UK Exoplanet Community Meeting

9 - 11 April 2024, Birmingham

Full programme and abstract book

Programme

The conference will start on Tuesday 9th April 2024 at 9am (talks start at 10am) and close on Thursday 11th April 2024 at 4:30pm (talks end at 3:30pm). There will be 8 main science sessions, 2 special sessions, and a dedicated poster session. A detailed program and all abstracts can be found in this document.

Posters

Posters will be up for the entire duration of the conference in the same room where coffee and lunch are served. There will be ample time to watch them, during coffee breaks, lunches and the dedicated poster session.

Postersboards are 3ft wide, 6ft tall. We have no format restriction as long as the poster fits on the board.

There will be poster pop-ups during the main science sessions. These pop-ups will be very short (1 minute, 1 slide) and are not mandatory.

There will be a poster competition, judgded by the SOC, with exciting prizes to be won for best science result and most innovative poster (still presenting good science).

Social events

Tuesday night, there will be a poster session, whilst buffet dinner will be served.

Wednesday night, the optional conference dinner will be held at the nearby Edgbaston Park Hotel. There is no dress code.

Location

The UK exoplanet community meeting 2024 is being held at the Student Guild, University of Birmingham. See the website for more details.

Tuesday 9th April 2024

9:00	*10:00*	*Registration + coffee*	
		CHAIR: Anjali Piette	
10:00	10:15	Mortier / Triaud	Welcome
10:15	10:30	Liu Pengyu	A peculiar planetary-mass candidate imaged around a binary star
10:30	10:45	Osborne Hannah	A homogenous analysis of small planet masses
10:45	11:00	Fairman Charlotte	The importance of optical Hubble observations in constraining retrieved atmospheric parameters of exoplanet transmission spectra.
11:00	11:15	Hammond Mark	Two-Dimensional Eclipse Mapping of the Hot Jupiter WASP-43b with JWST MIRI/LRS
11:15	11:30	Davis Yasmin	Understanding M Dwarf Radius Inflation: Insights from Low-Mass Eclipsing Binaries
11:30	11:45	Robinson Alfie	Investigating the effect of radiation pressure on protoplanetary disc dispersal
11:45	12:00	Various	Poster pop-ups
12:00	*13:30*	*Lunch*	
		CHAIR: Vincent Van Eylen	
13:30	13:50	Williams Jamie	Planet detections around white dwarfs
13:50	14:05	Madhusudhan Nikku	The Hycean Paradigm in the Search for Life
14:05	14:20	Guest Elizabeth	Using Machine Learning to Fill Data Needs in the ExoMol Database
14:20	14:35	Zhao Yunpeng	Planet formation in wind-driven discs via pebble accretion
14:35	14:50	Klein Baptiste	Understanding stellar activity through eight years of Sun-as-a-star observations
14:50	15:00	Various	Poster pop-ups
15:00	*15:30*	*Coffee*	
		CHAIR: Amaury Triaud	
15:30	16:45	Panic, Meru, Parker	Special session on EDI
16:45	17:00	Various	Poster pop-ups
17:00	*19:30*	*Poster session including buffet dinner*	

Wednesday 10th April 2024

		CHAIR: Hannah Wakeford	
9:00	9:20	McDonald Catriona	Delivering prebiotic feedstocks to habitable planets
9:20	9:35	Watson Christopher	Characterising exoplanet atmospheres with Doppler tomography.
9:35	9:50	Penzlin Anna	Reshaping protoplanetary disc around binaries through heat
9:50	10:05	Valentine Daniel	The first eclipse map of the hot Jupiter WASP-17b
10:05	10:15	Various	Poster pop-ups
10:15	*10:45*	*Coffee*	
		CHAIR: David Brown	
10:45	11:00	Alderson Lili	Atmospheres Across the Radius Valley - First Results from the JWST COMPASS Program
11:00	11:15	Bayliss Daniel	Discovering Non-Transiting Exoplanets with TESS
11:15	11:30	Schoettler Christina	The impact of internal and external perturbations on exoplanet architectures
11:30	11:45	Parker Luke	Into the red: opening up the M-band for characterisation of exoplanet atmospheres at high spectral resolution
11:45	12:00	Various	Poster pop-ups
12:00	*13:30*	*Lunch*	

CHAIR: Amaury Triaud

13:30	14:45	Triaud, Meru, Osborne, Willett, Ahrer	Special session on public engagement
14:45	15:00	Various	Poster pop-ups

15:00 15:30 Coffee

CHAIR: Sebastiaan Krijt

15:30	15:50	Palethorpe Larissa	Gliese 12 b, A Temperate Earth-sized Planet at 12 Parsecs
15:50	16:05	Ma Sushuang	Atmospheric clouds and hazes in the era of next-generation exoplanet data
16:05	16:20	Iglesias Daniela	Disc evolution in intermediate-mass stars
16:20	16:35	Doyle Lauren	The TESS SPOC FFI Target Sample Explored with Gaia
16:35	16:50	Tahseen Tara	Accelerating Atmospheric Simulation of Venus by Integrating a Machine-Learned Surrogate Radiative Transfer Scheme
16:50	17:00	Various	Poster pop-ups

18:30 22:00 Conference dinner

Thursday 11th April

CHAIR: Yvonne Unruh

9:00	9:20	Ahrer Eva-Maria	Aligned vs misaligned hot Jupiters as a planet formation testbed: First look at JWST NIRSpec/G395H observations of three exoplanets
9:20	9:35	Blake (Tze-En) Chang	Applying Neural Network-Based Emulator of non-LTE Radiative Transfer on Stellar Activity
9:35	9:50	Yip Kai Hou	Lessons learnt from engaging the global ML community through the Ariel Data Challenge.
9:50	10:05	Johnston Heather	The rise and fall of the giant planet occurrence rate
10:05	10:15	Hannah Wakeford	Announcement from Hubble User Committee

10:15 10:45 Coffee

CHAIR: Ed Gillen

10:45	11:05	Williams Joe	Pebble drift in HD 163296 - Constraining the mass of dust and ice reaching the terrestrial planet formation region
11:05	11:20	Yang Jingxuan	Evidence of Ammonia in the Atmosphere of WASP-43b
11:20	11:35	Kerins Eamonn	The Roman Galactic Exoplanet Survey
11:35	11:50	O'Sullivan Niamh	Enhancing Exoplanet Detection: Tackling Supergranulation in Earth-Twin Surveys
11:50	12:05	Grant David	Identifying and locating cloud species from their mid-IR vibrational mode absorption

12:05 13:45 Lunch

CHAIR: Annelies Mortier

13:45	14:00	Anna John Ancy	The significance of mitigating stellar activity in the search for Earth twins.
14:00	14:15	Chen Xueqing	Mapping atmospheric structures on the nearest brown dwarfs
14:15	14:30	Dash Spandan	Using high resolution cross correlation spectroscopy to probe oxygen fugacity regimes in lava ocean worlds
14:30	14:45	Elms Abbigail	Oldest white dwarf planetary systems in the Galaxy
14:45	15:00	Heinke Linus	Characterizing the Atmosphere of the Warm Sub-Saturn Exoplanet HAT-P-12b with JWST
15:00	15:15	Hooton Matthew	A first look at the atmospheres of three planets with a compact system with JWST/NIRSpec
15:15	15:30	Mortier / Triaud	Final comments and festive announcements

15:30 16:30 Coffee

List of posters

(67) Adam Koval: Introducing two improved methods for approximating radiative cooling in hydrodynamical models

(18) Adam Stevenson: Three close-in planets with a long-period Saturn-mass companion: optimizing RV planet detections.

(59) Agnibha Banerjee: Deeper understanding of rocky planet atmospheres through Atmospheric Retrievals of super-Earth L 98-59d using JWST

(45) Akshay Priyadarshi: A Galactic population synthesis approach to exoplanet demography

(44) Alastair Claringbold: LRG-BEASTS: Optical Transmission Spectrum of the Hot Saturn HAT-P-44b

(60) Alec Owens: Sulfur-bearing molecules from the ExoMol database

(54) Alexandros Ziampras: Low-mass planet migration in radiative disks

(11) Alicia Anderson: Investigating sources and propagation of errors in EPRV measurements with HARPS3 and the Terra Hunting Experiment

(5) Alicia Kendall: 1 Neptune, 2 Saturns: 3 Giants under 700K

(32) Alix Freckelton: The GR8STARS catalogue: a public library of spectra and homogeneous stellar parameters for solar-like stars

(6) Andrew Allan: Why hasn't there been more detections of helium escaping from the atmospheres of younger exoplanets?

(1) Andy Buchan: Exoplanetary composition and evolution from a population level analysis of polluted white dwarfs

(33) Angharad Weeks: Younger Stars Host Denser Rocky Planets

(4) Ben Davies: Finding Circumbinary Planets: A Transit Detection Framework for TESS Eclipsing Binaries

(55) Daisy Turner: Investigating Star-Planet Compositional Ties for Systems with Iron-Poor Host Stars

(34) Daniel Sebastian: Methods to measure exoplanet phases curves, and absolute masses.

(15) Denis Sergeev: The impact of convection on the climate of a tidally locked planet in global stretched-mesh simulations

(63) Deniz Akansoy: Radiative Transfer in Protoplanetary Discs - Can Companions Cast Detectable Shadows?

(3) Dimitri Veras: Migration, perturbations and resonances in white dwarf planetary systems

(49) Dimitris Stamatellos: The properties of disc instability planets embedded in their parent discs

(17) Edward Bryant: How do evolving stars impact their close-in planets?

(40) Emily Sandford: Multi-band attractor reconstruction of the light curve of Solar cycle 23

(65) Emmanuel Greenfield: The effect of disc photoevaporation on the evolution of migrating giant planets

(36) Farzana Meru: Sandwiched planet formation: restricting the mass of a middle planet

(50) Felix Sainsbury-Martinez: The Impact of Cometary 'impacts' on the Chemistry, Climate, and Observations of Earth-like Exoplanetary Atmospheres

(38) Fintan Eeles-Nolle: Stellar Multiplicity in and around the Neptunian Desert

(7) Francesca Waines: Investigating the occurrence of hot Jupiters with stellar age

(26) Gergely Friss: How good cradles can rocky exoplanets be for life?

(39) Ginger Frame: Using simulations to probe granulation on the stellar surface

(42) Giulia Ballabio: What does helium absorption tell us about atmospheric escape of exoplanets?

(51) Ioannis Apergis: Is that a CMOS in your pocket ?

(24) Isobel Lockley: TOI-1117 multi-planetary system: three Sub-Neptunes, one in the Neptunian Desert

(43) Jack Davey: Spectroscopic binning and retrieval sensitivity

(41) Jenni French: WD1032+011: An eclipsing white dwarf-brown dwarf binary with a highly irradiated secondary

(47) Jo Kershaw: Dynamics of rotating convection in planetary cores

(19) Joanna Barstow: Model synthesis of combined JWST transit observations of WASP-39b: overall findings and lessons learned

(12) Jorge Fernandez: The role of X-ray variability in shaping the Neptune desert and period-radius valley

(21) Juanita Antilen: Study of the degree of dust settling and gas dynamics in highly inclined protoplanetary discs

(22) Karolina Szewczyk: Assessing the origin of gas in hybrid disc candidates

(8) Kieran O'Brien: An energy sensitive wave-front sensor for XAO

(27) Laura Rogers: The white dwarf opportunity: which rocks and minerals make up a planet?

(20) Lawrence Berry: Inferring stellar tidal dissipation factors from citizen-scientist transit observations

(30) Luke Booth: Cool Gaseous Exoplanets: surveying the new frontier with Twinkle

(64) Maddy Scott: Enhancing Exoplanet Detection Beyond TESS: Insights from SPECULOOS on M-dwarf Occurrence Rates

(23) Marcelo Aron Fetzner Keniger: Astroclimes - describing the capabilities of our synthetic transmission spectra code for removing telluric lines

(66) Maria Zamyatina: Quenching-driven equatorial depletion and limb asymmetries in WASP-96b's atmosphere

(35) Marina Lafarga Magro: Obliquity measurement of a hot Neptune desert planet challenges previous findings

(68) Mark Phillips: Medium resolution spectroscopy of cool brown dwarfs

(2) Matthew Standing: An update on the multiplanet circumbinary system TOI-1338/BEBOP-1

(9) Matthias Tecza: ELT Planetary Camera & Spectrograph R&D

(25) Mitchell Young: The Future of Exoplanetary Doppler Tomography

(46) Morgan Williams: Ionisation Chemistry of the Inner Disc

(37) Peter Wheatley: The Next Generation Transit Survey (NGTS)

(29) Richard Booth: Dust formation in the outflows of catastrophically evaporating planets

(62) Ross Dobson: Estimating the number of radial velocity measurements required to mass-characterise exoplanets

(16) Samuel Gill: The Next Generation Transit Survey quick-look pipeline

(13) Sean O'Brien: Exotic Planet Candidates from Planet Hunters NGTS

(53) Sébastien Paine: Dust Entrainment in 2D Externally Photo-evaporated Disc Models

(14) Thomas Baycroft: Investigating the existence of circumbinary planets around HW Virginis

(52) Toby Rodel: Putting a TIaRA on SPOC: predicting long-period planet yields from TESS

(57) Vanessa Emeka-Okafor: Assessing the detectability of Earth-like atmospheres on terrestrial planets orbiting M-dwarf stars using High-Resolution Spectroscopy

(56) Vatsal Panwar: Impact of stellar activity contamination on Doppler spectroscopy of exoplanet atmospheres

(10) Vedad Kunovac: Resolving star spots on WASP-85A using high-resolution transit spectroscopy

(28) Xander Byrne: Atmospheres as a Window to Rocky Planet Surfaces

(61) Yixuan Chen: Hotter and Brighter: A New Flared Model of White Dwarfs Accretion Discs

(48) Yoshi Nike Emilia Eschen: Viewing the PLATO Field Through the Lenses of TESS

(31) Yuqi Li: Post-main sequence thermal evolution of planetesimals: Implications on white dwarf pollutants

(58) Zachary Ross: A compact system of super-Earths and Neptunes orbiting an active F8 main sequence star

Talk abstracts

Oldest white dwarf planetary systems in the Galaxy

Abbigail Elms (University of Warwick)

The composition of rocky planet material which existed several billion years ago can be uniquely studied from cool (thus old) white dwarfs accreting rocky debris. Recent studies have identified ultra-cool (Teff ¡ 4000 K) metal-polluted white dwarfs with cooling ages ¿ 9 Gyr, making them the oldest confirmed evolved planetary systems around white dwarfs in our Galaxy. We found the debris composition of one of these white dwarfs to be exceptionally lithium- and potassium-rich compared to Solar System benchmarks. Possible explanations for this mysterious composition include the accretion of planetary debris enriched by primordial lithium and accretion of ancient planetary crusts.

Investigating the effect of radiation pressure on protoplanetary disc dispersal

Alfie Robinson (Imperial College London)

Understanding disc dispersal is important for developing our models of planet formation during the final phase of disc evolution. Models of internal photoevaporation cannot explain the speed at which outer discs should disperse. It has been suggested that radiation pressure could solve this problem by removing the dust, rather than dispersing the disc. I will present self-consistent 2D simulations of disc dispersal, including the effects of both photoevaporation and radiation pressure. We find that including radiation pressure does not solve this problem, unless the photoevaporation has a specific profile, although there are interesting implications for the dust dynamics.

The significance of mitigating stellar activity in the search for Earth twins.

Ancy Anna John (University of St Andrews)

Minimising the impact of stellar variability in RV measurements is essential for attaining the 10 cm/s precision required to hunt for Earth twins orbiting other Suns. Despite the fact that we have access to new-generation RV instrumentation capable of providing this precision, stellar variability contaminates and overwhelms small RV signals, hampering our ability to discover Earth twins and determine their masses. In this talk, I will present our results from analysing stellar systems observed with HARPS and HARPS-N, with different levels of intrinsic stellar variability using TWEAKS, an RV analysis pipeline designed for attaining sub-m/s detection thresholds at long orbital periods. TWEAKS combines wavelength-domain and time-domain stellar activity mitigation. We applied TWEAKS to CoRoT-7 (high activity), HD144579 (moderate activity), and HD166620 (maunder minimum). Using wavelength-domain line-profile decorrelation vectors (SCALPELS) to mitigate the stellar activity and performing a deep search for planetary reflex motions using a trans-dimensional nested sampler (kima), we validated the existence of the third planet

in the CoRoT-7 system, whose planetary origin had been mistaken for a stellar activity artefact for the past decade. We also refined the planetary mass estimate of the known transiting planet CoRoT-7b to a precision of 10-sigma by accounting for the contributions of all additional (non-transiting) planets. In the data sets of the Rocky Planet Search (RPS) stars HD144579 and HD166620, we found no significant planetary signals. We validated the results via data-splitting and injection recovery tests. We found that the likelihood of finding a low-mass planet increases noticeably across a wide period range when the inherent stellar variability is corrected using SCALPELS decorrelation vectors. By obtaining the 95th percentile detection limits, we found that we are able to detect planet signals with $M \sin i \leq 1 \mathrm{M}_{\oplus}$ for orbital periods shorter than 10 days, and $M \sin i \leq 3.5 \mathrm{M}_{\oplus}$ for periods shorter than 200 days. Our decorrelation technique pushed the detection limits down to 54 cm/s, nearing the 50 cm/s calibration limit of HARPS-N. Therefore, we show we can push down towards the RV precision required to find Earth analogues using high-precision radial velocity data in the upcoming decade.

Reshaping protoplanetary disc around binaries through heat

Anna Penzlin (Imperial College London)

In the treasure trove of disc observations, the least understood and most mesmerizing are often circumbinary discs (HD 142527, CsCha or HD 100453) showing spirals, cavities and asymmetries. To unravel their shapes and dynamics we use 2D hydro-simulations. While cavity regions can be explained analytically by the moving binary potentials, to match the observed size and shape the hydrodynamic interaction of the potential, viscous disc and temperature is necessary. This changes and scales for each observation. Thereby, we can not just show possible cases but explain the differences we find in observations and test our understanding of protoplanetary disc.

Understanding stellar activity through eight years of Sun-as-a-star observations

Baptiste Klein (University of Oxford)

Stellar magnetic activity induces distortions in the absorption lines of Sun-like stars which greatly hamper the radial velocity search for Earth-mass planets. Based on 8 years of high-cadence Sun-as-a-star observations with the high-precision spectrograph HARPS-N, we investigate how this activity can be modelled in both wavelength and time domains, in preparation for long-term RV monitoring surveys such as the Terra Hunting Experiment or the PLATO mission.. We notably show that, without wavelength-domain activity filtering, traditional activity modelling frameworks like Gaussian Processes will fail at capturing long-term cycle-induced activity variations, limiting thereby our sensitivity to long-period low-mass planets.

Delivering prebiotic feedstocks to habitable planets

Catriona McDonald (University of Cambridge)

One of the fundamental requirements for life to emerge in any planetary context, is an inventory of prebiotic feedstock molecules from which the basic building blocks of life can form. Independent of a planet's chemical environment, prebiotic feedstocks can be delivered during cometary impacts which should be ubiquitous across planetary systems. We present 3D hydrocode simulations coupled with chemical modelling to constrain the survival of prebiotic feedstocks during impact processes. Thus, we can consider the prospects of successfully delivering feedstocks to habitable planets across different planetary system architectures where they could contribute to the emergence of life.

Applying Neural Network-Based Emulator of non-LTE Radiative Transfer on Stellar Activity

Chang Blake (Tze-En) (Imperial College London)

Stellar activity, such as faculae and spots, is one of the most prominent sources of uncertainty in transiting data. This study focuses on the UV facular spectra, where the facular contribution is large and non-LTE effect becomes important. Non-LTE calculations are computationally expensive, making it difficult to simulate the large number of spectra needed for facular spectra calculations. We build a non-LTE emulator that speeds up the computation. Our results for a G-type star show 90

The importance of optical Hubble observations in constraining retrieved atmospheric parameters of exoplanet transmission spectra.

Charlotte Fairman (University of Bristol)

Information on the composition of exoplanet atmospheres can be obtained from retrievals of their transmission spectra. With a sample of Hubble and Spitzer observations spanning 0.3-4.5 microns across 14 giant exoplanets, we investigate the importance of optical wavelengths in constraining free-chemistry retrieved parameters with POSEIDON. We find wavelengths below 0.6 microns are necessary to constrain scattering parameters and alkali species, with additional retrievals on HAT-P-11b demonstrating the importance of optical spectra in placing constraints on stellar contamination. Therefore, complementing JWST observations with optical Hubble data is vital in understanding cloud structure and stellar contamination in exoplanet atmospheres.

The impact of internal and external perturbations on exoplanet architectures

Christina Schoettler (Imperial College London)

Stars form together with others, often in initially highly dense regions where encounters can occur and affect young exoplanetary systems. I will present simulation results of the effect of flybys on a common exoplanetary system type: close-in Super-Earths with a distant Giant. A single encounter can modify this architecture: perturb inner planets, induce collisions and mutual inclination excitation, as well as place the Giant on eccentric/inclined orbits. These flybys typically induce 2 collisions in an inner 4-planet system. I will demonstrate how to

disentangle the impact on the excitation of inner planetary systems by Giants and external stellar flybys.

Characterising exoplanet atmospheres with Doppler tomography.

Christopher Watson (Queen's University Belfast)

Doppler tomography is an alternative technique to using conventional cross-correlation in high-resolution studies of exoplanet atmospheres. We outline the principles of Doppler tomography and show that it yields atmospheric detections with considerably lower background noise compared to cross-correlation approaches, and hence shows promise to extend atmospheric characterisation to more challenging targets and species. We demonstrate this in a comparative study of the atmosphere of HD179949b, where we make a tentative detection of molecular absorption on the night side of the planet - representing the first such night-side detection. We conclude with a look at future improvements planned for Doppler tomography.

Discovering Non-Transiting Exoplanets with TESS

Daniel Bayliss (University of Warwick)

Hidden within light-curves are the signatures of non-transiting exoplanets, via the subtle effects of reflection/emission, tidal ellipsoidal distortion, and Doppler beaming. For the first time, we search for these signatures in 140,000 bright dwarf stars in the southern ecliptic hemisphere of the TESS mission. We find 27 candidate signals that may be attributed to short-period, massive planets. Our candidates have periods ranging from 0.74 to 1.98 days, and amplitudes ranging from 94 to 528 ppm. The host stars are all bright (T¡11). We are now following-up these candidates with radial velocity measurements from HARPS.

The first eclipse map of the hot Jupiter WASP-17b

Daniel Valentine (University of Bristol)

We present a multi-dimensional JWST MIRI/LRS eclipse map of the hot Jupiter WASP-17b. Eclipse mapping is currently the only method of measuring 2D (longitude-latitude) emission profiles of exoplanet atmospheres, the capabilities of which have vastly increased owing to JWST's high precision and broad wavelength coverage. A wealth of information can be inferred from these maps, including heat redistribution efficiency, winds speeds, and chemical species distribution, which are vital to understanding multidimensional processes in exoplanet atmospheres. We confidently recover the hotspot offset of WASP-17b, a key diagnostic of such multidimensional properties. This work forms part of the JWST-TST DREAMS GTO-1353 program.

Disc evolution in intermediate-mass stars

Daniela Iglesias (University of Leeds)

The stellar range 1.5-3.5 Msun presents an interesting disc evolution; it contains the majority of gaseous debris discs and the highest giant planet frequency. In our spectroscopic/photometric survey, we identified 135 young intermediate-mass stars (IMSs). Our sample shows IR-excess evolution differs from low-mass stars; in IMSs, the inner disc regions are completely vacated and not gradually dissipated. We also studied gas presence in our sample via high-resolution spectroscopy. This requires comparisons to spectra of nearby stars to discard foreground clouds contamination. We apply this method to the eta Tel debris disc, contradicting the earlier hypothesis of disc wind.

Identifying and locating cloud species from their mid-IR vibrational mode absorption

David Grant (University of Bristol)

Clouds are prevalent in many exoplanet atmospheres, yet their composition is largely unknown. Presenting JWST mid-infrared spectroscopy of the hot Jupiter WASP-17b, we detect cloud-particle vibrational-mode absorption for the first time in a transiting exoplanet. We identify SiO2 (or quartz) as the cloud species and show how for planetary temperatures of 1700 K, SiO2 condenses around the limb, high up in the atmosphere, and with remarkably small particle sizes. These findings are crucial for understanding exoplanet atmospheres' global composition. I'll discuss how clouds sequester molecules from the gas phase and how their spatial distribution affects carbon-to-oxygen ratio and metallicity measurements.

The Roman Galactic Exoplanet Survey

Eamonn Kerins (University of Manchester)

The $4.3 billion Nancy Grace Roman Space Telescope (Roman) is NASA's next flagship mission after JWST, scheduled for launch late 2026. The Roman Galactic Exoplanet Survey (RGES) is a Core Community Survey occupying around 25% of the first 5 years of the mission. RGES will undertake high temporal cadence observations towards the inner Galaxy that should find 1,400 cool planets down to Mars mass found using microlensing, potentially hundreds of free-floating planets, and up to 200,000 hot planets through the transit method located at similar distances to the microlensing sample. The data is expected to be world-public within 48 hours of observation. ESA is also involved with Roman and, as ESA's appointed scientist to RGES, I'll overview the survey and highlight opportunities for UK community involvement.

Using Machine Learning to Fill Data Needs in the ExoMol Database

Elizabeth Guest (UCL)

Characterising exoplanetary atmospheres requires spectroscopic data in large volumes. The

ExoMol database, a key provider of molecular data, fulfills this need. Calculating the opacities required as inputs for many retrieval programmes requires vast numbers of molecular lines. Cross-sections of light absorbed depend greatly on atmospheric conditions, with pressure being a key example. This research uses machine learning to predict the pressure broadening of spectral lines, a parameter essential in calculating molecular opacity. Data have been lacking on the exotic molecules expected in exoplanetary atmospheres, however modern machine learning techniques have provided an avenue for producing more accurate molecular data.

Aligned vs misaligned hot Jupiters as a planet formation testbed: First look at JWST NIRSpec/G395H observations of three exoplanets

Eva-Maria Ahrer (MPIA Heidelberg)

In this talk, I will summarise our JWST programme and show a first look into our NIRSpec/G395H observations of three hot Jupiters, undertaken earlier this year. With our programme we will measure the metallicity and carbon-to-oxygen ratio of misaligned and aligned hot Jupiters. We selected our sample such that our exoplanet host stars do not allow tidal orbital realignment, which indicates that our misaligned planets have undergone high-eccentricity migration after the disk dissipated while our aligned targets migrated within the disk. We will compare their carbon-to-oxygen ratio and metallicity with predictions from planet formation and migration models.

A homogenous analysis of small planet masses

Hannah Osborne (MSSL/UCL)

Our current view of the mass-radius relationship of small exoplanets is not giving the full picture. Planet masses found through precision radial velocity (RV) observations are inconsistent; the offsets between instruments, data reduction pipelines, and the method used to account for stellar activity varies between studies. These inconsistencies can cause a significant difference in terms of the extracted planet mass. To combat this issue we have completed a homogenous analysis of small exoplanets RVs, using publicly available HARPS data. Here I will present the impact of different data extraction techniques and modelling choices on the subsequently measured planet masses.

The rise and fall of the giant planet occurrence rate

Heather Johnston (University of Leeds)

We carry out pebble-driven planet formation simulations to investigate the rise and fall of the giant planet occurrence rate. We introduce pre-main sequence stellar evolution and stellar-mass dependent accretion rates to conduct planet population synthesis. Our results show that the accretion rate is a key mechanism that governs the occurrence rate distribution. We find that giant planets around more massive stars tend to be (i) more massive, (ii) form

at a faster rate, and (iii) undergo runaway gas accretion at different locations than around low-mass stars. Hence, we can infer that giant planet composition may vary with stellar mass.

Planet detections around white dwarfs

Jamie Williams (University of Warwick)

Metal enrichment of white dwarfs is unambiguous proof that planetary material can survive post-main sequence evolution, but detections of planets around white dwarfs has been difficult. This is beginning to change, with new observatories such as JWST being capable of directly imaging planets at large separations. We present a new method of inferring planets through photometric or spectroscopic variability, focusing on HS0209+0832. This white dwarf has the first detection of photospheric zinc and shows evidence of a close-in evaporating giant planet on a 4.5 day orbit from a periodicity detected by TESS as well as variability of helium lines.

Evidence of Ammonia in the Atmosphere of WASP-43b

Jingxuan Yang (University of Oxford)

We retrieve atmospheric properties of hot Jupiter WASP-43b from four phase-resolved emission spectra observed by the MIRI/LRS onboard the JWST. Using a parametric atmospheric model and assuming a well-mixed atmosphere, we constrain the chemical abundances by fitting the four spectra simultaneously. We report evidence of water (6.5 sigma), ammonia (4 sigma), CO (3.1 sigma), and non-detection of methane. We show that the abundances derived from the MIRI dataset are consistent with previous phase curve observations by HST/WFC3. Our findings offer insights into the atmosphere of WASP-43b by simultaneously constraining the abundances of carbon, oxygen, and nitrogen-bearing species.

Pebble drift in HD 163296 - Constraining the mass of dust and ice reaching the terrestrial planet formation region

Joe Williams (University of Exeter)

The architectures and properties of planetary systems are thought to be shaped by the transport of dust and volatiles through protoplanetary disks during the planet formation phase. We present a novel method combining (1) observational tracers of pebble drift in the outer disk (namely enhanced gas-phase CO inside 70au), (2) radial drift modelling, and (3) MCMC sampling to constrain fundamental disk properties of HD 163296. With this, we reproduce inferred gas and dust masses with 'fragile' dust grains, and can place novel constraints on the amount of mass and water reaching the inner region where terrestrial planets may form.

Lessons learnt from engaging the global ML community through the Ariel Data Challenge.

Kai Hou Yip (UCL)

Data from missions like GAIA, Kepler, TESS, JWST, and soon, Ariel, has spurred the adoption of machine learning for uncovering hidden relationships and expediting data analysis in exoplanetary science. The Ariel Data Challenge showcases innovative solutions, focusing on atmospheric retrieval in its 2022 and 2023 editions. Key findings reveal the importance of physics knowledge for higher challenge scores, the effectiveness of diverse learning strategies, challenges posed by unknown data distributions, and the cost-effectiveness of crowd-sourcing for field-testing solutions in exoplanetary science.

Gliese 12 b, A Temperate Earth-sized Planet at 12 Parsecs

Larissa Palethorpe (University of Edinburgh)

Gliese 12b is the nearest (d=12pc) transiting temperate, Earth-sized planet found to date, orbiting a bright metal-poor star with one of the lowest activity levels known for M dwarfs. A planet was detected by TESS based on 3 transits across 3 sectors, with an ambiguous orbital period due to observational gaps. We performed follow-up observations with CHEOPS and various ground-based telescopes, and validate Gliese 12b as P=12.76 days, R_b = 0.90$R_\oplus$, with T_{eq} ∼315K. Gliese 12b represents one of the best targets to study if Earth-like planets orbiting cool stars can retain their atmospheres, a crucial step to advance our understanding of habitability.

The TESS SPOC FFI Target Sample Explored with Gaia

Lauren Doyle (University of Warwick)

The TESS mission's Full Frame Image (FFI) light curves, spanning 2.8 million stars, are pivotal for precise times series photometry in transiting exoplanet studies. However, this does not constitute a magnitude-limited sample. Addressing sample selection effects, we utilize Gaia DR2 and DR3 to analyse the TESS-SPOC FFI targets from Sectors 1–55. By cross-matching with Gaia targets brighter than G=14, we investigate stellar properties including magnitude, parallax, radius, temperature, and binarity. Specifically, we establish the planetary radius detection limit, crucial for detecting two transits around each target, and plot the TESS-SPOC FFI targets on a HR-diagram for the first time.

Atmospheres Across the Radius Valley - First Results from the JWST COMPASS Program

Lili Alderson (University of Bristol)

The JWST COMPASS program will obtain transmission spectra of 11 ¡3RE planets using

NIRSpec/G395H, building a critical link between atmospheric characterisation and planetary demographics. I will present the first multi-planet system observed by COMPASS, with the transmission spectrum of the 870K super-Earth TOI-836b. We find that spectra from two visits are consistent, and that by combining them we can narrow in on TOI-836b's atmospheric properties. I will compare TOI-836b to its sibling, the sub-Neptune TOI-836c, and the wider implications for this radius valley straddling system, and provide insight into planning future observations of super-Earths around bright stars.

Characterizing the Atmosphere of the Warm Sub-Saturn Exoplanet HAT-P-12b with JWST

Linus Heinke (KU Leuven — University of Edinburgh)

With the advent of the James Webb Space Telescope (JWST) our abilities to constrain the properties of exoplanetary atmospheres has improved significantly. The warm sub-Saturn mass planet, HAT-P-12b, was previously characterized through transit spectroscopy with instruments like HST and Spitzer. As part of the European ExoMIRI GTO program, we obtained observations from all feasible modes of the JWST, i.e. NIRISS SOSS, NIRSpec BOTS, and MIRI LRS, thereby allowing for a much more precise characterization. We will present the current state of our finding with a focus on the data reduction and first retrieval result from the NIRISS SOSS data.

Into the red: opening up the M-band for characterisation of exoplanet atmospheres at high spectral resolution

Luke Parker (University of Oxford)

Atmospheric characterisation of exoplanet atmospheres using high-resolution spectroscopy (HRS; R$\sim$100,000) is a major science driver for the Extremely Large Telescopes (ELTs), including the search for biosignatures on rocky planets between 3-5μm with METIS/ELT. However, HRS remains untested beyond 3.5μm, where the thermal background becomes a significant challenge. We present CRIRES+/VLT M-band observations of the young gas giant beta Pic b, detecting CO (S/N=6) in its atmosphere at 4.73μm, extending for the first time the use of HRS into the M-band (4-5μm). We further measure the planet spin rate and discuss the detection of H2O, and evidence for SiO.

Two-Dimensional Eclipse Mapping of the Hot Jupiter WASP-43b with JWST MIRI/LRS

Mark Hammond (University of Oxford)

We present an eclipse map of the two-dimensional thermal emission from the dayside of the hot Jupiter WASP-43b, derived from an observation of a phase curve with the JWST MIRI/LRS instrument. We derive the first statistical evidence for the latitudinal structure of an exoplanet, finding a latitudinal signal of 200 ppm and a longitudinal signal of 250

ppm. We conclude that there is a significant mapping signal which constrains the spherical harmonic components of the planetary emission up to order 2, showing an emission map with a small eastward hot-spot shift and no latitudinal asymmetry.

A first look at the atmospheres of three planets with a compact system with JWST/NIRSpec

Matthew Hooton (University of Cambridge)

Laplacian chains are an important tool to study the history of planetary systems, as the fragility of the chain significantly constrains the possible pathways through which the planets can form and evolve. Observations of TOI-178 revealed a compact system of six transiting super-Earths and mini-Neptunes: five of which form a chain of Laplacian resonance. In this talk, I will present a first look at the atmospheres of three planets in the TOI-178 system using recently-acquired JWST/NIRSpec transmission spectra with the aim of testing whether they formed in situ or migrated to their current separations.

Enhancing Exoplanet Detection: Tackling Supergranulation in Earth-Twin Surveys

Niamh O'Sullivan (University of Oxford)

In recent years supergranulation has emerged as one of the biggest challenges for the detection of Earth-twins in radial velocity (RV) planet searches. Supergranulation introduces RV variations on timescales of 1-2 days with amplitudes 0.5-1 m/s, considerably larger than the expected 10 cm/s signal from Earth-like planets. I will present new work focused on mitigating the impact of supergranulation using Gaussian Processes in the time domain as opposed to the traditional method of characterising these signals in the frequency domain. I will apply this new method to Sun-as-a-star data sets, and discuss implications of my results for future RV planet searches and their observing strategy.

The Hycean Paradigm in the Search for Life

Nikku Madhusudhan (University of Cambridge)

The search for life elsewhere is the holy grail of exoplanetary science. A new class of habitable exoplanets, called Hycean worlds, promises to expand and accelerate the search for planetary habitability and life elsewhere. Recently, the first JWST spectrum of a possible Hycean world, K2-18 b, was reported with detections of multiple carbon-bearing molecules in its atmosphere. In this talk we will report latest observational and theoretical developments in the characterisation of Hycean worlds, including new JWST observations of Hycean candidates and new constraints for K2-18 b. We will discuss open questions, emerging opportunities, and future directions in this area.

A peculiar planetary-mass candidate imaged around a binary star

Pengyu Liu (University of Edinburgh)

Direct imaging expands the parameter space of exoplanets to extremely wide separations. These planets challenge planet formation mechanisms. I will present a planet candidate imaged around a binary star system discovered by the Young Suns Exoplanet Survey (YSES). If confirmed, this would be the fourth exoplanet imaged with YSES. Combining Gaia and SPHERE, we perform precise astrometric analysis and rule out the possibility that it is a static background source. Its anomalous sky motion straddles that expected for a companion of the host star and that expected for a nearby free-floating object. I will discuss possible scenarios of this candidate.

Using high resolution cross correlation spectroscopy to probe oxygen fugacity regimes in lava ocean worlds

Spandan Dash (University of Warwick)

Short period ultra-hot rocky planets are expected to only have a secondary atmosphere formed from vaporisation of the mantle. The mantle composition itself is dependent on the oxidation state (quantified by fugacity). We investigate whether high-resolution cross-correlation emission spectroscopy can be used to place constraints on these fugacity regimes by simulating nights of dayside observations between 0.5-2.6 μm assuming instrumental parameters of currently used spectrographs. We then quantify the conditions that would enable us to differentiate between these fugacity regimes, if it is already possible to do so, or would require observations from the upcoming E-ELT.

Atmospheric clouds and hazes in the era of next-generation exoplanet data

Sushuang Ma (UCL)

Recent exoplanetary spectroscopic data underscores the crucial need for accurate cloud and haze modeling. Inadequate representation of clouds and hazes can mis-lead the interpretation of high-quality data like that from Webb and Ariel. To address this, I present YunMa, a cloud and haze radiative transfer model integrating aerosol formation and microphysics, adaptable as a standalone model or embedded in the retrieval framework TauREx 3. I'll showcase YunMa's simulations on various cloud and haze types, exploring the potential of extracting features from Webb and Ariel data, alongside large-scale simulations for exoplanet population studies, encompassing chemistry and cloud modelling.

Accelerating Atmospheric Simulation of Venus by Integrating a Machine-Learned Surrogate Radiative Transfer Scheme

Tara Tahseen (UCL)

This talk presents an approach to accelerating 3D Global Circulation Model (GCM) simulations by integrating a machine-learned surrogate model into the OASIS GCM. Traditional GCMs (based on numerical integrations of physical equations) are time-intensive, meaning resolution must often be compromised. This research aims to enhance computational efficiency, enabling higher resolution simulations within reasonable timeframes. The method involves replacing the radiative transfer module in OASIS with a recurrent neural network (RNN)-based model. Preliminary results show promise, with the benchmark model achieving a mean root mean squared error of 0.64

Mapping atmospheric structures on the nearest brown dwarfs

Xueqing Chen (University of Edinburgh)

Brown dwarfs and planetary-mass companions display rotationally modulated photometric variability due to their inhomogeneous atmosphere. We applied Doppler imaging to the nearest brown dwarf binary WISE1049AB using time-resolved, high-resolution spectroscopic observations from Gemini IGRINS to obtain for the first time H and K band simultaneous global top-of-atmosphere map for brown dwarfs. Compared to the only previous Doppler map for a brown dwarf in 2014 featuring a mid-latitude spot on WISE 1049B and no feature on WISE 1049A, our observations detected persistent spot-like structures on WISE 1049B in the equatorial to mid-latitude regions and revealed new polar spots on WISE 1049A.

Understanding M Dwarf Radius Inflation: Insights from Low- Mass Eclipsing Binaries

Yasmin Davis (University of Birmingham)

Precise measurements of host stars are crucial in the search for Earth-like exoplanets. M-dwarfs are favourable targets, but they display unexplained radius inflation in current models. For fully convective stars (M¡0.35 Msun), the extent of this inflation is unknown due to limited study. Low-mass eclipsing binaries (EBLMs) offer unique opportunities to determine empirical masses and radii, filling underpopulated regions in parameter space. This homogeneous study of a large sample of EBLM systems is essential for validating and refining existing stellar evolution models, increasing confidence in the accuracy of stellar parameters for single stars where empirical measurements are unattainable.

Planet formation in wind-driven discs via pebble accretion

Yunpeng Zhao (University Of Dundee)

Pebble accretion has been shown to explain formation of diverse planetary systems. The past planet formation models often assumed steady disc accretion, where the accretion rate is constant in radius. However, wind-driven accretion discs are expected to exhibit radially varying disc mass accretion due to mass ejection by disc winds, which may alter planet formation outcomes. Furthermore, disc wind-induced mass loss flattens the disc's surface mass density profile and can significantly decelerate planet migration. This talk will explore

the impact of disc wind strength and efficiency on planet formation and migration.

Poster abstracts

(67) Introducing two improved methods for approximating radiative cooling in hydrodynamical models

Adam Koval (University of Edinburgh)

Radiative transfer is a key process in the temperature evolution of young protoplanetary discs. Efficient cooling induces gravitational instabilities which may kick-start planet growth early in a disc's lifetime. Full radiative transfer is computationally expensive, therefore approximate methods are desirable for simulations. We present two new radiative cooling methods: the first combines two established, geometry-independent cooling methods to leverage their strengths in their preferred density regime; and the second, tailored to a disc-specific geometry, proves particularly suitable for modelling massive, self-gravitating discs. We demonstrate that this method performs well compared to full radiative transfer, at a substantially reduced cost.

(18) Three close-in planets with a long-period Saturn-mass companion: optimizing RV planet detections.

Adam Stevenson (The Open University)

We present our analysis of a compact multi-planet system around a low-activity G5V star. We compare traditional recursive period searches for Keplerian signals in radial velocity data with a posterior sampling approach that searches for the optimal number of Keplerian signals that are simultaneously present. This latter approach can yield more reliable results for non-ideally sampled datasets. We detect a long-period 0.35 Mjup outer planet and three significant short-period super-Earth-mass planets, with two near a 2:1 orbital resonance. These planets are likely products of inward migration, allowing us to study low-mass planet migration excited by an eccentric sub-Jovian object.

(59) Deeper understanding of rocky planet atmospheres through Atmospheric Retrievals of super-Earth L 98-59d using JWST

Agnibha Banerjee (The Open University)

L 98-59d is a super-Earth orbiting an M-type star. We perform retrievals on the transmission spectrum of L 98-59d obtained using NIRSpec G395H during a single transit, from GTO 1224.

The wavelength range of this spectrum allows us to potentially detect the presence of several atmospheric species such as H2O, CO2, CO etc. We report the tentative detection of H2S in its atmosphere.

This work is among the first to use transmission spectroscopy with JWST to study such an

atmosphere, and is a vital step towards a deeper understanding of rocky planet atmospheres.

(45) A Galactic population synthesis approach to exoplanet demography

Akshay Priyadarshi (The University of Manchester)

A key challenge in exoplanet demographics is to optimally synthesise results from different exoplanet detection methods targeting different orbital separations around diverse host star populations spanning different galactic regions. We suggest simulating planetary systems within a Galactic model to account for host and environmental variations. We report on this work's first phase, to construct a demographic model describing statistical properties of the Kepler exoplanet catalogue. Using Besancon Galactic model, we generate a synthetic stellar catalogue resembling Kepler targets. Planets are assigned to these stars using an adjustable exoplanet occurrence model. Using detection efficiencies from KeplerPORTS, we generate Kepler-detectable exoplanet catalogue. We optimise occurrence model via nested-sampling for best agreement between observed and modelled Kepler exoplanet datasets.

(44) LRG-BEASTS: Optical Transmission Spectrum of the Hot Saturn HAT-P-44b

Alastair Claringbold (University of Warwick)

We present an optical transmission spectrum of HAT-P-44b, the first atmospheric characterization for this inflated hot Saturn. The planet is a close sibling in mass, radius, and temperature to the exceedingly well-characterized WASP-39b. By combining two nights of observation with WHT/ACAM and performing retrievals on the transmission spectrum, we demonstrate evidence for sodium and clouds similar to WASP-39b. We discuss both the challenges presented by ground-based transmission spectroscopy, and the many benefits of extending infrared spectra into the optical for complete atmospheric characterization of giant planets. This analysis is part of the LRG-BEASTS survey, using 4m-class telescopes for transmission spectroscopy.

(60) Sulfur-bearing molecules from the ExoMol database

Alec Owens (University College London (UCL))

Sulfur chemistry is plays a key role in exoplanetary atmospheres, from the formation of hazes and clouds, to providing vital insights into photochemistry. The recent detection of sulfur dioxide in the gas giant Wasp-39b – a molecule exclusively produced photochemically – has brought sulfur-bearing species to the forefront. The ExoMol database offers molecular spectroscopic data for a number of key sulfur-bearing molecules (H2S, SO2, SO3) with new line lists recently being produced for carbonyl sulfide (OCS) and sulfur monoxide (SO). I will discuss the challenges associated with treating these systems, highlighting their importance, and presenting future plans of the ExoMol database.

(54) Low-mass planet migration in radiative disks

Alexandros Ziampras (Queen Mary University of London)

Low-mass planets migrate in the type-I regime. In the inviscid limit, the contrast between the vortensity trapped inside the planet's corotating region and the background disk vortensity leads to a dynamical corotation torque, which is thought to slow down inward migration. We investigate the effect of radiative cooling on low-mass planet migration using inviscid 2D hydro- dynamical simulations. We find that cooling induces a baroclinic forcing on material U-turning near the planet, resulting in vortensity growth in the corotating region, which in turn weakens the dynamical corotation torque and leads to 2–3× faster inward migration. This mechanism is most efficient when cooling acts on a timescale similar to the U-turn time of material inside the corotating region, but is nonetheless relevant for a substantial radial range in a typical disk (R $\sim$ 5–50 au). We finally make a note on current developments on planet migration in laminar disks and how radiative effects can change this picture.

(11) Investigating sources and propagation of errors in EPRV measurements with HARPS3 and the Terra Hunting Experiment

Alicia Anderson (University of Cambridge)

HARPS3 is being developed for the Terra Hunting Experiment - a 10-year observing strategy that will aim to complete nightly observations of a carefully selected group of solar-like stars in search of long-period, low-mass exoplanets. The ultimate goal is to achieve extreme-precision radial velocity (EPRV) measurements at the level of 10 cm/s to enable the detection of an Earth-twin. To accomplish this, we need to deconstruct the RV measurement process to understand all contributions of error and limitations in accuracy. This includes instrumental systematics, astrophysical and fundamental limitations, as well as data reduction algorithms. I am investigating the source and propagation of instrumental errors, from raw CCD images to the reduced spectroscopy output products by simulating raw data frames to provide a known input to the reduction pipeline. I will present my results and identify areas of the measurement process which could be improved for the EPRV regime.

(5) 1 Neptune, 2 Saturns: 3 Giants under 700K

Alicia Kendall (University of Leicester)

For orbital periods >10 days, there is a dearth of well-characterized transiting gas giants, where they become probes of planet formation and evolution. We present three planets solved through the NGTS Monotransits Program, each initially identified as single transit events in TESS Sectors. At 43.1 days, TIC-147277741b is one of few long period well-characterized Neptunes around bright stars, and is amenable for cool atmosphere studies using JWST. TOI-4940b and TOI-6669b are warm Saturns on ≈25 day orbits, the latter having moderate eccentricity ($e \approx 0.2$). Each has an equilibrium temperature <700K, with TOI-6669b especially cold at 460K.

(32) The GR8STARS catalogue: a public library of spectra and homogeneous stellar parameters for solar-like stars

Alix Freckelton (University of Birmingham)

Advancements in instrumentation and techniques for exoplanet detection and characterisation mean we are headed into an era in which the detection of an Earth-Sun analogue becomes possible. Bright solar-like stars offer an invaluable opportunity to study such systems in great detail. A homogeneous source of stellar parameters is then a necessity providing a solid foundation to such studies. I introduce the GR8STARS catalogue; providing spectra and homogeneous atmospheric parameters for almost 3000 FGK main-sequence stars in the solar neighbourhood. This open catalogue forms the perfect basis to select the best targets for an Earth twin search.

(6) Why hasn't there been more detections of helium escaping from the atmospheres of younger exoplanets?

Andrew Allan (Leiden University)

Highly irradiated exoplanets undergo extreme hydrodynamic atmospheric escape which varies signficantly over their evolution. We previously modelled the evolution of this escape as well its observability via the helium triplet 1083nm transit signature. We demonstrated that this escape and its observabilty are stronger at younger ages. Yet, there are several young (¡1Gyr) planets with weak or non-detections in He 1083nm. Modelling such systems, we conclude that for an individual planet, younger ages indeed produces a deeper absorption. For an exoplanet population however, this correlation is weak due to their diverse environments (ages and XUV fluxes) and sizes.

(1) Exoplanetary composition and evolution from a population level analysis of polluted white dwarfs

Andy Buchan (University of Warwick)

Polluted white dwarfs that have accreted planetary material provide a unique opportunity to probe the geology of exoplanetary bodies. However, the evolutionary pathways taken by such bodies, from their formation to their ultimate accretion, are not yet well understood. Different pathways may result in different compositional trends across samples of polluted white dwarfs, motivating a population level analysis. We consider three pathways and predict the corresponding observed compositional trends via population synthesis. We compare these predictions against the trends in a sample of real white dwarfs. We also assess the impact of observational bias and random noise.

(33) Younger Stars Host Denser Rocky Planets

Angharad Weeks (MSSL/UCL)

Interior compositions are key for our understanding of Earth-like exoplanets, but are extremely challenging to measure. Hitherto, only certain chemical elements in the photospheres of the host stars have been considered as a tracer to explain the diversity of exoplanet compositions. Here we present a homogeneous analysis of stars hosting rocky exoplanets, revealing a correlation between rocky exoplanet compositions and the ages of the planetary systems, with younger stars hosting denser rocky planets. We interpret this to be a result of chemical evolution of stars in the Milky Way, which modifies the material out of which stars and planets form.

(4) Finding Circumbinary Planets: A Transit Detection Framework for TESS Eclipsing Binaries

Ben Davies (University of Warwick)

The detection of the first circumbinary planet (CBP) was an exciting breakthrough in exoplanetary science, but the number of known CBPs remains small. Only 14 transiting CBPs have been discovered, making the study of their formation, evolution, and bulk properties difficult. Here, I present a framework for detecting transiting CBP candidates from TESS light curves of eclipsing binaries. I outline how the data is processed, including masking eclipses and detrending, as well as the procedure for detecting individual candidate transit events. In conclusion, I consider how potential candidates can be vetted and discuss follow-up observations necessary for their confirmation.

(55) Investigating Star-Planet Compositional Ties for Systems with Iron-Poor Host Stars

Daisy Turner (University of Birmingham)

As stars and planets are formed in the same environment, a connection should exist between the compositions of planets and their host stars. Exploring this relationship offers profound insights into their formation and evolution. Unravelling such complexities necessitates a diverse stellar sample spanning a wide range of chemical balances such as [α/Fe]. Optimal targets for this inquiry are planetary systems orbiting iron-poor host stars; they present an opportunity to study planets orbiting stars with compositions vastly distinct from the Sun. This poster presents preliminary results on efforts to expand this sample, focusing on small planets orbiting these unique stars.

(34) Methods to measure exoplanet phases curves, and absolute masses.

Daniel Sebastian (University Of Birmingham)

High-resolution cross-correlation techniques are a powerful tool to explore exoplanet atmospheres. We introduce the application of high-resolution cross-correlation techniques to high-contrast binary stars, having brightness ratios similar to those of well-analysed ultra-hot jupiters, and their host star. Since the spectral features of stars are well known, we can

both detect the atmospheric signal of the faint companion, and develop tools to accurately measure the mass of both stars. We show that this application can be extended to establish phase-resolved tracing of molecules within exoplanet atmospheres of ultra-hot jupiters using upcoming large aperture instrumentation like the ELT.

(15) The impact of convection on the climate of a tidally locked planet in global stretched-mesh simulations

Denis Sergeev (University of Exeter)

Convective processes are crucial in shaping exoplanetary atmospheres but are computationally expensive to simulate directly. We demonstrate a novel technique of modelling convection on exoplanets, using a 3D GCM with a global stretched mesh. This allows us to locally refine the model resolution to a km-scale and resolve fine-scale circulation on the day side of a tidally locked rocky exoplanet. Allowing for explicit convection in a stretched-mesh simulation results in changes in cloud distribution and precipitation on a planetary scale. Our methodology opens a computationally feasible avenue for improving our understanding of 3D mixing in exoplanetary atmospheres.

(63) Radiative Transfer in Protoplanetary Discs - Can Companions Cast Detectable Shadows?

Deniz Akansoy (Imperial College London)

Scattered light observations of discs like HD100453 or HD169242 show dips in intensity that are often speculated to be shadows caused by the planets or companions closer to the central star. Our aim is not just to understand if such shadows could be caused by planets but also to predict the depth and size of the shadow based on the shadow caster. Starting from a simple parameterizable model of an irradiated disc with a gap-opening object, we use radiative transfer simulation (radmc3d) for ranges of companion masses and distances. From the simulations, we determine the depth and size of the cast shadow onto the flared disc. Through an extensive parameter search, we found a simple empirical solution that describes all shadows in our sample to first order only depending on the radial distance and the planet's hill sphere. Thereby, our model can predict the conditions to recreate observed shadow structures.

(3) Migration, perturbations and resonances in white dwarf planetary systems

Dimitri Veras (University of Warwick)

This poster will present results from three of my recent papers, which attempt to answer the questions: (1) Can planetesimals migrate within white dwarf debris discs? (2) What is the smallest planetary driver of white dwarf pollution? (3) Which resonances are most effective at driving pollution?

(49) The properties of disc instability planets embedded in their parent discs

Dimitris Stamatellos (University of Central Lancashire)

The model of gravitational fragmentation as a result of disc instability offers an alternate formation mechanism for gas giant planets on wide orbits. A gravitationally unstable disc can fragment into self-gravitating clumps which have the potential to evolve further into protoplanets on a dynamical timescale. We model the evolution of gravitationally unstable discs and determine the effect of different barotropic equation of states (which broadly correspond to different physical conditions, e.g. disc metallicity, magnetic fields) on the properties of young protoplanets that are still embedded in their host discs.

(17) How do evolving stars impact their close-in planets?

Edward Bryant (MSSL/UCL)

Post-main sequence stellar evolution is expected to have a significant impact on the close-in exoplanets in orbit around them, specifically through the re-inflation of the planet's atmosphere and the rapid tidal in-spiral of the planet onto the star. I have performed a systematic transit search using TESS FFI photometry for exoplanets in orbit around approximately 500,000 evolved stars, characterising the detection sensitivity with injection-recovery simulations. By comparing this planet population for post-main sequence hosts to the main sequence population I will constrain the influence of the host star on the latter stages of a planet's lifespan.

(40) Multi-band attractor reconstruction of the light curve of Solar cycle 23

Emily Sandford (U of Cambridge -¿ Leiden Obs)

The ESA Solar and Heliospheric Observatory has observed the Sun near-continuously from space for almost 30 years. Three of its photometric instruments—the Variability of solar IRradiance and Gravity Oscillations experiment, the Extreme ultraviolet Imaging Telescope (EIT), and the Solar Extreme ultraviolet Monitor—observed all of solar cycle 23 (1996-2008), yielding beautifully sampled light curves tracing the Sun's optical, ultraviolet, and soft X-ray variability across the magnetic cycle. Here, I present the extracted EIT light curves and the preliminary results of analyzing them with attractor reconstruction, a technique which reconstructs the underlying dynamics driving quasi-periodic variability in time series.

(65) The effect of disc photoevaporation on the evolution of migrating giant planets

Emmanuel Greenfield (Imperial College London)

This research aims to characterise the behaviour of multi-planet systems of giant planets in protoplanetary discs. In the release of the Gaia catalogue we expect a few thousand of

such systems, it is then important to understand their orbital evolution. This work uses the Fargo3d hydrodynamical simulation code to investigate the effect of photoevaporation from the central star on resonances, specifically on how it affects the evolution of planetary eccentricities once they are trapped in a resonance. This research also characterises how photoevaporation changes migration rates and resonance trapping timescales, by affecting disc mass loss rates within the disc gaps.

(36) Sandwiched planet formation: restricting the mass of a middle planet

Farzana Meru (University of Warwick)

Planetary systems come in all shapes and sizes, with a vast diversity in the properties of the systems. From a simple theoretical perspective, we would expect planetary systems to form with the more massive planets in the outer parts of the system. However, this is not necessarily the case suggesting that sequential planet formation is a complex process. In this talk I will discuss a possible formation scenario whereby a small planet might form and be "sandwiched" in between two more massive planets.

(50) The Impact of Cometary 'impacts' on the Chemistry, Climate, and Observations of Earth-like Exoplanetary Atmospheres

Felix Sainsbury-Martinez (University of Leeds)

Impacts of icy and rocky bodies have shaped the resulting composition of solar-system objects, and the habitability of the Earth. Such impacts are also highly likely to occur on exoplanets and may indeed be a key mechanism for the delivery of water to potentially habitable exoplanets. We couple an impact model, which includes thermal ablation and pressure-driven breakup, with the 3D Earth-system model CESM. We use this model to explore the short/long term effects associated with a massive, pure-water-ice, impact. This includes investigating the advection of water and heat away from the impact site and resulting changes to local/global chemistry.

(38) Stellar Multiplicity in and around the Neptunian Desert

Fintan Eeles-Nolle (University of Warwick)

Understanding transiting exoplanets in and around the Neptunian Desert is a crucial step in studying the nature of the desert itself. Probing the relationship between stellar multiplicity and exoplanet properties is part of this process. Using Gaia DR3 astrometry, we build a population of common proper motion companions to exoplanet hosts, calculating multiplicity rates across different transiting planet populations. Comparative analysis across multiple surveys sheds light on the impact stellar companions have on exoplanet demographics. Findings are discussed within current evolution and formation models, improving our understanding of the effects of stellar companions on exoplanets in the Neptunian Desert.

(7) Investigating the occurrence of hot Jupiters with stellar age

Francesca Waines (MSSL/UCL)

There still much uncertainty regarding the formation and evolution history of hot Jupiters, despite their frequent appearance. These gas giants experience strong tidal interactions resulting in tidal orbital decay, whereby the planets inspiral into their host stars. We test the occurrence of hot Jupiters with stellar age to investigate whether there is a trend. To do so, we use a sample of 1000 TESS hot Jupiter planet candidates, avoiding false positives and fit stellar isochrone ages to each system. Additionally, we address known correlations with metallicity and stellar mass to fit a trend of occurrence solely due to stellar age.

(26) How good cradles can rocky exoplanets be for life?

Gergely Friss (University of Edinburgh)

To the best of our knowledge, Earth is the only place in the universe that supports life as we understand it. But what are the key environmental conditions that enabled life to emerge on our rocky planet? One hypothesis is that warm little ponds, experiencing wet-dry condition cycles, could provide a suitable environment to support the emergence of pre-biotic molecules necessary for life. In this study, we couple a 1-D model of atmospheric chemistry with a warm little pond model and explore the physical parameter space of rocky planets and how they influence the prebiotic chemistry that helps to explain the origins of life.

(39) Using simulations to probe granulation on the stellar surface

Ginger Frame (University of Warwick)

Stellar variability, mainly from granulation, poses a major challenge in finding Earth-like planets. Granules create convective blueshifts, shaping spectral lines with a C-shape bisector. Current instruments can't accurately probe granulation, and empirical methods have limited predictive accuracy. Yet, simulations offer a solution. By using MURAM's HD/MHD simulations and radiative transfer codes, we synthesize stellar spectral lines. Our focus is understanding granulation's physics, especially its interaction with magnetic fields on Sun-like stars. These insights will enhance radial velocity confirmation for low-mass, long-period planets.

(42) What does helium absorption tell us about atmospheric escape of exoplanets?

Giulia Ballabio (Imperial College London)

Atmospheric escape is considered the major contributing factor in shaping the demographic of detected exoplanets. Helium escape from planetary atmospheres has become the primary observational probe, having been observed in 20 exoplanets. I will present a new

theoretical model to predict the excess absorption from helium line. By using insights from hydrodynamic outflow models that constrain the outflows temperatures, I will show how the helium absorption scales with incident irradiation and this population-level prediction can be used to probe how the mass-loss efficiency scales with planetary properties. I will show the first pathway to directly observationally constraining atmospheric escape and its impact on exoplanet population.

(51) Is that a CMOS in your pocket ?

Ioannis Apergis (University of Warwick)

CCDs have spearheaded the photometric searches for transiting exoplanets over the previous two decades. However, CMOS detectors have rapidly replaced CCD in most commercial applications, as they are cheaper to manufacture, use less power, and have faster readout speeds. We present a study of the new Andor Marana 4BV11 scientific CMOS camera for bright star photometry of transiting exoplanet systems. Or study includes laboratory testing and on-sky testing at the NGTS facility in Paranal, Chile. Our results show how CMOS cameras can be used and optimized for bright-star photometry.

(24) TOI-1117 multi-planetary system: three Sub-Neptunes, one in the Neptunian Desert

Isobel Lockley (University of Warwick)

I present the discovery of three Sub-Neptunes around a Sun-like star, TOI-1117. Performing a joint fit of TESS light curves and HARPS radial velocity data revealed an inner transitting planet, TOI-1117b, and two non-transitting planets, TOI-1117c and TOI-1117d. TOI-1117b lies within the orbital period parameter space known as the 'Neptunian desert', where only a small fraction of exoplanets have been found and their formation mechanism is unknown. Furthermore, all three planets were found to have short periods, 2.22817, 4.579, and 8.67days and circular orbits and I present analysis of the potential 4:2:1 resonance chain.

(43) Spectroscopic binning and retrieval sensitivity

Jack Davey (UCL)

With transmission spectroscopy data of higher resolution now being offered by spaced-based observatories, it is imperative that we understand the capabilities of retrieval pipelines. Towards this aim, we present a sensitivity study aiming to quantify the deviation of retrieved parameters from their true values as a function of spectral resolution and observed photometric error. We use simulated transmission spectra of planets similar to WASP-39b across the wavelength range of the JWST NIRSpec PRISM instrument and bin the data to various regimes. We produce sensitivity maps with these data and also consider biases due to the binning method used.

(41) WD1032+011: An eclipsing white dwarf-brown dwarf binary with a highly irradiated secondary

Jenni French (University of Leicester)

White dwarf-brown dwarf binaries with ultrashort periods (hrs) exhibit similar levels of irradiation to hot Jupiters, alongside a higher contrast, thus providing good irradiated hot Jupiter proxies. Only 10 of these rare systems are known, 4 of which eclipse. WD1032+011 is the only eclipsing white dwarf-brown dwarf binary with a known inflated brown dwarf secondary. We obtained HST spectra and isolated the brown dwarf spectrum for both its nightside in eclipse and irradiated dayside. I will discuss our results relating to the L1 spectral type, the 210K day-nightside contrast, and the energy circulation and inflation of the brown dwarf.

(47) Dynamics of rotating convection in planetary cores

Jo Kershaw (University of Leeds)

Analysis of the flow in Earth's liquid outer core will lead to an understanding of the mechanisms behind the geodynamo. This project's focus is to replicate the heat transport dynamics within the Earth's polar zone using the conditions at the boundaries of the tangent cylinder, rather than those of the full spherical shell. The simpler geometry should allow assessment of more extreme, Earth-like parameters and facilitate comparison with experimental results.

The aim is to improve our models of rotating convection in curvilinear geometries in order to advance our understanding of magnetic field generation in astrophysical systems.

(19) Model synthesis of combined JWST transit observations of WASP-39b: overall findings and lessons learned

Joanna Barstow (The Open University)

As part of the Transiting Exoplanet Community's JWST ERS programme, hot Jupiter WASP-39b was observed by all available instruments, providing a complete transit spectrum from 0.52 – 12 microns. A range of modelling tools, from chemical equilibrium grids to free retrievals, were applied to this groundbreaking dataset. We detect and constrain the abundances of Na, K, H2O, CO2, CO, SO2 and H2S, and find evidence for cloud and haze covering only part of the terminator. We present the planet's comprehensive metallicity and C/O ratio. While initial estimates were model dependent, we highlight lessons learned that allowed us to overcome this challenge.

(12) The role of X-ray variability in shaping the Neptune desert and period-radius valley

Jorge Fernandez (University of Warwick)

Atmospheric escape is a key process in planet evolution, shaping both the Neptune desert and the period-radius valley. X-ray driven photoevaporation is likely responsible for most of the atmospheric escape, and yet the differences in long-term X-ray emission between individual stars remains poorly characterised. We combine Gaia data with more than two decades of X-ray observations with XMM-Newton to characterise the X-ray variability of individual stars. We found FGK stars vary too little to explain the observed population scatter, and so they must be systematically brighter/fainter than average. We also found this variability leads to a long-term increase in escape rates on close-in exoplanets.

(21) Study of the degree of dust settling and gas dynamics in highly inclined protoplanetary discs

Juanita Antilen (MSSL, UCL)

Dust settling creates favorable conditions for planet formation in protoplanetary discs, which occurs in highest density regions, and it is greatly affected by the gas dynamics, the initial grain size distribution and the gas to dust ratio. We constrain the strength of dust settling and level of turbulence of the gas for three highly inclined protoplanetary discs: DoAr 25, MY Lup and RY Lup. For this aim, we perform radiative transfer modeling of ALMA and VLT/SPHERE data, which trace the vertical distribution of mm- and um-sized dust grains. This work provides new insights about the physical conditions in the earliest stages of planet formation.

(22) Assessing the origin of gas in hybrid disc candidates

Karolina Szewczyk (University of Leeds)

We investigate narrow gas absorption features superimposed on the photospheric Ca II K line in a number of very young (¡17 Myr) debris discs. Via comparison to spectra of nearby stars, we seek to rule out interstellar absorption as the culprit, ascertaining circumstellar origin. By employing this method, we identified four new hybrid disc candidates: TYC6822-283-1, HIP94167, HIP48613, and TYC5649-822-1. Additionally, we confirm the circumstellar nature of gas in the debris disc around HIP61782. Gas in these discs can impact the atmospheres of formed planets and their potential for habitability, which stresses the need to ascertain its origin and composition.

(8) An energy sensitive wave-front sensor for XAO

Kieran O'Brien (Durham University)

Kinetic Inductance Detectors are an emerging super-conducting detector technology that enable large optical/NIR detectors. Each pixel measures the arrival time and wavelength of individual photons. They are noise-free and operate at MHz rates. This makes them a unique choice for an energy-sensitive wave-front sensor. Funded by UKRI, we are developing a demonstration system for an XAO WFS, aiming at inclusion in the upcoming ELT-PCS

development. I will present the concept and some of the expected gains from such an instrument.

(27) The white dwarf opportunity: which rocks and minerals make up a planet?

Laura Rogers (University of Cambridge)

We live in an epoch of rocky planet discovery, but if we are to truly assess the habitability of these exoplanets, we must understand what the rocks are made from i.e., their mineralogy. White dwarf planetary systems provide the optimal route to tackle this by making the link between composition and mineralogy: bulk composition of the planetary material from spectra of the white dwarf atmosphere, and its mineralogy from infrared spectra of the accreting dust disc. How do we link the bulk abundances to the mineralogy? What does this mean for rocky bodies and habitability?

(20) Inferring stellar tidal dissipation factors from citizen-scientist transit observations

Lawrence Berry (UCL)

Several studies have demonstrated evidence for tidal decay in hot Jupiters like Wasp-12b through transit timing variations.

By using citizen-scientist data we are able to model the decay of many more systems. However, such amateur data is often inaccurate due to experimental errors and in-homogenous light-curve modelling. To handle this, new statistical techniques have been developed to improve outlier detection and adapt to uncertainty in the reported observational errors.

This allows us to more tightly constrain well-known decay candidates, identify promising new candidates, and infer an empirical distribution of stellar tidal dissipation factors, opening up new avenues for research into stellar structure.

(30) Cool Gaseous Exoplanets: surveying the new frontier with Twinkle

Luke Booth (Cardiff University)

The planned launch of Twinkle in 2025 provides an opportunity to conduct the first homogeneous spectroscopic survey of cool gaseous planets, an understudied population with great potential to expand the understanding of planetary formation mechanisms and atmospheres. In this temperature regime, Twinkle is capable of detecting most major molecules predicted by equilibrium chemistry and can successfully recover an injected mass-metallicity trend. With 20 high-priority survey candidates observable during its 3-year primary mission, and more recent TESS discoveries set to bolster this number, the mission is therefore well-suited to providing the first insights into cool gaseous planets at a population level.

(64) Enhancing Exoplanet Detection Beyond TESS: Insights from SPECULOOS on M-dwarf Occurrence Rates

Maddy Scott (University of Birmingham)

While TESS has enhanced exoplanet discovery, its limitations in detecting small and long-period planets persist. The prevalence of multiplicity in planetary systems suggests TESS may miss undetected planets. This poster introduces a SPECULOOS survey targeting M-dwarf systems where TESS has found at least one planet. The survey will use the SPECULOOS telescopes in Chile, which specialise in observing small planets around small stars, enabling the detection of longer-period planets. Initial results from this survey promise to enrich our understanding of exoplanetary systems and contribute to assessing M-dwarf occurrence rates.

(23) Astroclimes - describing the capabilities of our synthetic transmission spectra code for removing telluric lines

Marcelo Aron Fetzner Keniger (University of Warwick)

Proper removal of telluric lines is essential to achieve good precision and unbiased measurements of atmospheric abundances and temperatures of exoplanets via high resolution cross-correlation spectroscopy. Yet, there is still no single established method for correcting telluric spectra.

We develop a new code for generating synthetic transmission spectra, which would allow us to remove telluric lines. The transmission spectra is modelled from molecular cross-sections, an atmospheric profile and a radiative transfer equation. We demonstrate the code's efficacy in removing telluric lines from data from numerous instruments in the visible and infrared range, for several spectral types.

One aspect that sets our code apart from similar ones in the literature is that we also hope to use it to measure the amount of greenhouse gases in the Earth's atmosphere. So, our goal is not only to remove telluric lines, but to fit them as well.

(66) Quenching-driven equatorial depletion and limb asymmetries in WASP-96b's atmosphere

Maria Zamyatina (University of Exeter)

Quench level location in hot Jupiter atmospheres is unknown. We explore the sensitivity of its location to an increase in the planet's metallicity using aerosol-free 3D GCM simulations of WASP-96b. We find that the temperature increase associated with the metallicity increase shifts the quench level to pressures dominated by the jet, and causes an equatorial depletion of CH4, NH3 and HCN. We show how this depletion affects WASP-96b's transmission spectrum, and how the analysis of the evening-morning limb asymmetries of H2O, CH4 and CO2 features distinguishes atmospheres of different metallicities that are at chemical equilibrium from those at thermochemical disequilibrium.

(35) Obliquity measurement of a hot Neptune desert planet challenges previous findings

Marina Lafarga Magro (University of Warwick)

The origin of the Neptunian desert, a scarcity of Neptune-sized planets in close orbit around their host stars, remains a mystery in exoplanet research. A way to shed light on the formation and evolution of the few planets within the desert is to study their obliquity. We use ESPRESSO and MAROON-X spectroscopic transit observations of one of these planets, WASP-156 b, to measure its obliquity. Preliminary analysis suggests an aligned obliquity, in contrast to previous findings indicating misalignment. This also challenges an observed trend of polar orbits for several Neptunian desert planets, hinting at different formation or evolution routes.

(68) Medium resolution spectroscopy of cool brown dwarfs

Mark Phillips (University of Edinburgh)

Measurements of the C/O ratio in brown dwarfs are lacking, in part due to past models adopting solar C/O only. We have expanded the ATMO 2020 atmosphere model grid to include non-solar metallicities and C/O ratios in the T dwarf regime. We compare these new models with medium-resolution (R $\approx$ 1700), near-infrared (0.8 - 2.4 μm) Gemini/GNIRS spectra of three benchmark late-T dwarfs, GJ 570D, HD 3651B, and Ross 458C. We find solar C/O ratios and best-fitting parameters (Teff , log(g), Z) broadly consistent with other analyses in the literature, and model-data discrepancies are consistent across all three objects.

(2) An update on the multiplanet circumbinary system TOI-1338/BEBOP-1

Matthew Standing (European Space Agency)

I will present an observational update of the BEBOP-1 circumbinary planet system. The system is known to host two circumbinary planets, a 95-day planet identified by TESS, and a second 215-day non-transiting planet discovered by radial velocities. BEBOP-1 is the second multiplanetary circumbinary system ever discovered, but does it host any additional planets? Understanding the population of planets in these extreme systems can provide us with unique insights into planet formation.

(9) ELT Planetary Camera & Spectrograph R&D

Matthias Tecza (University of Oxford)

We will present an overview of the science cases for the ELT-PCS instrument, its current status and a future outlook.

In particular, we will present the current status and future plans of the PCS R&D programme

carried out in Oxford as part of the UK-ELT programme. The goal of our R&D programme is to measure and optimise in a lab experiment the contrast ratios achievable by different types of integral field spectrographs, in order to achieve the overall contrast requirements of PCS of $\sim 10^9$.

(25) The Future of Exoplanetary Doppler Tomography

Mitchell Young (Queen's University Belfast)

Doppler Tomography is an analysis technique used in high-resolution studies of exoplanetary atmospheres and offers an alternative to conventional cross-correlation. Initial assessments of the technique show a marked improvement over cross-correlation in terms of background noise, providing a pathway to more detailed atmospheric characterisation. But the current implementation of Doppler Tomography leaves room for improvements to be made. Here, I will demonstrate a number of planned improvements (e.g. replacing line lists with atmospheric models, accounting for rotational broadening) and highlight how each impacts the performance of the technique and the quality of the results.

(46) Ionisation Chemistry of the Inner Disc

Morgan Williams (Imperial College London)

Magnetohydrodynamic effects are known to be significant in the inner regions (¡1 AU) of protoplanetary discs and may provide a pathway for planet formation. To include these effects in simulations, the ionisation levels of these regions must be known; this requires a chemical network. We have developed an exact solution technique for a network that includes the chemical effects of a realistic distribution of dust grain sizes. The resultant charging of the dust has important implications for the size distribution of the dust and, in turn, the viability of mechanisms like the streaming instability.

(37) The Next Generation Transit Survey (NGTS)

Peter Wheatley (University of Warwick)

I will summarise the capabilities and achievements of the NGTS facility at the ESO paranal observatory and outline how members of the UK community can get involved.

(29) Dust formation in the outflows of catastrophically evaporating planets

Richard Booth (University of Leeds)

Disintegrating, ultrashort-period planets offer a window into the poorly understood interior composition of exoplanets through material evaporated from their rocky interiors that can be observed via transits of their dusty tails. We present results from radiation-hydrodynamic

simulations of the mass-loss from these planets. Dust forms readily in the winds, a consequence of large dust grains obtaining lower temperatures than the planet's surface. We also report that the coupling between the planet's surface temperature and the outflow properties via the dust's opacity can drive time-variable flows when dust condensation is sufficiently fast.

(62) Estimating the number of radial velocity measurements required to mass-characterise exoplanets

Ross Dobson (MSSL/UCL)

Mass characterisation of exoplanets from radial velocity (RV) measurements is difficult due to stellar activity and the high instrumental precisions required. We present a Python tool to estimate the data-points required to obtain a desired precision on the mass estimate. By simulating RV data-points, we fit Keplerian models with MCMC, and use Gaussian processes to characterise correlated noise such as stellar activity. Our tool can simulate multi-planetary systems with eccentric orbits, utilise existing RV data, and simulate multiple instruments. Ground-based RV facilities are oversubscribed, therefore better estimates of required observing time will aid in planning proposals and prioritising targets.

(16) The Next Generation Transit Survey quick-look pipeline

Samuel Gill (University of Warwick)

The Next Generation Transit Survey (NGTS) comprises 12 robotic 20-cm telescopes with red-sensitive cameras. Since 2017, NGTS has unveiled over 20 exoplanets and supported diverse research, including white dwarfs and stellar flares. With TESS's surge in exoplanet candidates, NGTS's precise photometry serves as a vital complement. To meet this demand, NGTS processes observations efficiently at Cerro Paranal, Chile. While not replacing the primary planet-finding pipeline, the quick-look pipeline aims to swiftly generate publication-ready light curves and assess transit signal confidence. This paper outlines NGTS's instrumental and computational resources, operational strategy amid TESS discoveries, and the quick-look pipeline's implementation.

(13) Exotic Planet Candidates from Planet Hunters NGTS

Sean O'Brien (Queen's University Belfast)

Planet Hunters NGTS enlists public volunteers to search for transits in data from the ground-based Next Generation Transit Survey (NGTS). Volunteers classify the shape of transit-like features in phase-folded lightcurves, then their assessments are combined through a weighting scheme to select candidates for further vetting. We will present the most interesting systems discovered by citizen scientists. If confirmed, these candidates would present challenges to planet formation theories with potential discoveries of a close-in giant planet orbiting a low-mass star and a close binary hosting a planet on an S-type orbit (where the

planet orbits one of the stars).

(53) Dust Entrainment in 2D Externally Photo-evaporated Disc Models

Sébastien Paine (Queen Mary University of London)

The environment in which circumstellar discs evolve plays a crucial in their evolution, and the formation of planets. An important, but under-studied aspect of this is what sizes of dust get entrained in the disc wind. This affects the amount and position of planet-forming solids, as well as shielding the disc from UV radiation. We have developed a particle solver to study 2D axisymmetric models, finding dust entrainment varies significantly depending on where from the disc surface dust is launched into the wind. This has implications for the structure of gas mass loss and observational characteristics of proplyds in IR.

(14) Investigating the existence of circumbinary planets around HW Virginis

Thomas Baycroft (University of Birmingham)

Circumbinary planets around post-common-envelope binaries are a debated topic, HW Virginis being a prime example. Eclipse timing variations have been used to claim planets orbiting HW Vir, but no solution so far is stable or can predict future eclipses. There has to be more to the story. I will present a re-analysis of the existing data along with new insight from Hipparcos-Gaia astrometry.

(52) Putting a TIaRA on SPOC: predicting long-period planet yields from TESS

Toby Rodel (Queen's University Belfast)

TESS is generally biased towards shorter period planets and many longer period planets are only seen as a single transit or "monotransit". We have developed the Transit Investigation and Recoverability Application (TIaRA) pipeline, a tool for making TESS sensitivity maps. We then combine these with occurrence rates derived from Kepler to estimate yields for TESS. We predict 2271+241-138 detectable planets from the Year 1 and 3 SPOC FFI lightcurves. By comparing our results to the TOI catalogue, we estimate (with a 3-sigma confidence level) that 75% of planets with periods over 25 days have yet to be discovered.

(57) Assessing the detectability of Earth-like atmospheres on terrestrial planets orbiting M-dwarf stars using High-Resolution Spectroscopy

Vanessa Emeka-Okafor (University of Warwick)

We showcase simulated observations focused on the detection of transiting terrestrial planets possessing Earth-like atmospheres within the habitable zone of an M5 and M7 host star. These simulations leverage the advanced capabilities of ESO's forthcoming Extremely Large

Telescope (ELT) operating at high resolution. Our investigation encompasses a comprehensive set of molecular opacities observable in the near-infrared. The simulated observations assume the use of a high-resolution spectrograph with a spectral resolution of R=100,000 and a simultaneous wavelength coverage spanning 0.96 to 2.4 microns. The methodology employed in our simulations aligns with already established high-resolution spectrographs such as SPIROU and GIANO. Under ideal observing conditions with the removal of spectral and telluric contaminants, our findings indicate that, on average, only a handful of transits are needed to detect the simultaneous molecular signatures of an Earth-like atmosphere around a transiting terrestrial planet orbiting an M5 and M7-dwarf star at 10 pc, respectively. Furthermore, our study extends the simulations to assess the potential detrimental effects of data analysis; in particular, Principal Component Analysis (PCA) which is fairly standard when using High-Resolution Cross Correlation Spectroscopy. When doing so, we find that PCA erodes the signal of cooler, slowly moving planets around M-dwarfs, thus requiring significantly more observing time to detect their atmospheric signatures.

(56) Impact of stellar activity contamination on Doppler spectroscopy of exoplanet atmospheres

Vatsal Panwar (University of Warwick)

Advancements in high-resolution cross-correlation spectroscopy have enabled high-precision characterization of exoplanet atmospheres. However, the effect of stellar contamination on such measurements is poorly understood and limited to the RM effect. Quantifying this effect is important, as measuring accurate atmospheric properties can reveal clues to the formation pathways of exoplanets. Stellar activity manifests from temporally varying photospheres and inhomogeneities, e.g. spots which contaminate the stellar spectra. Using a stellar grid with 1D stellar models, we simulate high-resolution observations of exoplanets orbiting active stars. We show the impact of stellar contamination on the cross-correlation signal of exoplanetary atmospheres and their inferred properties.

(10) Resolving star spots on WASP-85A using high-resolution transit spectroscopy

Vedad Kunovac (University of Warwick)

Stellar spots contribute to radial velocity "jitter," hindering Earth-like planet detection around Sun-like stars. Limited observational constraints exist due to unresolved spots in high-resolution spectra. Our study of active star WASP-85A mapped surface activity via transiting planet spot occultations, utilising six transits observed with ESPRESSO and HARPS-N spectrographs. Distinct spot occultations were detected over multiple transits, with the Rossiter-McLaughlin method revealing local line profiles and resolving individual spots. We quantify their properties and impact on the measured stellar obliquity. This research informs future investigations of exoplanetary systems around active stars, aiding Doppler searches for Earth-like planets.

(28) Atmospheres as a Window to Rocky Planet Surfaces

Xander Byrne (University of Cambridge)

On warm rocky planets, such as Venus, the high temperatures at the base of their atmospheres may enable thermochemical equilibrium between rock and gas. This links the composition of the surface to that of the observable atmosphere. Using an equilibrium chemistry code, we find a sharp boundary in pressure-temperature space separating simultaneously mineralogical regimes and atmospheric regimes, potentially enabling inference of surface mineralogy from spectroscopic observations of the atmosphere. Weak constraints on the surface pressure and temperature also emerge.

(61) Hotter and Brighter: A New Flared Model of White Dwarfs Accretion Discs

Yixuan Chen (Imperial College London)

Gaseous debris discs around white dwarfs (WDs) are important for understanding the final stages of the evolution of planetary systems. However, the widely used flat disc model does not consider the effects of gases on their structure and fails to predict the infrared excess of the brightest WD discs. To solve this problem, I introduced a flared disc model, which comprises an optically thin superheated surface layer and an optically thick interior. The spectral energy distributions from this flared disc model are in better agreement with the observational data, providing further insights into the characteristics of gaseous WD discs.

(48) Viewing the PLATO Field Through the Lenses of TESS

Yoshi Nike Emilia Eschen (University of Warwick)

PLATO will begin observing stars in the Southern Field (LOPS2) after launch in late 2026. By this time TESS will have observed the stars in LOPS2 for at least four years, with an average of 9.8 TESS sectors per star. We calculate the TESS photometric precision for each Target PLATO Input Catalogue star in LOPS2 field. We also identify known systems in the LOPS2 field, including 55 confirmed transiting planets, $\sim$300 TESS planet candidates and $\sim$1000 eclipsing binaries. We calculate the sensitivity of PLATO to discovering new transiting exoplanets in these known systems over grids of planetary orbital radius and period. Our work will help in understanding the discovery space open to PLATO well ahead of the start of the mission.

(31) Post-main sequence thermal evolution of planetesimals: Implications on white dwarf pollutants

Yuqi Li (University of Cambridge)

Our understandings of exoplanet interiors rely heavily on modelling. Fortunately, planetary materials in the atmospheres of white dwarfs probe the composition of planetary building blocks. A crucial question is whether the composition of accreted bodies is altered during

the system's giant branches. We model the irradiation-induced heating from main sequence to asymptotic giant branch of the host star and show that large scale melting is only possible in the smallest bodies (10 km) closest to the host star (1 AU). Therefore, observed massive core/mantle-rich white dwarf pollutants remain an indicator of core-mantle differentiation during planetary formation.

(58) A compact system of super-Earths and Neptunes orbiting an active F8 main sequence star

Zachary Ross (The Open University)

We apply the DMPP hypothesis that short period mass losing planets suppress chromospheric emission to an active star in the Hyades. The star exhibits chromospheric emission clearly below the overall cluster trend. We use multi-dimensional gaussian process regression with nested sampling to account for stellar activity contributions to the RVs. We find a compact system of super-Earths and Neptunes with between three and five planets. We also identify the third line moment as a better metric for the measurement of the CCF asymmetry than the traditionally used bisector inverse span.