present the first attempt to describe the multi-dimensional structure of accreting young stars based on fully compressible time implicit multi-dimensional hydrodynamics simulations. I will discuss the relevance of assumptions and treatments of accretion used in 1D stellar evolution codes.

Time of talk: Thursday 11:50

Name: Laura Venuti

Organisation: INAF - Osservatorio Astronomico di Palermo

Title: Variety of accretion regimes in the young open cluster NGC 2264

Abstract:

Pre-main sequence (PMS) stars are surrounded by disks throughout the first few Myr following their birth. The star-disk interaction is governed by the magnetospheric accretion process. In this talk, we present the results of an extensive u-band accretion survey of the 3 Myr-old open cluster NGC 2264. Performed at CFHT/MegaCam as a part of the CSI 2264 international campaign, the survey provided simultaneous UV+optical photometric monitoring over two full weeks for about 750 young cluster members (of which about 45% have disks). We use the diagnostics of the UV excess, measured over the reference flux level defined by non-accreting members, to investigate accretion properties over the stellar mass range 0.1-1.5 Mo, and infer evidence for a huge variety of accretion regimes within the cluster. While a definite correlation is observed between the average accretion rate M_acc and stellar mass, a significant spread in M_acc values is detected at any given stellar mass. Little contribution to this spread arises from M_acc variability, monitored here over week timescales. We explore and discuss the origin of this large intrinsic spread, which may be associated with a multiplicity of accretion mechanisms: unstable accretion regimes, characterized by short-lived, stochastic accretion bursts, are found to be dominant at the largest M_acc; conversely, stable, funnel-flow accretion regimes, with a steady behavior over many rotational cycles, are found at more moderate accretion rates. In addition, we find a connection between accretion properties and spatial distribution of cluster members: strong accretors are assembled close to the active star forming sites within the cloud, whereas milder accretors and disk-free objects distribute more evenly across the region, possibly as a result of dynamical evolution from their birth sites. This suggests that an intrinsic age/evolutionary spread across the cluster may also contribute to the observed spread in M_acc at any given mass.

Time of talk: Thursday 12:10

Name: Alicia Aarnio

Organisation: University of Michigan

Title: Assessing Magnetospheric Accretion in Herbig Ae/Be Stars

Abstract:

In the last few years, large spectropolarimetric surveys have found low magnetic field detection rates in Herbig Ae/Be stars. It has also been recently noted that magnetic field structure and strength dramatically change with increasing stellar mass. These results are very suggestive that the mechanisms for accretion and outflow in Herbig Ae/Be star+disk systems may differ from the magnetospheric accretion paradigm as envisaged for T Tauri star+disk systems. We present the results of our high resolution optical spectroscopic campaign of ~60 Herbig AeBe stars. Our survey includes multi-epoch observations; the timescales sampled range from high cadence (~minutes) to observations taken over several years, probing a wide range of kinematic processes. We find that the strength of variability increases with the cadence of the observations, and over all timescales sampled, the strongest variability occurs within the blueshifted absorption components of the Balmer series lines. We see no inverse P-Cygni profiles, traditionally indicative of ongoing accretion. We discuss the implications of these results in context of recent spectropolarimetric surveys for our understanding of how accretion is occurring in these objects, as well as ongoing radiative transfer modeling.

Time of talk: Thursday 12:30

Name: Carlo Felice Manara

Organisation: ESA/ESTEC

Title: Disk evolution in young clusters: accretion, winds, and dynamical properties of young stars and their disks

Abstract:

The evolution of protoplanetary disks in young stellar clusters is regulated by the interplay of various physical processes, such as accretion and winds, and by the interactions with other stars in the cluster. Accretion and winds are best studied spectroscopically. Instruments like the VLT/X-Shooter spectrograph allow us to observe simultaneously the signatures of the accretion process, such as the UV-excess and the emission lines, together with lines tracing winds and outflows, such as helium lines and forbidden lines. At the same time, such spectra allow us to robustly derive the physical parameters of the central objects, such as their temperature and their mass. These processes relate to the disk mass and size, which can nowadays be studied with ALMA. Finally, the coming Gaia data releases will open the field to new studies of dynamical evolution of stars in young clusters by means of kinematical modelling.

I will report on the stellar, accretion, and wind properties derived with X-Shooter of the complete samples of low-mass stars in the Lupus and Chamaeleon star forming regions, and discuss the dependence of stellar and accretion parameters with the disk properties obtained with ALMA surveys in these regions. I will also show how we can use Gaia data to study young clusters and the effect of interactions on the evolution of disks.

Time of talk: Thursday 12:50

Name: Philip Lucas

Organisation: University of Hertfordshire

Title: A population of eruptive variable protostars in VVV

Abstract:

We present the recent discovery of a substantial population of optically hidden eruptive variable protostars in VISTA Variables in the Via Lactea survey (VVV). VVV was the first panoramic time domain survey of the Milky Way in the near infrared. It ran from 2010-2015, observing a 560 sq deg area of the Galactic bulge and plane between 50 and 70 times in the Ks filter. A wide variety of high amplitude infrared variables were detected (DeltaKs > 1 mag) but YSOs represent about half of the population. The YSOs have a variety of light curve types but a substantial proportion can be described as photometric outbursts. Most of these "eruptive" variables appear to be bona fide examples of episodic accretion, similar to the FUor and EXor phenomena. However, their outburst durations and spectroscopic properties are a mix of the FUor and EXor types; those established types are much rarer in the sample. We provisionally refer to these mixed sources as MNors, after the illuminating source of McNeil's Nebula, V1647 Ori. Eruptive variability is at least an order of magnitude more common amongst class I YSOs than in class II YSOs: we will present a first estimate of the incidence in class I YSOs. Finally I describe the planned "VVVX" extension of VVV to the rest of the southern plane, which is currently at the second and final stage of the ESO public survey selection process.

Time of talk: Thursday 14:40

Name: Matthew Bate

Organisation: University of Exeter

Title: The dependence of stellar properties on metallicity

Abstract:

I will present the results of four radiation hydrodynamical calculations of star cluster formation that span metallicities ranging from 1/100 to 3 times the solar value. The calculations treat both the thermodynamical evolution of the low-density interstellar medium (including hydrogen and carbon chemistry), and radiation transport which dominates temperatures near protostars. I will discuss the statistical properties of the stars and brown dwarfs that are produced, including how the mass function, multiplicity, and properties of multiple systems depend on the metallicity of the progenitor cloud.

Time of talk: Thursday 15:00

Name: Thomas Megeath

Organisation: University of Toledo

Title: Low Mass Star Formation in the Diverse Environments of Orion: Result from the Herschel Orion Protostar Survey

Abstract:

Low mass stars from in a diverse range of environments, from isolated dark clouds to dense clusters in close proximity to massive stars. How the low mass star formation process differs between these environments is not well understood. We do know that within this range of environments, the densities of young low mass stars varies by orders of magnitude, yet the initial mass function remains relatively invariant. Comparative studies of

protostars in these environments are needed to assess how variation in gas density, turbulence and kinetic temperature affect the fragmentation, collapse and accretion of gas and the formation of stars and disks. I will overivew a survey of protostars in the Orion A & B molecular clouds with the Spitzer, Herschel, Hubble and Apex telescopes, spanning 1.6 to 870 um, as well as follow-up observations in the near-IR and sub-millimeter. The goals of these observations are to characterize multiplicity, infall, accretion, outflow, and disk formation in the diverse environments found in the Orion clouds. These observations find a decrease in the spacing of protostars with increasing gas density, an increase of protostellar luminosity with increasing gas density, and an increase in the number of companions with increasing stellar density. I will discuss how these observations are leading to a better understanding of the physical factors, both external and internal, that control the rate and efficiency at which low mass stars form and ultimately determine their multiplicity and masses.

Time of talk: Thursday 15:20

Name: Jan Forbrich

Organisation: University of Vienna

Title: The Orion Radio All-Stars: new perspectives in stellar radio astronomy

Abstract:

The sensitivity upgrades of both the NRAO Very Large Array (VLA) and the NRAO Very Long Baseline Array (VLBA) have begun to provide us with a much improved perspective on stellar centimeter radio emission, particularly concerning young stellar objects (YSOs) and ultracool dwarfs. I will mainly present a deep VLA and VLBA radio survey of the Orion Nebula Cluster (ONC), where we have found 556 compact radio sources, a sevenfold increase over previous studies, and intricate detail on the radio emission of proplyds. We can now better disentangle thermal and nonthermal radio emission by assessing spectral indices, polarization, variability, and brightness temperatures (VLBA). With simultaneous radio-X-ray time domain information (Chandra) and VLBA precision astrometry, this project is providing unpredented constraints on the magnetospheric activity of YSOs across a wide mass range, new insights into the impact of the massive Trapezium stars on their environment, and new astrometric constraints on the ONC itself. Additionally, I will present new VLBA results in ultracool dwarf astrometry. More generally, and beyond providing a new perspective on stellar cm radio emission and physics, this presentation will highlight how VLBI astrometry will allow us to extend the Gaia sample of YSOs and ultracool dwarfs by including embedded objects, distant obscured sources in the Galactic plane, and faint ultracool dwarfs, while providing important opportunities for astrometric cross-calibration with Gaia.

Time of talk: Thursday 15:40

Name: Nadia Murillo

Organisation: Leiden University

Title: Do siblings always form and evolve at the same time? Coevality of multiple protostellar systems with Herschel

Abstract:

Multiplicity is common in field stars and protostars. While fragmentation is considered to be the mechanism of formation, the question of when and how this occurs is still open. Previous studies towards pre-main sequence binaries found pairs of non-coeval (different ages) components, with frequencies of 15 to 33%. Is this non-coevality present from the moment of formation or product of dynamical evolution? We address this question by determining the relative evolutionary stages of the components in young embedded multiple protostellar systems. Spectral energy distributions (SEDs) for known multiple protostellar systems in the Perseus star forming region are constructed from literature data and Herschel PACS photometric maps. Inclination effects and the

surrounding envelope and outflows are considered in order to decouple source geometry from evolution. This together with the shape and properties derived from the SED are used to accurately determine each system's coevality. Synthetic SEDs are used to study the frequency of apparent non-coevality due to geometry. Effects of unresolved multiple protostellar systems on SED shapes are also investigated. We find 33% of multiple protostellar systems in our sample to be non-coeval, with higher order multiples showing a tendency to be non-coeval. Random pairing of synthetic SEDs suggest an apparent non-coevality frequency of 17%, however our sample does not show signs of strong geometric effects, hence the observed non-coevality is real. The implications that the non-coevality frequency found in our work has on formation mechanisms and evolution are examined.

Time of talk: Thursday 16:50

Name: Megan Reiter

Organisation: University of Michigan

Title: Powerful jets driven by intermediate-mass protostars in the Carina Nebula

Abstract:

We present new spectroscopy and Hubble Space Telescope imaging of protostellar jets driven by intermediate-mass stars in the Carina Nebula. New, near-IR [Fe II] observations of these jets reveal dense gas that is self-shielded from Lyman continuum photons from nearby O-type stars, but is excited by non-ionizing FUV photons that penetrate the ionization front within the jet. Each jet contains a substantial mass of dense, neutral gas that is not seen in Halpha emission from these jets. In some cases, [Fe II] emission traces the jet inside its natal dust pillar, connecting the larger Halpha outflow to the embedded IR source that drives it. New proper motion measurements reveal tangential velocities similar to those typically measured in lower-luminosity sources (100-200 km/s). Combining high jet densities and fast outflow speeds leads to mass-loss rate estimates an order of magnitude higher than those derived from the Halpha emission measure alone. Higher jet mass-loss rates require higher accretion rates, implying that these jets are driven by intermediate-mass (~2-8 Msun) protostars. For some sources, mid-IR luminosities of the driving sources are clearly consistent with intermediate-mass protostars others remain deeply embedded and require long-wavelength, high-resolution images confirm their luminosity. These outflows are all highly collimated, with opening angles of only a few degrees. With this new view of collimated jets from intermediate-mass protostars, we argue that these jets reflect essentially the same outflow phenomenon seen in low-mass protostars, but that the collimated atomic jet core and the material it sweeps up is irradiated and rendered observable. Thus, the jets in Carina offer strong additional evidence that stars up to ~8 Msun form by the same accretion mechanisms as low-mass stars.

Time of talk: Thursday 17:10

Name: Guido De Marchi

Organisation: European Space Agency

Title: The Tarantula of low-mass stars

Abstract:

We are studying the recent low-mass star formation in the Tarantula Nebula using the Hubble Tarantula Treasury Project observations. Looking for stars with prominent Halpha excess emission (> 4 sigma, equivalent width > 10A), we have identified more than 20,000 pre-main sequence (PMS) stars over an area of ~180 x 180 pc^2. We are able to detect and study not only the youngest PMS objects, but also those approaching the main sequence, with ages older than ~10 Myr. This is so far the largest sample of individually resolved young low-mass stars.

We find that the distribution of PMS stars is considerably more diffuse than that of massive stars: while many young PMS stars are often close to massive objects, a similarly high number of both young and older PMS objects are clumped in regions with very few or no high-mass stars around. This implies that the conditions for the formation of low-mass stars are more lenient than those required by high-mass stars, and it might even suggest that the relevant processes are quite different. This could have important implications for the concept of initial mass function.

In the central regions, around the R136 cluster, we have already completed the analysis of the physical properties of both younger and older PMS stars. We confirm our previous findings on the dependence of the mass accretion rate on the mass and age of the stars. We show that, in similar conditions of mass and age, in the Tarantula Nebula the mass accretion rates are systematically higher than in the Milky Way, yet still lower than those we measured in active star forming regions in the Small Magellanic Cloud. These findings appear to indicate that the metallicity of the environment may play a significant role in the mass accretion process.

Time of talk: Thursday 17:30

Name: Lee Hartmann

Organisation: University of Michigan

Title: Mass functions of star clusters and the upper mass stellar IMF

Abstract:

I will discuss numerical simulations which offer a simple, universal, and robust explanation of the star cluster (initial) mass function - gravitational focusing - with implications for the upper mass end of the stellar IMF.

Time of talk: Thursday 17:50

Name: Philippe André

Organisation: CEA Saclay

Title: The role of interstellar filaments in the origin of the stellar initial mass function

Abstract:

The origin of the stellar initial mass function (IMF) is one of the most debated issues in astrophysics. Two major features of the IMF are 1) a fairly robust power-law slope at the high-mass end known since Salpeter (1955), and 2) a broad peak below 1 Mo corresponding to a characteristic stellar mass scale. In recent years, the dominant theoretical model proposed to account for these features has been the ""gravo-turbulent fragmentation"" picture, whereby the properties of interstellar turbulence lead to the Salpeter power law and gravity sets the characteristic mass scale (Jeans mass). I will discuss modifications to this picture based on Herschel observations of nearby molecular clouds. The Herschel results point to the key role of the quasi-universal filamentary structure pervading the cold interstellar medium and support a scenario in which star formation occurs in two main steps: First, large-scale compression of interstellar material in supersonic MHD flows generates a cobweb of ~ 0.1 pc-wide filaments in the ISM; second, the densest filaments fragment into prestellar cores above the line mass threshold for gravitational instability. In this observationally-driven scenario, the dense cores making up the peak of the prestellar core mass function (CMF) - likely responsible for the characteristic IMF mass scale - result from gravitational fragmentation of filaments near the critical mass per unit length. The power-law tail of the CMF/IMF arises from the characteristic power spectrum of initial density fluctuations measured along the Herschel filaments (Roy et al. 2015) and from the power-law distribution of masses per unit length observed for supercritical filaments.

Friday 26th August

Discs

Talk Abstracts

Time of talk: Friday 9:00

Name: Catherine Espaillat

Organisation: Boston University

Title: Observational review

Abstract:

We know that most stars were once surrounded by protoplanetary disks. How these young disks evolve into planetary systems is a fundamental question in astronomy and observations of young pre-main sequence stars may provide insights. In this talk, I will review the key constraints on theoretical models provided by observations of the dust and gas in protoplanetary disks. I will discuss disk demographics and evolution as well as disk structure, particularly those disks that contain holes or gaps which many researchers have posited are the footprints of planets. Recent MIR and sub-mm imaging work will be discussed as well as remaining questions in the field of protoplanetary disks.

Time of talk: Friday 9:40

Name: Richard Alexander

Organisation: University of Leicester

Title: Theory review

Abstract:

In this talk I will review our understanding of protoplanetary discs. These discs are of considerable interest, as they are both the primary means of driving protostellar accretion, and also the sites of planet formation. I will briefly discuss disc formation and structure, and then look in detail at the various physical processes - angular momentum transport in the disc, and mass and angular momentum loss in winds - which drive disc evolution. This is a rapidly evolving field, so I will attempt to highlight key recent developments, as well as giving a critical assessment of where the field currently stands. I will conclude by discussing future directions for our study of disc evolution, and the key questions we wish to answer in the coming years.

Time of talk: Friday 10:20

Name: Tim Naylor

Organisation: University of Exeter

Title: A Dynamic Colour-Magnitude Diagram for the Orion Nebula Cluster

Abstract:

We have undertaken time-series multi-colour photometry of the Orion Nebula Cluster over seven nights, with simultaneous multi-fibre spectroscopy. This allows us to construct "movies" of how the positions of stars in colour-magnitude space change with time, and use the spectroscopy to analyse the physical mechanisms driving those changes. Whilst many stars remain largely static in position, some classical T Tauri stars show remarkable peregrinations around the colour-magnitude space. Some changes are clearly due to changes in dust obscuration, though there is evidence for grain growth in the extincting material. The degree of variability is clearly correlated with position in colour-magnitude space with the more variable stars lying below the majority of the pre-main-sequence. As these are the classical T Tauri stars this leads to the remarkable conclusion that in a colour magnitude diagram the heavily accreting stars classical T Tauri stars appear to be older than the disc-

less weak-lined T Tauri stars. The simultaneous spectroscopy allows us to show that this is purely an effect of the accretion luminosity.

Time of talk: Friday 10:40

Name: Kenny Wood

Organisation: University of St Andrews

Title: A Model for (Quasi-) Periodic Multi-wavelength Photometric Variability in Young Stellar Objects

Abstract:

We present radiation transfer models of rotating young stellar objects (YSOs) with hotspots in their atmospheres, inner disk warps and other 3-D effects in the nearby circumstellar environment. Our models are based on the geometry expected from the magneto-accretion theory, where material moving inward in the disk flows along magnetic field lines to the star and creates stellar hotspots upon impact. Due to rotation of the star and magnetosphere, the disk is variably illuminated. We compare our model light curves to data from the Spitzer YSOVAR project to determine if these processes can explain the variability observed at optical and mid-infrared wavelengths in young stars. We focus on those variables exhibiting ``dipper"" behavior that may be periodic, quasi-periodic, or aperiodic. We find that the stellar hotspot size and temperature affects the optical and near-infrared light curves, while the shape and vertical extent of the inner disk warp affects the mid-IR light curve variations. Clumpy disk distributions with non-uniform fractal density structure produce more stochastic light curves. We conclude that the magneto-accretion theory is consistent with certain aspects of the multi-wavelength photometric variability exhibited by low-mass YSOs. More detailed modeling of individual sources can be used to better determine the stellar hotspot and inner disk geometries of particular sources.

Time of talk: Friday 11:50

Name: Gilles Chabrier

Organisation: University of Exeter & ENS Lyon

Title: Formation of proto-stellar and proto-planetary disks in star formation: the key roles of different physical mechanisms

Abstract:

Protostar or protoplanetary disks are the link between the collapse of prestellar star-forming clumps at large scales, and the formation of planet embryos at small scales. Understanding the magnetic, thermal and stability properties of these disks, as well as the key problem of angular momentum transport during the core collapse, are thus mandatory to have a reliable description of protostellar/protoplanetary disks. In this talk, I will present calculations of disk formation that include the most complete relevant physics: non-ideal MHD, turbulence, non-equilibrium chemistry. The output of these calculations, disk properties and outflow signatures, will be compared with recent observations, allowing us to better understand the genesis and the nature of disks.

Time of talk: Friday 12:10

Name: Alvaro Ribas

Organisation: Boston University

Title: Protoplanetary disk lifetimes in nearby star-forming regions

Abstract:

The timescales and relevant parameters for protoplanetary disk evolution are crucial to fully understand planet formation, but a consistent view of this phenomenon has remained elusive given its complexity and limited sample sizes. In this contribution, I will present the most complete study of disk evolution up to date, performed with a sample of more than 2300 YSOs in 22 nearby (<500 pc) star-forming regions and associations. The unprecedented size of the sample and homogeneous treatments applied allowed us not only to derive the most precise measurement of the characteristic disk lifetime so far but also to statistically confirm an important dependence of disk lifetimes with stellar mass. Such a dependence could even lead to differences in the architectures of planetary systems around low-mass and high-mass stars. Finally, I will describe our current efforts on expanding these results with a more detailed subsample and advanced SED modeling techniques.

Time of talk: Friday 12:30

Name: Melissa McClure

Organisation: European Southern Observatory

Title: T Tauri disk gas masses measured from hydrogen deuteride

Abstract:

The total gas mass of a protoplanetary disk is a fundamental, but poorly determined, quantity. A new technique (Bergin et al. 2013) has been demonstrated to assess directly the bulk molecular gas reservoir of molecular hydrogen using the HD J=1-0 line at 112 microns. In this work we present a small survey of T Tauri disk observations of the HD line. Line emission is detected in two cases at >3 sigma significance. Using detailed disk structure models, including the effect of UV gas heating, we determine the amount of gas required to fit the HD line and the amount of dust required to fit the observed disk spectral energy distributions. For both disks, the amount of gas required is more than the MMSN value, and the gas/dust ratio is at least a factor of two lower than that of the ISM. We discuss the implication of this result for these disks' carbon chemistry and the disk mass probability distribution.

Time of talk: Friday 12:50

Name: Stefan Kraus

Organisation: University of Exeter

Title: Resolving the disc structure of FU Orionis stars

Abstract:

During their formation phase stars gain most of their mass in violent episodic accretion events, such as observed in FU Orionis stars. In this talk I will report on VLTI interferometric observations that allows us study the disk structure around these objects on sub-AU scales.

Time of talk: Friday 14:40

Name: Katharine Johnston

Organisation: University of Leeds

Title: A Keplerian-like disc around the forming O-type star AFGL 4176

Abstract:

I will present our ALMA line and continuum observations at 1.2mm with ~0.3" resolution that uncover a Keplerian-like disc around the forming O-type star AFGL 4176. The first-moment maps, pixel-to-pixel line modelling, and position-velocity diagrams of the CH3CN J = 13–12 K-line emission all show a velocity gradient along the major axis of the source, coupled with an increase in velocity at small radii, consistent with Keplerian-like rotation. I will also present APEX 12CO observations that show a large-scale outflow from AFGL4176 perpendicular to the major axis of mm1, supporting the disc interpretation. Finally, we have conducted radiative transfer modelling of the ALMA data, showing that a Keplerian disc surrounding an O7 star, with a disc mass and radius of 12 Msun and 2000 AU reproduces the line and continuum data, further supporting our conclusion that our observations have uncovered a Keplerian-like disc around an O-type star. This work is published in Johnston et al. (2015).

Time of talk: Friday 15:00

Name: James Owen

Organisation: IAS, Princeton

Title: Vortices from low-mass planet formation in transition discs

Abstract:

Transition discs are protoplanetary discs that show evidence for dust trapping in their outer regions. Recent high angular resolution mm imaging of these discs has indicated that dust particles, as well being trapped radially, are also concentrated in non-axisymmetric features, and it has been suggested that the dust particles are trapped in a large scale vortex. Since the dust particles that naturally accumulate in transition disc dust traps have Stokes numbers close to unity, there is naturally a large reservoir of ``pebbles'' in transition disc dust traps. I will argue that the transition disc dust traps are prime sites for rapid ``pebble accretion'' onto low-mass planetary embryos. At the planetary accretion rates expected in nominal transition discs, the accretion luminosity is sufficiently high to heat the surrounding disc to radii well outside the planet's Hill sphere. This makes the disc locally baroclinic and can lead to vortex formation. I will present this ``new'' scenario for vortex formation in transition discs and discuss the long term consequences, while arguing it is perhaps more natural than those scenarios discussed so far.

Time of talk: Friday 15:20

Name: Michael Ireland

Organisation: Australian National University

Title: High Angular Resolution Mid-Infrared Imaging of Transitional Disks

Abstract:

Transitional and so-called pre-transitional disks consist of an optically thin inner disk and an optically thick outer disk. In some disks, there is evidence for much more complex disk evolution than simply a cleared inner hole. For example, in the case of Oph IRS 48, there is a dust trap in the outer disk and evidence for multiple cavity

sizes. We present high angular resolution observations of several disks with the Keck II telescope at infrared wavelengths, primarily 3.7 microns, using adaptive optics and precision calibration techniques including aperture mask interferometry. For Oph IRS 48 and HD 169142, we model the disks using RadMC-3D and show that an azimuthally symmetric disk can model most but not all of the observed structure. In the case of HD 169142, a point-assymetry has been interpreted as direct luminosity from a planet. We discuss alternative explanations from disk emission, showing why interpretation of high angular resolution observations of luminous disk-bearing stars with single telescopes will always be difficult to interpret. A much more ambitious instrument program such as the Planet Formation Imager will be needed to comprehensively disentnagle complex disk evolution from planet formation.

Time of talk: Friday 15:40

Name: Pablo Loren-Aguilar

Organisation: University of Exeter

Title: Toroidal vortices as a solution to the dust migration problem

Abstract:

We have identified a new type of dynamical dust–gas instability in protoplanetary discs that produces global toroidal vortices, due to the process of dust settling. We have investigated the evolution of a dusty protoplanetary disc with two different dust species (1 mm and 50 cm dust grains), under the presence of the instability. We show how toroidal vortices, triggered by the interaction of mm grains with the gas, stop the radial migration of metre-sized dust, potentially offering a natural and efficient solution to the dust migration problem.

Time of talk: Friday 16:50

Name: Giovanni Rosotti

Organisation: Institute of Astronomy, University of Cambridge

Title: What is the minimum planet mass that creates observable signatures in proto-planetary discs?

Abstract:

I will discuss the prospects for observing how super-Earths and giant planetary cores shape the proto-planetary disc. While previous theoretical work has shown how they affect the dust surface density much more than the gas one, no proper study has been conducted of what is the minimum planetary mass that produces observable signatures. I address this problem by running multi-fluid gas and dust simulations and generating simulated observations. I'll highlight in particular how there exists a minimum planet mass that is able to produce a pressure maximum outside its orbit and therefore a dust trap. Planet masses lower than the threshold can still affect the dust surface density, by creating traffic jams in the dust radial velocity; the minimum planet mass detectable is roughly 10-15 Earth masses, but is a strong function of the disc temperature. Finally, I will discuss how it is possible to have an estimate of the mass of the planet from the observations, which involves measuring either the gap width in scattered light observations or the pressure maximum location in sub-mm images.

Time of talk: Friday 17:10

Name: Eiji Akiyama

Organisation: NAOJ

Title: Differential Grain Growth in the Spiral Structure of the LkHa 330 Disc

Abstract:

Grain growth represents an initial step toward planet formation since it involves the coagulation of approximately micron-sized dust residing in protoplanetary discs around young stars. We have conducted H-band (1.6 um) linear polarimetric observations and 0.88 mm continuum interferometric observations toward a transitional disc around the intermediate-mass pre-main sequence star LkHa 330. The observations show a pair of asymmetric spiral arms in the disc. We discuss the origin of the spiral arms and suggest that a massive unseen planet is the most plausible explanation based on recent global hydro simulations. The possibility of grain growth causing the asymmetric structure of the spiral arms was investigated through the opacity index (beta) by plotting the observed SED slope between 0.88 mm from our SMA observation and 1.3 mm from literature. The results imply that grains are indistinguishable from ISM-like dust in the east side (beta ~ 2.0), but much smaller in the west side (beta ~ 0.7), indicating differential grain growth or dust trapping in the spiral arms. Combining the results of near-infrared and submillimetre observations, we find that the spiral arm is geometrically thick, and that grains grow to millimeter size near the disc mid-plane. Future observations at centimeter wavelengths and differential polarization imaging in other bands (Y to K) with extreme AO imagers are required to understand how large dust grains form and to further explore the dust distribution in the disc.

Time of talk: Friday 17:30

Name: John Monnier

Organisation: University of Michigan

Title: GPI observations of Herbig Ae/Be stars

Abstract:

The discovery of transition disks around young stars has provided the opportunity to study planet formation in situ when giant planet formation and growth are most vigorous. Using the Gemini Planet Imager (GPI) in differential polarimetry mode, we have begun a survey to characterize a statistically-significant sample of young disks at each major stage of planet formation, from the youngest “full disk” stage and through pre-transition and transition disk stages. GPI is ideal for this survey due to its unprecedented sensitivity to scattered light emitted between 20-150 AU from the star, a region of the protoplanetary disk where giant planet formation is known to occur. I will report initial observational results and radiative transfer modeling of a few well-known systems. We explore how to combine ALMA and GPI imaging to measure radial variations in the disk’s grain size distribution, outer disk gas pressure scale heights, and chemical snowlines.

Poster submissions, by session

Poster Ref.	Session	Name		Organisation	Title
A1	Molecular clouds	Jorge	Abreu Vicente	Max Planck Institute for Astronomy	ALMA kinematic study of the Integral Shaped Filament in Orion
E1	Molecular clouds	Ahmad	Ali	University of Exeter	Modelling stellar feedback in clusters using Monte Carlo radiation hydrodynamics
E2	Molecular clouds	Simon	Bihr	Max Planck Institute for Astronomy	THOR - The HI, OH, Recombination Line survey of the Milky Way
A2	Molecular clouds	David	Bresnahan	University of Central Lancashire	The dense cores and filamentary structure of the molecular cloud in Corona Australis
A3	Molecular clouds	Vianey	Camacho	IRyA-UNAM	Understanding the energetics of clumps and dense cores.
A4	Molecular clouds	Giuliana	Cosentino	University College London	Kinematics, SiO and CH3OH parsec-scale Emission in Filamentary Infrared Dark Clouds.
A5	Molecular clouds	Simon	Coudé	Université de Montréal	POL-2 & BISTRO: the SCUBA-2 polarimeter and the study of magnetism in star-forming regions
E3	Molecular clouds	Kevin	Douglas	Okanagan College	The GALFA-HI Second Data Release
A6	Molecular clouds	Sergio Abraham	Dzib Quijano	Max Planck Institute for Astronomy	A comprehensive Galactic plane radio wavelength star formation survey
A7	Molecular clouds	Erica	Fogerty	University of Rochester	Molecular cloud formation in high shear, magnetized colliding flows

Poster Ref.	Session	Name		Organisation	Title
A8	Molecular clouds	Kathryn	Goldsmith	University of Leeds	The interaction of astrophysical flows with clouds and filaments
A9	Molecular clouds	Munan	Gong	Princeton University	Simulating CO formation in realistic star formation environments
A10	Molecular clouds	Sebastian	Haid	University of Cologne	The consequences of stellar feedback on molecular clouds
A11	Molecular clouds	Kazunari	Iwasaki	Doshisha University	Formation of massive filamentary molecular clouds by shock compression
A12	Molecular clouds	Venu	Kalari	Universidad de Chile	Feedback and triggering on the molecular clouds in R136
A13	Molecular clouds	Ivayla	Kalcheva	University of Leeds	Properties of the CORNISH-North UCHII sample
A14	Molecular clouds	Jared	Keown	University of Victoria	Characterizing Starless Cores, Protostars, and Filaments in Cepheus
A15	Molecular clouds	Jeong-Gyu	Kim	Seoul National University	Disruption of Molecular Clouds by Radiative Feedback from Massive Stars
A16	Molecular clouds	Alexander	Lodge	UCLan	Properties of pre-stellar cores observed using the Herschel SPIRE Instrument
A17	Molecular clouds	Jingqi	Miao	Kent University	The roles of chemical feedback in the evolution of molecular clouds in PDRs and HII regions
A18	Molecular clouds	Omnarayani	Nayak	Johns Hopkins University	Relating Young Stars Imaged by Spitzer and Hubble to the CO Molecular Gas Observed with ALMA in 30 Doradus and N159 West
A19	Molecular clouds	Jan	Orkisz	Observatoire de Paris / IRAM	Turbulence versus star formation efficiency in Orion

Poster Ref.	Session	Name		Organisation	Title
A20	Molecular clouds	Hsi-An	Pan	Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)	The Role of GMC Observations in the Big Picture: Effects of Galactic Disc Inclination and Resolution on Observed GMC Properties and Larson's Scaling Relations
A21	Molecular clouds	Liubin	Pan	Harvard-Smithsonian Center for Astrophysics	Compressibility and density fluctuations in supernova-driven turbulence in molecular clouds
A22	Molecular clouds	Julian	Pittard	University of Leeds	MHD simulation of stellar feedback in a filamentary molecular cloud formed by the thermal instability
A23	Molecular clouds	Daniel	Seifried	University of Cologne	Zooming into the dynamical and chemical evolution of molecular clouds
E4	Molecular clouds	Neha	Sharma	ARIES-Nainital-India	Optical polarimetric and molecular line observations of two bright-rimmed clouds, BRC 18 and BRC 38.
A24	Molecular clouds	Laszlo	Szucs	Max Planck Institute for Extraterrestrial Physics	On the caveats of tracing molecular gas with CO emission
A25	Molecular clouds	Gwenllian	Williams	Cardiff University	What can filament dynamics tell us about core formation?
E5	Molecular clouds	Chang	Won Lee	Korea Astronomy and Space Science Institute	TRAO multi-beam Survey of Nearby Molecular Clouds
A26	Molecular clouds	Sac Nicte	Xiomara Serrano Medina	Max Planck Intitute for Radioastronomy	Turbulence in the Orion Nebula
B1	Protostellar cores	Joseph	Booker	University of Toledo	HST Scattered Light Imaging of Orion Protostars: Do Outflows Halt Infall?
B2	Protostellar cores	James	Di Francesco	National Research Council of Canada	The Next Generation Very Large Array

Poster Ref.	Session	Name		Organisation	Title
B3	Protostellar cores	Mathilde	Gaudel	CEA Saclay	Rotation in protostellar envelopes of CALYPSO sources
B4	Protostellar cores	Il-Gyo	Jeong	Korea Astronomy and Space Science Institute	Star forming activities in the vicinity of the HII region G84.9+0.5
B5	Protostellar cores	Hyunwoo	Kang	Korea Astronomy and Space Science Institute	Investigation of simultaneous observation results of water and class I methanol masers toward class II methanol maser sources
B6	Protostellar cores	Hyun-Jeong	Kim	Seoul National University	Massive Young Stellar Objects with H2 Outflows in Infrared Dark Cloud Core MSXDC G53.11+00.05 MM1
B7	Protostellar cores	Kee-Tae	Kim	Korea Astronomy and Space Science Institute	KVN Studies of Water and Methanol Masers in Massive YSOs
B8	Protostellar cores	Rajika	Kuruwita	Australian National University	Jets from forming binary star systems
E6	Protostellar cores	Bilal	Ladjelate	CEA-Laboratoire AIM-Paris-Saclay	Star-formation in the Ophiuchus Molecular Cloud: Similarities and diversity
B9	Protostellar cores	Pierre	Marchand	CRAL-ENS Lyon	Non ideal MHD and chemistry in star formation
B10	Protostellar cores	Chris	Mowat	University of Exeter	The JCMT Gould Belt Survey: A First Look at SCUBA-2 Observations of the Lupus I Molecular Cloud
B11	Protostellar cores	Zsofia	Nagy	University of Toledo - USA	Measuring rotation in protostellar envelopes: ALMA Observations of Edge-On Orion Protostars
B12	Protostellar cores	Raul	Naranjo Romero	Instituto de Radioastronomia y Astrofisica	Hierarchical gravitational fragmentation. I. Collapsing cores within collapsing clouds

Poster Ref.	Session	Name		Organisation	Title
B13	Protostellar cores	Fernando	Olguin Choupay	University of Leeds	The physical properties of the prototypical MYSO GL 2591
B14	Protostellar cores	Howard	Smith	Harvard-Smithsonian Centre for Astrophysics	Unraveling YSO Clusters in Protostellar Cores and IRDCs
B15	Protostellar cores	Rachael	Spowage	Cardiff University	Investigating the presence of a transition to coherence in (magneto-)hydrodynamical simulations
B16	Protostellar cores	Jacob	Ward	Keele University	Integral field spectroscopy of massive YSOs in the Small Magellanic Cloud
B17	Protostellar cores	Jennifer	Wiseman	NASA Goddard Space Flight Center	A Newly Discovered Ammonia Source With Peculiar Chemistry Near the HH 111/HH 121 Protostellar System
B18	Protostellar cores	James	Wurster	University of Exeter	How non-ideal MHD affects the evolution of the environment around a forming protostar
B19	Protostellar cores	Yao-Lun	Yang	The University of Texas at Austin	The Class 0 Protostar BHR71: Herschel Observations and Dust Continuum Models
B20	Protostellar cores	Alison	Young	University of Exeter	Hydrodynamic and radiative transfer modelling of first hydrostatic core candidates
B21	Protostellar cores	Ka Ho	Yuen	The Chinese University of Hong Kong	Divergence between dynamic and spatial field-density variance during proto-star core formation in interstellar media
C1	Protostars & clusters	Morten	Andersen	Gemini Observatories-Gemini South	The very low-mass stellar content of the young supermassive Galactic star cluster Westerlund 1
C2	Protostars & clusters	Costanza	Argiroffi	DiFC - University of Palermo	X-ray Doppler shift from TW Hya: constraints on the accretion process

Poster Ref.	Session	Name		Organisation	Title
C3	Protostars & clusters	Becky	Arnold	University of Sheffield	Binary clusters of stars
C4	Protostars & clusters	Cameron	Bell	ETH Zurich	A stellar census of the 32 Ori moving group
C5	Protostars & clusters	Tyler	Bourke	SKA Observatory	Revealing the jets in the BHR71 protostellar system
C6	Protostars & clusters	Ross	Burns	JIVE	Water masers in a jet-driven bowshock: Episodic ejection from a massive young stellar object
C7	Protostars & clusters	Justyn	Campbell-White	University of Kent	Classifying HII Regions Using Shape Analysis of IR Bubbles
C8	Protostars & clusters	Zhiwei	Chen	Ruhr-University Bochum	Stellar feedback of massive star formation in M17
C9	Protostars & clusters	Claire	Esau	The University of Sheffield	No evidence for primordial mass segregation
C10	Protostars & clusters	Shane	Fogerty	University of Rochester	Silicate dust grain composition in the interstellar medium
C11	Protostars & clusters	Dirk	Froebrich	University of Kent	Photometric Monitoring of nearby young Clusters as a Citizen Science Project
C12	Protostars & clusters	Abigail	Frost	University of Leeds	A MIDI/VISIR Study of an MYSO
C13	Protostars & clusters	Phillip	Galli	Institute of Astronomy, Geophysics and Atmospheric Sciences, Brazil	A VLBI Distance Determination to the Taurus-Star Forming Region

Poster Ref.	Session	Name		Organisation	Title
C14	Protostars & clusters	Simon	Goodwin	University of Sheffield	Prestellar sources in Serpens
C15	Protostars & clusters	Dan	Griffiths	University of Sheffield	Massive Wide Binaries as Tracers for the Dynamical History of Stellar Regions
C16	Protostars & clusters	Mario Giuseppe	Guarcello	INAF - Osservatorio Astronomico di Palermo	Photoevaporation and close encounters: how the environment around Cygnus~ OB2 affects the evolution of protoplanetary disks
C17	Protostars & clusters	Mario Giuseppe	Guarcello	INAF - Osservatorio Astronomico di Palermo	Time resolved X-ray spectral analysis of class II YSOs in NGC2264 during optical dips and bursts
C18	Protostars & clusters	Zhen	Guo	KIAA-PKU	Evidence of star-disk interaction on a classical T Tauri star
C19	Protostars & clusters	David	Guszejnov	Caltech	The Minimum Physics of Star Formation
C20	Protostars & clusters	Sasha	Hinkley	University of Exeter	New Extreme-Mass Ratio Systems at 10 Million Years
C21	Protostars & clusters	Michael	Jones	University of Exeter	Predicting the dependence of stellar properties on environment.
C22	Protostars & clusters	Venu	Kalari	Universidad de Chile	Star formation processes may be affected by metallicity
C23	Protostars & clusters	Christine	Koepferl	University of St Andrews	Insights from Synthetic Star-forming Regions Measuring Star-formation Rates and Gas/Dust Properties
C24	Protostars & clusters	Nanda	Kumar	Centre for Astrophysics - University of Hertfordshire	Highly variable young massive stars in ATLASGAL clumps
C25	Protostars & clusters	Masanobu	Kunitomo	Nagoya University	On the effect of planet formation on stellar surface composition

Poster Ref.	Session	Name		Organisation	Title
C26	Protostars & clusters	Alejandro	Lopez	Instituto de Radioastronomia y Astrofisica- UNAM	Angular momentum in bipolar outflows
C27	Protostars & clusters	Steve	Mairs	University of Victoria	How Do Protostars Assemble Mass? A Sub-Millimetre (JCMT) Variability Survey of Deeply Embedded Protostars
C28	Protostars & clusters	Sally	Makin	University of Kent	Star formation in Cygnus-X: hunting young stellar outflows in the infrared with UWISH2
C29	Protostars & clusters	Brian	Mazur	University of Toledo	A Spectroscopic Survey of 100-1000 AU Companions to Orion YSOs
C30	Protostars & clusters	Stefan	Meingast	University of Vienna	VISION - Vienna survey in Orion
C31	Protostars & clusters	Georgios	Pantolmos	University of Exeter	Magnetic braking of cool stars: dependence on coronal temperature
C32	Protostars & clusters	Mark	Pecaut	Rockhurst University	Star Formation History of the Scorpius-Centaurus OB Association
C33	Protostars & clusters	Monika	Petr-Gotzens	European Southern Observatory	The VISTA Orion mini-survey: Young Stellar Objects in Orion B
C34	Protostars & clusters	Robert	Pomohaci	University of Leeds	Near-IR spectroscopy of Massive Young Stelar Objects
C35	Protostars & clusters	Simon	Purser	University of Leeds	A search for ionised jets towards massive protostars
C36	Protostars & clusters	Tae-Soo	Pyo	Subaru Telescope / NAOJ	Ejection of Knots and Photometric Variability in DG Tau 30 years

E7	Protostars & clusters	Carolina Berenice	Rodríguez Garza	IRyA-UNAM	First observations of Galactic massive star-forming regions taken with the Mexican Large Millimeter Telescope
C37	Protostars & clusters	Christian	Schneider	ESA/ESTEC	Hot jets from young, cool stars
C38	Protostars & clusters	Priya	Shah	Maluana Azad National Urdu University- Hyderabad	Triggered Star Formation at different spatial scales in NGC 281
C39	Protostars & clusters	Romas	Smilgys	University of St Andrews	Formation of stellar clusters in Galactic flows
C40	Protostars & clusters	Sonu	Tabitha Paulson	Indian Institute of Space Science and Technology-Trivandrum	Probing High Mass stars with 6.7 GHz Methanol Masers
C41	Protostars & clusters	Mauricio	Tapia	Instituto de Astronomia - UNAM - Ensenada - Mexico	NGC 6334 V revisited: The nature of the young elongated infrared nebula
E8	Protostars & clusters	Benny	Tsang	The University of Texas at Austin	Radiation Pressure Feedback in Super Star Cluster Formation
C42	Protostars & clusters	Elaine	Winston	Smithsonian Astrophysical Observatory	TARDISS: Time and Relative Dimensions in Serpens South
C43	Protostars & clusters	Scott	Wolk	Harvard-Smithsonian Center for Astrophysics	Discovery of Two New Nearby Associations of Young Stars
C44	Protostars & clusters	Eleonora	Zari	Leiden Observatory	Maximum likelihood membership analysis of OB associations with Gaia
D1	Discs	Amelia	Bayo	Universidad de Valparaiso	In depth view of the debris disk around TWA7
D2	Discs	Dominika	Boneberg	Institute of Astronomy-Cambridge	The midplane conditions of protoplanetary discs
D3	Discs	Claire	Davies	University of Exeter	Revealing the structure of the inner disk rim with CHARA

Poster Ref.	Session	Name		Organisation	Title
D4	Discs	Tom	Douglas	University of Exeter	Radiation-hydrodynamic simulations of line driven disc-winds around MYSOs
D5	Discs	Duncan	Forgan	University of St Andrews	Detecting Filaments and Spiral Structures in Smoothed Particle Hydrodynamic Simulations of Star Formation
D6	Discs	Gesa	H.-M. Bertrang	Universidad de Chile & Universidad Diego Portales	How to interpret observations of magnetic fields in protoplanetary disks
D7	Discs	Edward	Hone	University of Exeter	Unveiling the sub-AU kinematics of the Herbig B[e] star MWC297
D8	Discs	John	Ilee	Institute of Astronomy - Cambridge	G11.92—0.61 MM1: A disc around a young massive star?
D9	Discs	Dylan	Kee	University of Tübingen	Line-Driven Ablation of Star Forming Disks
D10	Discs	Jacques	Kluska	University of Exeter	What does the disks inner rim look like? Images and implications from the interferometric VLTI/PIONIER survey of Herbig Ae/Be Objects.
D11	Discs	Alexander	Kreplin	University of Exeter	Resolving the inner disk of UX Orionis
D12	Discs	Felipe	Navarete	University of São Paulo	Jets and disks driven by High-Mass YSOs revealed through 3D Spectroscopy
D13	Discs	Rhana	Nicholson	LJMU- Astrophysics Research Institute	Supernova enrichment of planetary systems in unusual star clusters
D14	Discs	Johan	Olofsson	IFA - Universidad de Valparaiso	Azimuthal asymmetries in the debris disk around HD61005
D15	Discs	Jon	Rees	University of Exeter	Environmental impact on disc lifetimes
D16	Discs	Julia	Roquette	Universidade Federal de Minas Gerais (UFMG)	Near-Infrared variability of disk-bearing stars in Cygnus OB2

D17	Discs	Alberto	Sanna	Max-Planck-Institut fuer Radioastronomie	Gas dynamics driven by a massive YSO: Observations confront Theory
D18	Discs	Andrey	Sobolev	Ural Federal University - Astronomical Observatory	Towards detecting methanol emission in low-mass protoplanetary discs with ALMA: The role of non-LTE excitation
D19	Discs	Yuhei	Takagi	National Astronomical Observatory of Japan	Evolution timescale of circumstellar disks in nearby star forming regions
D20	Discs	Sierk	van Terwisga	Leiden University	A Short Cut to Rings – resolved ALMA images of CN rings in Lupus
D21	Discs	Merel	van't Hoff	Leiden Observatory	Robustness of N2H+ as tracer of the CO snowline
D22	Discs	Matthew	Willson	University of Exeter	Sparse Aperture Masking Interferometry Survey of Transitional Disks

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