| ID | Name | Affiliation | Poster Title | Abstract |
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| 1 | Roland Vanderspek | MIT | TESS Mission Operations. | We present an overview of the operation of the TESS Payload Operations Center at MIT. The flow and timing of operations, from target selection through contact monitoring and data processing, are described. The process of selecting targets from the various candidate target lists (exoplanet, GI, asteroseismology, DDT) is described in detail. |
| 2 | Joel Villasenor | MKI | Fireflies and Caterpillars: the Morphology and Statistics of Micrometeorite Events on TESS | Since the start of operations, full frame images have occasionally exhibited transient optical flashes best characterized as bright, trailing arcs that extend across one or more cameras. These are best observed by differencing consecutive full frames, where the stationary background is substantially reduced to reveal faint trails. These optical transients have since been called "fireflies," referring to the simultaneous appearance of dozens across the field of all camera frames, and in the next set completely disappearing. A few appear segmented, due to cosmic ray mitigation processing (CRM), and are called caterpillars. Here we present a model that lays the basis for these events – that micrometeorite impacts on the spacecraft give rise to spall and debris, which are illuminated by sunlight before being pushed away by solar pressure. The different types of arcs and blobs are explained by the origin and trajectory of the debris across the shaded and sunlit portions of the camera field of view. Numerical simulations and comparison with the fireflies provide estimates of the micrometeorite characteristics and impact location. Simulation of CRM processing also verifies the caterpillar structure, and provides visual time resolution to 20s. A summary of micrometeorite occurrences over the year will also be presented. |
| 3 | Joshua Pepper | Lehigh University | Top Targets Missed in the TESS Prime Mission | While TESS will observe about 85% of the sky during the prime mission, small areas are missed due to gaps between sectors, cameras, and CCDs. These areas include a small number of stars that would be valuable to probe for transits. While they represent a small fraction of all potential TESS targets, these stars could host exciting transiting planets. Here I present a provisional list of such stars and their collective properties. |
| 4 | Catherine Clark | Northern Arizona University, Lowell Observatory | Understanding the Multiplicity of TESS Exoplanet Host Candidates | A critical aspect of exoplanet detection is the characterization of the host star that the exoplanet orbits. This includes the multiplicity of the host star, as undetected multiplicity can bias stellar and planet parameters determined from transit detection alone. To address this frequent gap in our knowledge of exoplanet hosts, we will utilize speckle interferometry to directly image approximately 500 TESS exoplanet host candidates to determine their multiplicity. Previous investigations have shown that undetected multiplicity can cause the radius of a transiting exoplanet to be underestimated, moving what were thought to be Earth-sized exoplanets into the super-Earth regime. Since 40 to 50% of exoplanet host stars reside within multiple star systems, and given the degree to which initially undetected multiplicity has skewed Kepler results, high-resolution imaging of our nearby low-mass neighbors is necessary for both accurate characterization of transiting exoplanets, as well as a better understanding of stellar astrophysics. Our investigation will |

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| | | | | expand on the speckle observations taken as a part of the POKEMON speckle survey of nearby M-dwarfs to better constrain the multiplicity of low-mass TESS exoplanet host candidates, and to constrain M-dwarf multiplicity by subtype across the entire M-dwarf sequence. |
| 5 | Kim McLeod, Alex Granados, Nora Hoch, Fiona Powers Ozyurt, Hannah Stickler | Wellesley College | How Undergraduates At a Sea-Level, Light-Polluted Observatory in Eastern Massachusetts can Contribute to TESS Follow-Up | Wellesley College is a small liberal arts school for women located in Eastern Massachusetts. Built in 1900, Wellesley's Whitin Observatory is considered an unusually fine facility for undergraduate training in astronomy. This summer we commissioned Wellesley's new 0.7m telescope which we will use to follow up TESS candidates as part of the TESS Follow Up Program's SG1 team. Building upon our 7 years of experience observing transits for the KELT project, we describe the process by which a team of students (even ones in sea-level, light-polluted skies) can help to (i) identify and rule out TESS false positives, and (ii) provide improved, multiwavelength light curves for some candidates. |
| 6 | Dana Louie | University of Maryland | Multiband Photometry Simulations to Distinguish TESS-Discovered Transiting Exoplanets from Astrophysical False Positives | NASA's Transiting Exoplanet Survey Satellite (TESS) is currently conducting its 2-year science mission searching most of the sky for transiting exoplanets. Predictions show that TESS will discover thousands of new candidate exoplanets, but these exoplanets must be distinguished from astrophysical false positives—or validated—using other instruments or techniques. The Japanese-developed 3-band Multi-color Simultaneous Camera for Studying Atmospheres of Transiting Planets (MuSCAT), as well as the 4-band MuSCAT2, can be used to validate TESS discoveries. Our goal is to simulate MuSCAT/MuSCAT2 follow-up observations of TESS discoveries to reveal which planet candidates can be effectively validated using MuSCAT/MuSCAT2, and which must be validated using other techniques. This will allow the TESS Follow-Up Observing Program (TFOP) working group to better prioritize and optimize validations of TESS detections. We create two software tools to assist TFOP in planning MuSCAT follow-up observations: 1.) A code to produce simulated light curves of exoplanets and false positives observed using MuSCAT/MuSCAT2; 2.) A code that will read a list of parameters for several TESS objects of interest (TOIs), and output predictions for which TOIs can be effectively validated with MuSCAT/MuSCAT2. We model observations starting with a model stellar spectrum and ending with detection of electrons on the MuSCAT/MuSCAT2 CCD arrays. We scale the stellar flux to the star's apparent magnitude, model the effects of refraction and transmission through Earth's atmosphere, and include noise sources from the target star, sky background, scintillation, and CCD read noise. We model MuSCAT/MuSCAT2 instrument performance as reported by Narita et al. (2015, 2019). We demonstrate our tools by applying them to the Barclay et al. (2018) predicted TESS discoveries. |
| 7 | Norio Narita | Astrobiology Center | Development of MuSCAT3 and Future Contribution of the MuSCAT | In this poster, we introduce the latest status of development of MuSCAT3. MuSCAT3 will be a wide-field 4-color simultaneous camera, equips 3 PIXIS2048 back-illuminated CCD cameras and 1 SOPHIA2048 deep-depletion CCD camera manufactured by Teledyne Princeton Instruments. We plan to develop and install MuSCAT3 on a 1-2m class |

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| | | | Network to TESS Follow-Up | telescope in North America. Once the development is completed, MuSCAT3 will work in cooperation with existing MuSCAT on 1.88m telescope located in Okayama, Japan and MuSCAT2 on 1.52m telescope located in Tenerife, Canaries, Spain. The network of MuSCAT1/2/3 will have unique multi-color continuous-monitoring capability in the northern hemisphere, which will enable us unique TESS follow-up observations. |
| 8 | Duncan Wright | University of Southern Queensland | MINiature Exoplanet Radial Velocity Array (MINERVA) | Australis is a new telescope array and spectrograph at Mt Kent observatory in Australia. It is run by a consortium of US, Chinese and Australian universities and has been operational since 10th November last year. It is made up of five 0.7m CDK 700 telescopes from Planewave (four currently installed) and a high-resolution (R>80000) spectrograph from KiwiSpec covering 480 - 630nm. Here I present a technical overview of the instrumentation and operations as well as the detailed setup, installation, performance and analysis of the new MINERVA Australis system and show our benchmarking and early science results. |
| 9 | William Waalkes | University of Colorado, Boulder | Ground-Based Photometry of TESS Candidates Orbiting M dwarfs | In the 12 months since TESS launched, 76 planet candidates orbiting M dwarfs have been identified. Of these, 4 were already known planets, 10 were false positives, 30 have been validated to varying degrees, and 32 are still in the vetting process. We present light curves of several of these TESS planets taken with 1-m telescopes of the Las Cumbres Observatory (LCO). We find that for objects with TESS magnitudes > 10, LCO outperforms TESS for single transit detections. This magnitude range includes virtually all M dwarfs smaller than 0.25 Solar radii around which TESS is likely to find planets. We also compare these planets to previous simulations of the expected TESS yield and analyze their viability for atmospheric characterization with JWST. |
| 10 | Petr Kabath | AI ASCR | Detection Limits for Characterization of Exoplanetary Environments with 2-m Class Telescopes | TESS is discovering new exoplanets orbiting bright stars, well-suited for ground-based follow-up. The limited observing time at 4-8m class telescopes prompted us to investigate if 2m telescopes with modern instruments can help to characterize the atmospheres of these exoplanet. We discuss the feasibility of this idea and show results from the OES echelle spectrograph at the Perek 2-m telescope (Czech Republic). We also describe a new instrument project - PLATOSpec - for follow up of the TESS and PLATO planetary candidates. This is a R~70,000 optical echelle spectrograph for the ESO 1.5m telescope at La Silla observatory, Chile. |
| 11 | Akihiko Fukui | University of Tokyo | Status and Operation of Multi-Band Imagers for Transiting Exoplanets MuSCAT1 and 2 | MuSCAT and MuSCAT2 are optical three- (g-, r-, and $z_s-$) and four- (g-, r-, i-, and $z_s-$) band simultaneous imagers, respectively, developed with the aim of observing transiting exoplanets. MuSCAT was developed for the NAOJ 188cm telescope in Okayama, Japan, in 2104 and MuSCAT2 was developed for the TCS 1.52m telescope at Teide observatory in Spain in 2017. One of the main purposes of these instruments is to validate and characterize the planetary candidates discovered by TESS. In this contribution, we will introduce the features, performance, and operational status of these instruments including recent upgrades of the CCD chips for z-band. We will also show some scientific results on follow-up observations of several K2 planetary candidates, |

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| | | | | demonstrating the capabilities of MuSCATs for the upcoming TESS candidates in the northern sky. |
| 12 | John Kielkopf | University of Louisville | New Stellar Science in Ground-Based Follow-Up of TESS Data | We describe ground-based observations of transiting planets, eclipsing binaries, and other stellar variability identified by the TESS follow-up observing program and in our analysis of TESS full frame images. With 0.5 to 0.7 meter telescopes in Kentucky, Arizona, and Queensland, Australia, we acquire high precision photometric data and spectra that confirm exoplanet candidates, and also yield an improved understanding of stellar limb darkening, surface temperatures, granulation, spots, and flares. Recently acquired examples illustrate the rich variety of temporal stellar variation in the TESS full frame images to be explored with subsequent multi-band photometry and spectroscopy for new science. |
| 13 | Louise D. Nielsen | Observatory of Geneva | Radial Velocity Follow-Up with CORALIE on the Swiss 1.2m Euler Telescope | Since the release of the first TESS sectors, the the high resolution spectragraph CORALIE on the Swiss 1.2 Euler telescope has observed more than 70 Tess Targets of Interest. The main science cases are long- and ultra-short-period giant planets, brown dwarfs and the transition between ice- and gas-gaints. Further more, 22 candidates falling under the NASA level-1 requirement for TESS mission has been vetted, mostly in collaboration with teams working with HARPS and ESPRESSO. To this date CORALIE data has contributed to the mass determination of 7 TESS planets. I wish to present an overview of the follow-up efforts done with CORALIE in the first 9 month of the TESS mission, including our first confirmed planets; TOI-120, 129 and 169. |
| 14 | Samuel N Quinn | Center for Astrophysics \| Harvard & Smithsonian | The TESS Follow-up Observing Program Spectroscopic Effort | Over the course of its two-year primary mission, TESS will survey most of the sky in search of small planets transiting the nearest stars, the brightness of which enables studies of planetary compositions and atmospheric properties. The efficient deployment of ground-based observing facilities in pursuit of such characterization, however, requires a community effort to vet planet candidates and coordinate resources. The TESS Follow-up Observing Program (TFOP) is a mission-organized, community-driven working group, the primary goal of which is to deliver such coordination. We describe the organization of TFOP spectroscopic resources and highlight opportunities for TFOP involvement among the community. |
| 15 | Markus Rabus | Las Cumbres Observatory | LCO NRES: Operations and Initial Results | Recently, the Network of Robotic Echelle Spectrographs (NRES) has started its operation. NRES is part of the Las Cumbres Observatory (LCO), using its 1m-telescope network. NRES has been completely integrated into the LCO ecosystem, which also includes scheduling, data analysis and archiving. The network character allows us to overcome problems of classical observations introduced by block scheduling and day/night cycles. NRES comprises four uniformly build spectrographs with two latitude distributed units per Hemisphere. Therefore, NRES allows observing the celestial sphere for almost 24 hours. The echelle spectrographs have a resolution of R~53,000 covering 380 to 860 nm and each spectrograph is fed by three fibers, each 2.58 arcsec on the sky. Two are connected to each of the two telescopes on site and one is connected to a ThAr lamp. By observing simultaneously the ThAr calibration we are measuring wavelength drifts during the night, which allows us |

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| | | | | to precisely measure the stellar radial velocity (RV) over time. Following LCO's photometric network, NRES will add another workhorse facility to the LCO TESS follow-up effort. We will present the LCO infrastructure and initial results from NRES. |
| 16 | David Armstrong | University of Warwick | Populations of Planet Masses: TESS and the NCORES Program | Giant planets are thought to form via core-accretion, whereby cores form early on in the protoplanetary disk, and then at a critical point attract gas from the disk to build up an atmosphere. The precise composition of a planet's core, particularly the ice-mass fraction, tells us about the formation process and where in the protoplanetary disk the planet formed. In most cases the gaseous envelope hides this core, meaning we cannot determine its composition. However in situations where the planet is exposed to intense radiation, that gaseous envelope may be lost, providing us with a unique opportunity. I will introduce the NCORES program, a HARPS campaign to characterise TESS-discovered planets orbiting close in to their host stars where photoevaporation can play a role. To date NCORES has led or contributed to the mass-determination of 9 TESS planets smaller than $4R_e$, with the majority of the program yet to come. NCORES aims to produce a well-characterised sample of bright TESS planets to enable the study of close-in planets and cores on an individual and population level. I will discuss some early results from the program, including TOI-431, a two-planet system with a USP super-Earth and companion Neptune-mass planet representing an ideal target for atmospheric characterisation. Finally I will describe a new gap emerging in the planetary mass distribution, possibly caused by tidal interactions with the host star. Understanding this signature in detail will require the potentially homogeneous sample of transiting planets with measured masses that TESS can provide. |
| 17 | Francois Bouchy | Geneva Observatory | NIRPS will Join HARPS for the follow-up of M-dwarf Transiting Planets Revealed by TESS | TESS successfully reveals a growing list of new planetary candidates transiting M dwarfs. The brightest M dwarfs are intensively observed with HARPS but a large fraction will require spectroscopic observations in the near-infrared. The Near-InfraRed Planet Searcher (NIRPS) is a new ultra-stable infrared (YJH) spectrograph that will be installed on ESO 3.6-m telescope in La Silla, Chile. Aiming to achieve a precision of 1 m $s^{-1}$, NIRPS is designed to find and to characterize rocky planets orbiting M dwarfs, and will operate together with the High Accuracy Radial velocity Planet Searcher (HARPS). We will present the status of the instrument and its expected performances for the mass measurement of TESS candidates transiting M dwarfs. |
| 18 | Brett Addison | University of Southern Queensland | Measuring the Masses and Orbital Obliquities of Sub-Jovians, Warm Jupiters, and Multi-Planet Systems Discovered by TESS Using the MINERVA- | The recently commissioned MINERVA-Australis telescope array is a facility dedicated to the follow-up, confirmation, characterization, and mass measurement of planets discovered by TESS orbiting bright stars (V<10). The facility is located at the University of Southern Queensland's Mount Kent Observatory in Australia. Its flexible design enables multiple 0.7m robotic telescopes to be used both in combination, and independently, for high-resolution spectroscopy and precision photometry of TESS transiting planet candidates. MINERVA-Australis is already delivering a radial velocity precision of 3 m $s^{-1}$ and continued improvements to the spectrograph's |

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| | | | Australis Telescope Array | thermal stability are expected to result in a precision of 1 m s $^{-1}$ in the near future. It is expected that TESS will discover a large number of planet candidates orbiting bright stars in the coming years, and dedicated facilities such Minerva-Australis are urgently needed to confirm the candidates and characterize them. The predecessor to the TESS mission, Kepler, discovered thousands of exoplanets, the majority of which were between the size of Earth and Neptune ("super-Earth" or "mini-Neptunes"). Unfortunately, the great majority of stars targeted by Kepler were too faint for detailed follow-up work to be performed by all but the world's largest telescopes. In this sense, TESS is a game changer. It is expected to discover a plethora of Neptune and super-Earth candidates orbiting bright stars that are suitable for high-precision radial velocity follow-up on dedicated facilities such as with MINERVA-Australis. I will discuss the current efforts being made by the MINERVA-Australis consortium to follow-up the planet candidates discovered by TESS to confirm their planetary nature, and to measure their masses and orbital properties. The mass measurements we obtain, when combined with the planetary radii given by the TESS transit observations, will allow us to determine the bulk compositions of those objects and to distinguish them as either rocky, watery, or gaseous worlds. In addition to confirming and measuring the masses of TESS planet candidates, I will also discuss our efforts to probe the processes involved in planet formation and migration. Using MINERVA-Australis, we are measuring the sky-projected spin-orbit angles (i.e., the angle, $\lambda$, between the spin angular momentum vector of a host star and the orbital angular momentum vector of its planet) of exoplanets by observing the Rossiter-McLaughlin effect. Of particular importance are spin-orbit measurements of the least explored parameter space such as sub-Jovian planets, warm Jupiters and long-period planets, and multi-planet systems. These measurements are critical in determining the dominant mechanisms responsible for planet migration, whether it is disk-driven migration, or dynamical-migration mechanisms (e.g., planet-planet scattering, Lidov-Kozai cycling with tidal friction, and secular chaos). |
| 19 | Enric Palle | Instituto de Astrofisica de Canarias | MuSCAT2 Multi-Color Validation of TESS Candidates: I. An Ultra-Short-Period Substellar Object sAround an M dwarf | We report the discovery of TOI-263.01 (TIC~120916706), a transiting substellar object (R = 0.78 $R_j$) orbiting a faint M dwarf ($V = 18.97$) on a 0.56~d orbit. The host star is faint, which makes RV confirmation impractical, but the large planet-star radius ratio makes the candidate suitable for validation through multi-color photometry. We observed three transits simultaneously in r, i, and z using the MuSCAT2 multi-color imager, and we obtained a low-resolution spectrum for stellar characterisation with the ALFOSC spectrograph. We model the light curves with pytransit using a transit model that includes a physics-based light contamination component that allows us to estimate the contamination from unresolved sources from the multi-color photometry. This enables us to derive the true planet-star radius ratio marginalized over possible contamination, and, combined with the stellar radius, gives us a reliable estimate of the object's absolute radius. The MuSCAT2 photometry strongly excludes contamination from unresolved sources with a significant color difference to TOI-263. Further, |

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| | | | | contamination from sources with the same color as the host is constrained to levels where the star-planet radius ratio has a median of 0.194, and is no larger than 0.26. This confirms the substellar nature of this planet candidate. Thus the object is either a giant planet or a brown dwarf located deep inside the so-called "brown dwarf desert". Both possibilities offer a challenge to current planet/BD formation models and makes TOI-263.01 an object deserving in-depth followup studies. |
| 20 | Jan Subjak | Charles University and Czech Academy of Sciences, Czech Republic | OES Spectrograph, Ground Based Support of Space Missions | OES is an echelle spectrograph installed at Perek 2-m telescope operated by Czech Academy of Sciences, Czech Republic. We restarted the operations with OES and use it mainly for ground based follow-up of exoplanetary candidates and we collaborate in a join effort with Tautenburg observatory, Germany. In this particular contribution, we will present our first results from radial velocity follow-up of Kepler/K2 and TESS targets. We will present OES as an invaluable instrument mainly for characterization of hot-Jupiters, Brown Dwarfs and interesting stellar objects. |
| 21 | Carl Ziegler | University of Toronto | Sculpting of TESS Planetary Systems by Binary Stars | The large field-of-view of TESS necessitated relatively low spatial resolution, thus multiple stars contribute to almost every TESS light curve. High-angular resolution imaging can detect the previously unknown companions to planetary candidate hosts that dilute the transit depths, and in some cases are the source of false positive transit signals. We use speckle imaging on SOAR to search for nearby companions to over 500 TESS planet candidates in the Southern sky, finding approximately 1 in 5 planets is smaller than estimated based on the TESS transit observations. We find a deep deficit of planet candidates in close binary systems, with separations less than 100 AU, compared to the expected binary rates of field stars. The magnitude of the binary suppression as well as the orbital separation at which it begins are in agreement with that found in the comparatively homogeneous Kepler host star population. We also find a large surplus of TESS planet candidates in wide binary systems. These systems are almost exclusively giant planets, however, suggesting orbital migration, caused by perturbations from the stellar companion, may lead to planet-planet scattering and reduce the occurrence of small planets in wide binary systems. |
| 22 | Valeriy Vasilyev | Max Planck Institute for Solar System Research | Multi-Color Photometry for Exoplanet Transits | The Kepler Mission discovered thousands of exoplanet candidates and hundreds of multi-transiting systems, enabling detailed population studies. We present a framework for forward modeling populations of exoplanetary systems by proposing several statistical models for the underlying system architectures, modeling the Kepler detection pipeline to derive simulated observed catalogs of exoplanetary systems, and comparing our simulations to the properties of planets in the Kepler DR25 catalog. We show that models assuming independent periods and sizes cannot adequately reproduce the observed population. In contrast, a clustered model for planet periods and sizes provides a significantly improved description of the Kepler multi-planet systems, especially in modeling the observed multiplicity, period ratio, and radius ratio distributions. We train a Gaussian Process emulator in order to explore the parameter space, efficiently quantifying the best-fit model parameters and their uncertainties. Our results are consistent with previous studies finding that the |

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| | | | | observed multiplicity distribution implies two populations of planetary systems, a low mutual inclination (a few degrees) population with low eccentricities (~0.01) and a high mutual inclination population forming the remaining ~40% of planetary systems. Our model makes predictions for the properties of the non-transiting observations that can be tested by future radial velocity follow-up campaigns. We provide publicly available code for simulating planetary systems from our models, and discuss how these results may be used to inform RV follow-up observations of new TESS discoveries. |
| 23 | Matthias Yang He | The Pennsylvania State University | Characterizing the Architectures of the Kepler Exoplanetary Systems: a Forward Model with Clustered Periods and Sizes | The Kepler Mission discovered thousands of exoplanet candidates and hundreds of multi-transiting systems, enabling detailed population studies. We present a framework for forward modeling populations of exoplanetary systems by proposing several statistical models for the underlying system architectures, modeling the Kepler detection pipeline to derive simulated observed catalogs of exoplanetary systems, and comparing our simulations to the properties of planets in the Kepler DR25 catalog. We show that models assuming independent periods and sizes cannot adequately reproduce the observed population. In contrast, a clustered model for planet periods and sizes provides a significantly improved description of the Kepler multi-planet systems, especially in modeling the observed multiplicity, period ratio, and radius ratio distributions. We train a Gaussian Process emulator in order to explore the parameter space, efficiently quantifying the best-fit model parameters and their uncertainties. Our results are consistent with previous studies finding that the observed multiplicity distribution implies two populations of planetary systems, a low mutual inclination (a few degrees) population with low eccentricities (~0.01) and a high mutual inclination population forming the remaining ~40% of planetary systems. Our model makes predictions for the properties of the non-transiting observations that can be tested by future radial velocity follow-up campaigns. We provide publicly available code for simulating planetary systems from our models, and discuss how these results may be used to inform RV follow-up observations of new TESS discoveries. |
| 24 | Brianna Zawadzki | Penn State University | Formation of Habitable Zone Planets Around Low-Mass Stars | NASA's TESS mission is expected to find thousands of exoplanets around low-mass stars. Using N-body simulations of planetary embryos around a 0.2 solar mass star, we investigate planets that form within the habitable zone (HZ) of these stars and the process by which they form. We find that planets form rapidly, with most collisions occurring within the first 1 Myr. The presence of a gas disk accelerates the planet formation process and reduces the final number of planets. Because planet formation occurs significantly faster than the disk lifetime, super-Earths in or near the habitable zone of low-mass stars must have extended gaseous envelopes unless these envelopes are later removed by a secondary process like photo-evaporation. In addition, we find that the final distribution of planets does not retain a memory of the slope of the initial surface density profile regardless of whether or not a gas disk is present. Thus, attempts to reverse-engineer the distribution of solids from present-day observations may not provide sufficient information to infer the initial distribution of solids. |

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| 25 | Francisco J. Pozuelos | University of Liege | What can Dynamical Analyses tell us About Multi-Planetary Systems? | Multiplanetary systems are very often some of the most interesting laboratories to test planetary formation theories. In this study we introduce the MEGNO (Mean Exponential Growth factor of Nearby Orbits) parameter and its different applications to test the stability of multiplanetary systems. In addition, this parameter might be used to predict the location of main belt analogues, which are particularly interesting for transiting planetary systems since the finger prints of these disks may be hidden in TESS-like data. In this poster we present some of the results obtained so far using this technique. |
| 26 | Jonathan Brande | NASA GSFC/University of Maryland | The First Year of TESS Dynamics | The Transiting Exoplanet Survey Satellite (TESS) is projected to discover thousands of new transiting exoplanets around a range of stars. Although transit surveys are extremely powerful tools for characterizing certain planetary and orbital parameters (e.g. planet-to-star radius ratio, orbital period, inclination), the transit method is not inherently sensitive to planet mass. Planet mass-radius models can be used to estimate planet masses given certain assumptions about planetary composition, and radial velocity measurements can be made to directly measure planet masses. However, transit data from TESS may also provide the ability to constrain planetary masses given the presence of transit timing variations (TTVs). Hadden et al. (2018) discussed the prospects for TTV detection from TESS before launch. Now that TESS data is being collected en masse, we can revisit predicted yields. We take the detected multi-planet systems and measure their transit times, identifying cases whether there are deviations from linear ephemerides. Furthermore, we make revised predictions about which candidates could have the best prospects for detecting timing variations from TESS extended mission data. |
| 27 | Courtney Dressing | University of California, Berkeley | Characterizing Planetary Systems Orbiting TESS Cool Dwarfs | By observing nearly the entire sky, TESS provides an opportunity to dramatically improve the census of transiting planets orbiting nearby stars. Building on our previous work studying planets orbiting cool dwarfs observed by Kepler and K2, we are using TESS to conduct a detailed survey of how the properties and prevalence of planetary systems vary across the M dwarf spectral range. We will present results from the first year of our project including adaptive optics imaging to investigate the multiplicity of candidate planet host stars, spectroscopic follow-up observations to determine stellar metallicities, and radial velocity observations to identify astrophysical false positives and place constraints on the masses of TESS Objects of Interest. We will also discuss our TOI vetting framework and the tools our team is developing to distinguish false positives from bona fide transiting planets. |
| 28 | Wei Wang | National Astronomical Observatories | Space mission dedicated for the characterization of habitable rocky planets | A new era is foreseen to arrive around 2030 with a pool of exoplanets amounting to around ten thousand, including mainly small to medium-sized planets, and a small number of habitable terrestrial rocky planets, thanks to the space-borne transits surveys by the Kepler, TESS and PLATO missions, and ground-based transit and radial-velocity (RV) surveys. However, the exoplanet community is actually not fully prepared yet for detailed characterization of those terrestrial planets, especially those with wide orbits that may be |

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| | | | | habitable for life. The currently proposed mission like ARIEL is a first step to this purpose, however its 1m aperture only allows rough characterizations of warm super-Earths. Therefore, we propose to build a space-borne 4-m class telescope that dedicated for the characterization of habitable rocky planets, that shall start its operation within the next 10-15 years and last for 5 years or longer. We are looking for international collaborations from various institutes and research groups to join this ambitious effort in the aspects of science, instrumentation, platform, funding resources. |
| 29 | Kristine Wai Fun Lam | Technical University Berlin | A Pair of Mini-Neptunes Around an M dwarf in a Near 3:2 Mean Motion Resonance: TTV Measurements from K2 and Prospects in TESS | In multi-planet systems, planets orbiting close to the mean motion resonances (MMR) are subjected to strong gravitational interaction which causes large perturbations in each of their orbits. This effect leads to periodic variations in their transits which can be measured by means of transit timing variations (TTVs). Transit timing analysis can help validate multi-planets systems, and put constraints on the star-planet mass ratio which are otherwise unreachable with radial velocity follow-up. This is particularly the case for faint M-dwarf host stars. The number of multi-planet systems validated around M-dwarfs remains low. Studying these systems will allow us to peer into how the planetary systems was formed at very short orbital periods and around a very low mass star. Here, we present the discovery of a short-period mini-Neptune pair around a faint M-dwarf which have periods close to a 3:2 MMR (Lam et al. 2019, in prep). Using multi-campaign observations in K2, we measured the TTVs of both the inner and outer planets to find strong, sinusoidal and anti-correlated TTVs with amplitudes on the order of hours. We modelled the TTVs to predict the transit times and measured the mass ratios of both planets. We find that the inner planet has a radius and mass of $\backsim 2.2R_{earth}$ and $\backsim 5.6M_{earth}$, and the outer planet has a radius and mass of $\backsim 3.2M_{earth}$. We investigate the system architecture and stability, and discuss the possible formation paths of the system. Planets orbit close to a first order MMR can induce strong TTVs (as well as TDVs). Secular perturbation of their orbital planes can cause a change in a planet's inclination. The torque from planets can drive adjacent planets to orbit in our line-of-sight, hence previously non-transiting planet could be detected from photometry. Our analysis of the multi-planet system shows that planets exhibiting strong TTVs can benefit from longer time baseline observations. TTV systems that have been/will be detected in the TESS mission, particularly targets that are close to the ecliptic poles, would be of interest for detailed dynamical analysis and provide insights to the formation and evolution history of planetary systems. |
| 30 | Lisa Kaltenegger | Carl Sagan institute Cornell | TESS HABITABLE ZONE STAR CATALOG - and What we Found so Far | The Transiting Exoplanet Survey Satellite (TESS) Habitable Zone Stars Catalog, identifies a list of 1822 nearby stars with a TESS magnitude brighter than T=12 and reliable distances from Gaia DR2, around which the NASA's TESS mission can detect transiting planets, which receive Earth-like irradiation. For all those stars TESS is sensitive down to 2 Earth radii transiting planets during one transit. For 408 stars TESS can detect such planets down to 1 Earth size during one transit. For 1690 stars, TESS has the sensitivity to detect planets down to 1.6 times Earth-size, a commonly used limit for |

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| | | | | rocky planets in the literature, receiving Earth-analog irradiation. For a subset of 227 stars for which TESS can probe the full extent of the Habitable Zone, the full region around a star out to about a Mars-equivalent orbit. Observing the TESS Habitable Zone Catalog Stars will also give us deeper insight into the occurrence rate of planets, out to Earth-analog irradiation as well as in the Habitable Zone, especially around cool stars. We present the stars as well as TOIs detected for this special TESS star sample. |
| 31 | Jorge Lillo-Box | European Southern Observatory (ESO) | Exoplanet Archeology with TESS (and Kepler) | Theoretical works on planetary system formation and early evolution predict the existence of co-orbital planets (two planets sharing the same orbital period) with occurrence rates up to 30% in multi-planetary systems. Trapped either in the gravitational potential of more massive planets or in 1:1 mean motion resonances, these bodies keep the dynamical and chemical properties of the formation of the planetary system and are thus fossils of these processes. Looking for these exotic configurations represents a new viewpoint to study planet formation and migration mechanisms. The TROY project (Lillo-Box et al., 2018) is a multi-technique effort in the hunt for these celestial fossils. In this talk I will show the latest results of the project regarding the valuable data provided by TESS and by our own new, dedicated, re-analysis of the Kepler data. In particular, I will present the results presented in Leleu et al. (2019) on the analysis of similar-period planet candidates detected by both TESS and Kepler, with a special focus on the co-orbital candidate TOI-178. Three planets were detected in this system, with the external two components practically sharing the same orbital period. I will also show the latest results on other TESS candidates and the Bayesian analysis of the full set of Kepler light curves in a dedicated search for these bodies accounting for different co-orbital configurations. The results of this analysis provides, for the first time, statistically significant and observational measurements of the occurrence rate of co-orbital planets. |
| 32 | Michael B Lund | Caltech/IPAC-NExScI | Characterizing The Impact of Undetected Stellar Companions on Derived Planetary Radii | The calculation of the radii of TESS Objects of Interest (TOI) includes within it an assumption that the planet is passing in front of a single star. The presence of a second star, however, can create a systematic error in the derivation of the planetary radii. This bias can moderately reduce the calculated planet size if the planet orbits the primary star and can significantly reduce the calculated radius if the planet orbits the fainter secondary star. Radial velocity follow-up can identify cases of a second star on short orbits, and high-resolution imaging can do the same for stars with sufficient angular separations. Between these two regimes, however, there is likely a population of stellar companions that cannot be detected. These undetected stellar companions can create an apparent population of TOIs that are presumed to be roughly earth-sized but are actually larger. We explore the fraction of stellar companions that can be identified with high resolution imaging and how the remainder of undetected companions affect the derivation of the planetary properties including radius, density, and surface gravity. |
| 33 | Sebastian Zieba | Institute for Astro- and Particle Physics, | Transiting Exocomets Detected in | We search for signs of falling evaporating bodies (FEBs, also known as exocomets) in photometric time series obtained for Beta Pictoris after fitting and removing its delta Scuti-type |

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| | | University of Innsbruck, Austria | Broadband Light by TESS in the Beta Pictoris System | pulsation frequencies. Using photometric data obtained by the TESS satellite we determined the pulsational properties of the exoplanet host star Beta Pictoris through frequency analysis. We then pre-whitened the 54 identified delta Scuti p-modes and investigated the residual photometric time series for the presence of FEBs. We identify three distinct dipping events in the light curve of Beta Pictoris over a 105-day period. These dips have depths from 0.5 to 2 millimagnitudes and durations of up to 2 days for the largest dip. These dips are asymmetric in nature and are consistent with a model of an evaporating comet with an extended tail crossing the disc of the star. We present the first broadband detections of exocomets crossing the disc of Beta Pictoris, complementing the predictions made 20 years earlier by Lecavelier Des Etangs et al. (1999, A&A, 343, 916). No periodic transits are seen in this time series. These observations confirm the spectroscopic detection of exocomets in calcium H and K lines that have been seen in high resolution spectroscopy. |
| 34 | Lisa Kaltenegger | Carl Sagan institute Cornell | On the Habitability of the Planets in the GJ 357 System | "To date more than 4,000 exoplanets have been discovered, providing a first glimpse of the diversity of other worlds. Several of these planets receive irradiation from their host star that is similar to Earth, which could provide liquid water and habitable surface environments for rocky planets or moons. The first TESS planets already show a diversity of planets orbiting cool stars. In addition the first companion planets to TESS planets discovered with follow-up observations expand our picture of planetary systems around cool stars beyond the TESS observing time. Most exoplanets with small minimum masses orbit in the HZ of dim M dwarfs. Thus the brightness of GJ 357 makes this system a very interesting target for observations and atmospheric characterization of the planets' atmospheres. For transiting terrestrial planets around the closest stars, the James Web Space Telescope scheduled for launch in 2021, as well as upcoming ground-based telescopes, might be able to detect biosignatures in a rocky planet's atmosphere for planets around the closest stars. The ELTs, will focus on observations in the visible, but also have capabilities in the NIR to IR like the METIS instrument at the ELT. Observations can also characterize planetary atmospheres if the planet does not transit their host star due to the known orbital movement and resulting radial velocity shift. Several space mission concepts to characterize Earth-like planets are currently being designed e.g. by NASA's science and technology definition teams, but no new concept has been selected yet. Different concepts like stars-shades and coronagraphs are designed to take spectra of extrasolar planets with the ultimate goal of remotely detecting atmospheric signatures to characterize nearby Super-Earths and Earth-like planets, enable comparative planetology beyond our Solar System and search for signs of life on other worlds." |
| 35 | Elisabeth R. Adams | Planetary Science Institute | Ultra-Hot Jupiters in TESS | Ultra-short-period planets, with periods of less than two days, are skirting right on the edge of destruction. For ultra-hot Jupiters (UHJs), the strongest challenge comes from tides: the closer these massive planets get to their stars, the faster the rate of orbital decay, and the eventual fate of some is to spiral into their stars. Tentative evidence for tidal disruption comes from the distribution of short-period orbits and the |

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| | | | | metallicities of stars hosting what may be the remnants of tidally disrupted gas giants. However, more direct evidence comes from long-baseline observations of short-period planets that may be undergoing orbital decay. Such is thought to be the fate of WASP-12 b (P=1.09 d), whose orbital period seems to be decreasing (Patra et al., 2017). Not surprisingly, planets that may be inspiralling are intrinsically rare, and there are also not many ultra-hot Jupiters known around bright stars that are easy to monitor from the ground over the decade+ that is required to determine the rate of orbital decay. TESS will provide dozens of candidates ultra-hot Jupiters, many bright, that will be good candidates for observing tidal effects. Unfortunately, giant planets also tend to come with many false positives. We demonstrate a heuristic method based solely on TESS photometry that can significantly improve planetary recovery for these massive, tidally-challenged planets, and demonstrate using WASP-18 b, (P = 0.94 d), showing how modeling the out-of-transit phase curve variability can be used to efficiently separate eclipsing binaries from ultra-hot Jupiters. |
| 36 | Jiayin Dong | Penn State | Characterization of Warm Large Exoplanets (WaLEs) Discovered by TESS | Warm Large Exoplanets (WaLEs), planets larger than 6 Earth radii with 10-100 day orbital periods, are a key missing piece in our understanding of how planetary systems form and evolve. Several origins channels have been proposed for WaLEs (e.g., in-situ, disk-driven migration, high-eccentricity migration) and each channel leads to different expectations for WaLEs' masses, eccentricities, host star obliquities, etc.. A larger sample size of WaLEs with the characterization of these parameters is required to distinguish the origins channels. The TESS mission enables the discovery of hundreds of WaLEs. As the first step of distinguishing origins channels, I will present some recent discoveries of WaLE candidates from TESS and the characterization of WaLEs' radii and eccentricities from their transit light curves. |
| 37 | Myeong-Gu Park | Kyungpook National University, Korea | Survey of Giants with Exoplanets | We, K-EXO, have searched for giants with exoplanets since 2003. Almost 700 targets, mostly late-type giants, have been observed with Bohyunsan Observatory Echelle Spectrograph (BOES) at the 1.8 m telescope of Bohyunsan Optical Astronomy Observatory (BOAO) in Korea. We have so far discovered 35 exoplanet systems, some of which are one of the largest stars with an exoplanet. The most recent target we have observed and analyzed is HD 81817, which is known as a hybrid star. We show that HD 81817 is not accompanied by a white dwarf, but by a substellar companion of $27.6 M_{Jup}$. |
| 38 | Songhu Wang | Yale | Spectroscopic Confirmation of TESS-detected Hot Jupiter Candidates Orbiting Very Bright Stars | In this talk, I will discuss the RV efforts we made with CHIRON for TESS Alerts. We aim to provide a brightest ever sample of hot Jupiters for future studies. As a specific and compelling case in point, we report the first confirmation of a hot Jupiter discovered by TESS: HD202772A b. The presence of light contamination from the bright stellar companion makes the confirmation of planetary nature technically hard. The talk will focus on the follow-up efforts made by TFOP collaboration that entirely rules out the false positives. HD 202772A b is one of few known transiting hot Jupiters orbiting bright, quickly evolved stars. It is also one of the best targets for the atmosphere and obliquity study. |
| 39 | Rafael Brahm | Pontificia | Warm Jupiters in | The existence of a significant population of giant planets |

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| | | Universidad Catolica de Chile | the TESS Era: The Chile-MPIA Collaboration. | orbiting at close separations from their parent stars (<1AU) presents a challenge for the standard picture of how planets form in the core accretion scenario. While "In Situ" formation is still a valid mechanism under particular assumptions for the proto-planetary disc, the most accepted theories for generating close-in giant planets consider their formation beyond the ice-line, and a subsequent inward migration. This migration can be produced either by exchange of angular momentum with the proto-planetary disc or via gravitational interactions with other objects in the system. There are several testable predictions for the physical and orbital properties that these objects should have under each of the proposed mechanisms of formation. Transiting giant planets orbiting bright stars are particularly useful in this regard due to the possibility of inferring the internal composition of the planets and of determining the miss-alignment angle between the orbit an the spin of the star. However, the vast majority of well characterised transiting giant planets have extremely small semi-major axis and short periods (<10d), and therefore their current structure and orbital configuration could have been significantly affected by tidal interactions with the host star erasing the tracers of their formation path. Transiting warm jupiters on the other hand, have orbital periods longer than 10d and are key objects for testing formation/migration scenarios. While the number of well characterized transiting warm Jupiters has started to increase in the last few years, it is still below 40 systems. While not being its primary scientific goal, the TESS mission is expected to discover of the order of 500 warm (P>10d) giant ($R_p$>0.4$R_j$) planets orbiting moderately bright stars (V<13). This number could even double if single transiters are considered. In this way, the combination precise photometry, quasi uninterrupted observations, and an all sky monitoring of the TESS mission has the potential of increasing the number of well characterized transiting warm jupiters by at least one order of magnitude. In this context, as part of TFOP, we are running a project between researchers from different Chilean institutions and the MPIA from Germany with the goal of systematically characterizing the warm Jupiter systems that TESS is currently discovering. The final goal of this collaboration is to measure the mass, radius and orbital parameters of these systems with a precision of 20% or better in order to build a statistically significant sample for comparing its properties to those predicted by different formation/migration mechanisms. In this talk I will briefly describe the status of our collaboration, including our independent search of transiting systems in the FFIs (from our own extraction pipeline - TESSERACT -), the ground-based photometric (CHAT, LCOGT, AstraLux) and spectroscopic (FIDEOS, CORALIE, CHIRON, FEROS, HARPS, PFS) facilities that we use, and the analysis tools that we have developed to fully characterize these systems (CERES, ZASPE, juliet). I will also describe the properties of our first discoveries (TOI-120, TOI-201, TOI-481, and several other non-TOI systems). |
| 40 | John Ahlers | NASA/GSFC & USRA | Measuring Spin-Orbit Alignment of Planets | Exoplanets orbiting A/F-type stars commonly misalign from their host stars' spin planes, implying that they form and evolve under different conditions than for exoplanets orbiting |

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| | | | Orbiting TESS's A/F Stars via Gravity-Darkening | lower-mass stars. So far, the distribution of alignment angles around A/F-stars appears to be stochastic, although only a few dozen measurements have currently been made. TESS is expected to discover over 2000 exoplanets orbiting A/F-stars, providing an enormous opportunity to characterize spin-orbit misalignment in greater detail. In this presentation I will describe our current knowledge of spin-orbit alignment occurrence rates and their implications for planet formation, and I will explain how I measure alignment angles from TESS transit light curves by taking advantage of A/F-stars' asymmetric, gravity-darkened surfaces. |
| 41 | Ashley Davidson | St. Paul's School | STOKED* with TESS: KELT-11 b and WASP-127 b | We perform an analysis of exoplanets KELT-11 b and WASP-127 b using data collected from TESS as well as from supplemental instruments used in previous studies. Updated ephemerides will be used for future observations, including observations done by the James Webb Space Telescope (JWST) to be launched in 2021. Here, we retrieve datasets from previous publications as well as from TESS. Then, our public allesfitter code models the data from each instrument individually and also conducts a combined run of all data. For both KELT-11 b and WASP-127 b, we provide updated ephemerides, notably period and epoch. These updated values refine future observations and make it possible for telescopes like JWST to be able to observe known exoplanets more efficiently and precisely.*STudy Of Known Exoplanet re-Discoveries |
| 42 | Rohan Subramani | Yorktown High School | STOKED* with TESS: WASP-77Ab | We perform a study of Hot Jupiter WASP-77Ab, a promising candidate for future atmospheric characterization, using TESS data in addition to photometric and RV data from past observations. We aim to constrain the astrophysical parameters of this planet, especially period and epoch, in order to effectively predict future transits despite the compounding effect of uncertainties in the period over time. We use the publicly available software package allesfitter in order to find an appropriate model based on data from WASP-South, EulerCAM, TRAPPIST, CORALIE, HARPS, Kuiper, and most recently, TESS. We greatly decrease the uncertainties for period and epoch, which will serve to maintain an efficient observation schedule with JWST when characterizing the atmosphere of this gas giant. The continued progression in our understanding of exoplanet atmospheres is an essential part of our ongoing quest to better know the origins of life, our planet, and the universe around us. *STudy Of Known Exoplanet re-Discoveries |
| 43 | Nader Haghighipour | University of Hawaii | Using Orbital Dynamics to Detect Circumbinary Planets: A Novel Approach | One of Kepler's most exciting breakthroughs has been the discovery of circumbinary planets. Only about a dozen such planets were found, however, leaving a vast gap in our understanding of their formation, evolution and habitability. TESS, and only TESS, will enable us to detect an order of magnitude more circumbinary planets. As TESS observes each portion of the sky for a considerably shorter amount of time compared to Kepler, the methods used for detecting Kepler's circumbinary planets cannot be utilized for TESS. To overcome this obstacle, we have developed a novel technique based on the occurrence of multiple transits during one conjunction, that has been tailored to the observing mode of TESS and is guaranteed to provide circumbinary planet |

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| | | | | candidates. For instance, when the system is a spectroscopically double-lined binary, our method will immediately provide an estimate of the planet's period. Importantly, four of the eleven transiting Kepler circumbinary planets manifest such transits, indicating that the effect is common. Using this novel technique, and capitalizing on the eclipsing binaries monitored by TESS, we expect to detect hundreds of transiting circumbinary planet candidates, providing the community with a wealth of samples for statistical analysis. In this talk, we introduce our technique and present its detail capabilities. We will also present a detailed analysis of the yield of our technique and its predictions for the number of circumbinary planets detected by the TESS telescope |
| 44 | David Martin | University of Chicago | Circumbinary Planets in the TESS Era | One of the most revolutionary results from the Kepler mission is a sample of planets orbiting around two stars - circumbinary planets. They question how we think planets form and evolve, and provide observational challenges not seen in single stars. With TESS we will face new challenges, largely imposed by the shorter observing windows. Nevertheless, if we can overcome these then dozens or even hundreds of such planets may be found. I will briefly review the field to date, before focusing on the TESS mission and showing initial progress. Connections will be made with ground-based surveys and the related field of binary star characterisation, which I propose will be revolutionised by TESS. |
| 45 | Prajwal Niraula | MIT | Understanding Bias in the Exoplanetary Atmospheric Retrieval Process | Most the atmospheric retrieval techniques currently employ line-by-line generated opacities across a grid of temperature and pressure for relevant molecular species. These cross sections are computed under assumptions of certain pressure broadening and isotopic fractions, which have inherent uncertainties associated with them. If not properly considered, these uncertainties will non-linearly propagate into the atmospheric retrieval process, and may appreciably bias the results. Understanding these uncertainties will be increasingly important as we look forward to obtaining higher resolution spectroscopic data with the next generation of the telescopes, and discerning small bio-signature signals in the atmospheres of temperate worlds such as TRAPPIST-1 planets. Different databases such as HITRAN, exomol, and GEISA have in the recent year taken steps into providing new parameters such as pressure broadening coefficients and collision induced absorption in the anticipation of their utility for exoplanetary atmospheric studies. In this study, we leverage these publicly available tools to winnow out some of the potential biases in the current atmospheric retrieval studies. We use multiple cross-sections generated under different assumption, and evaluate the typical biases among the retrieved parameters. |
| 46 | Ilaria Carleo | Wesleyan University | Characterizing Exoplanetary Atmospheres in the TESS Era | The characterization of exoplanet atmospheres will be a major scientific endeavor in the coming decades, in particular the search for biosignatures in the atmospheres of temperate, rocky exoplanets. It is a primary science driver for upcoming space-based (e.g., JWST) and ground-based (e.g., GMT) facilities. There are currently several different research directions in exoplanet atmosphere characterization that probe fundamental questions in exoplanet formation and evolution, |

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| | | | | as well as provide stepping stones to developing the facilities and techniques to ultimately detect biosignatures in the atmospheres of small planets. Observations of extended atmospheres provide an opportunity to not only measure the current conditions in the planetary atmosphere, but also put constraints on formation history and interior structure (Owen et al. 1999), interactions with host star (Cauley et al. 2017), and atmospheric and planetary evolution (Oberg et al. 2011). One such research direction is the characterization of extended exoplanetary atmospheres with different spectral absorption lines, namely Lyman-alpha, $H\alpha$, or HeI at different wavelengths. Here, we present an analysis aimed to estimate the planetary mass-loss rate and the signal of these lines starting from the properties of the TESS candidates sample. This allows to select the more promising targets for a follow-up with radial velocities and possibly atmospheric characterization. We also present a summary of our follow-up observations to characterize the planets in the system GJ9827, the nearest planetary system that Kepler or K2 has ever found, with three super-Earth planets in 1:3:5 commensurability. GJ9827b has a relatively hot atmosphere, which makes it an ideal target for measuring atmospheric escape, particularly given the high activity of its host star. |
| 47 | Tara Fetherolf | University of California Riverside | Phase Variations of Known Exoplanets Observed by TESS | The precision photometry from the Transiting Exoplanet Survey Satellite (TESS) is primarily directed towards the detection of planetary transits, but it can also be utilized for a variety of additional science applications. In particular, a phase modulation present in the photometry can be used to study the planetary mass and albedo, potentially providing insights into the atmospheric properties of the planet. We analyze phase variations of the known exoplanets that have been observed by TESS during Cycle 1. A least-squares fitting technique is used to fit for the effects of Doppler boosting, ellipsoidal variations, and reflected light from the day-side of the planet. Using the strengths of the phase variations, we infer estimates of the planet masses and albedos. To search for the presence of secondary eclipses, our fitting algorithm is repeated assuming twice the catalog orbital period. We combine our analysis of the inferred masses and albedos, relative strengths of the phase variation amplitudes, and potential secondary eclipse signatures to perform detailed analyses of the phase variations for known exoplanets and inevitably study their atmospheric properties. Furthermore, we identify the exoplanets with interesting phase modulations that cannot be explained by the aforementioned effects included in our assumed phase variation model. Our plan is to incorporate our phase variation analysis into the vetting process for current and future TESS planet candidates. |
| 48 | Tansu Daylan | MIT | WASP-121 Phase Curve | We study the red-optical phase curve of the ultra-hot Jupiter WASP-121b as observed by the Transiting Exoplanet Survey Satellite (TESS) during its Sector 7 observations. Given its short orbital period of ~ 1.275 days, inflated state and bright host star, WASP-121b has a high potential for detailed atmospheric characterization. Towards this purpose, we use allesfitter to characterize its phase curve, including the thermal and reflected components as well as the secondary transit. We find no phase offset between the secondary and the |

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| | | | | atmospheric emission component, indicating that heat circulation on the surface is inefficient. We also measure excess emission in the TESS bandpass, compared to the expected emission based on previous atmospheric retrieval studies. This implies either a higher-than-expected geometric albedo for WASP-121b or existence of opacity sources. We do not find significant evidence for Doppler beaming or ellipsoidal variation, consistent with the low mass of WASP-121b. Future HST and JWST observations of WASP-121b will benefit from this red-optical light curves measured by TESS. |
| 49 | Thomas Mikal-Evans | MIT | Atmospheric Characterization of the TOI-270 System Using Hubble | The TESS mission recently uncovered a remarkable multi-planet system consisting of a super-Earth and two temperate mini-Neptunes around the bright M3 dwarf star TOI-270 (Guenther et al., 2019). We will acquire near-infrared transmission spectra for the two mini-Neptunes (TOI-270 c&d) using HST WFC3 as part of GO-15814 (PI: T. Mikal-Evans). |
| 50 | Jessie Christiansen | NASA Exoplanet Science Institute | TESS Is A Statistics Mission | With its unprecedented sky coverage and uninterrupted observing baseline, TESS offers us the unique opportunity to expand our understanding of planet formation, migration and evolution. Although TESS is not a statistics mission, I will show that the effort that has gone into creating and documenting the TESS Input Catalog, the public availability of the Full Frame Images allowing for the post facto creation of unbiased stellar target lists, the funding of Guest Investigator projects to produce open source and therefore rigorously quantifiable light curve generation and planet detection software, and the assembly of the largest ground-based team of exoplanet observers to characterize planet candidates yet allows for unmatched flexibility and opportunity in measuring planet occurrence rates. By measuring these occurrence rates as a function of a suite of host star parameters and environments, we will be able to inform many open questions. In this talk, I will explore the ability of TESS to constrain planet occurrence rates as a function of stellar age, mass, and metallicity. For each of these, competing theories of planet formation and migration predict different functional forms of the planet occurrence rates, and TESS will provide the ability to discriminate between these hypotheses. |
| 51 | Rachel Fernandes | Department of Planetary Science & Lunar and Planetary Laboratory, The University of Arizona | The Exoplanet Population Observation Simulator: Applications to Transit and Radial Velocity Surveys | The large number of planets discovered in exoplanet surveys such as Kepler and TESS provide a unique opportunity for constraining the origins of planetary systems. We present EPOS, the Exoplanet Population Observation Simulator, a tool that leverages the statistical power of these surveys by enabling exoplanet occurrence rate calculations as well as detailed comparisons of planet population synthesis models to exoplanet survey data while taking into account detection biases. Here, we use EPOS to calculate the intrinsic distribution of giant planets for Kepler and radial velocity datasets and find the same rising trend with increasing distance from the star out to ~1au. We identify a break in the giant planet distribution between ~2 and 3 au—close to the location of the snow line in the solar system— after which the occurrence rate decreases with distance from the star. Extrapolating a broken power-law distribution to large |

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| | | | | semimajor axes 10-100 au, we find good agreement with the ~1% planet occurrence rates from direct imaging surveys. Assuming a symmetric power law, we also estimate that the occurrence of giant planets between 0.1 and 100 au is ~30% for planets with masses 0.1–20 MJup and decreases to ~6% for planets more massive than Jupiter. We discuss the comparison with population synthesis models and the implications for the structures detected in young disks and attributed to new born planets. We conclude with an outlook of how TESS data could be incorporated into EPOS to expand upon the statistical exoplanet analysis carried out with Kepler. |
| 52 | David Armstrong | University of Warwick | An Emerging Gap in the Planet Mass Distribution | Structure in the planet distribution provides an insight into the processes that shape the formation and evolution of planets. The Kepler mission has led to an abundance of statistical discoveries in regards to planetary radius, but the number of observed planets with measured masses is much smaller. By incorporating results from recent mass determination programs, we have discovered a new gap emerging in the planet population for sub-Neptune mass planets with orbital periods less than 20 days. The gap follows a slope of decreasing mass with increasing orbital period, has a width of a few $M_{\oplus}$, and is potentially completely devoid of planets. Fitting gaussian mixture models to the planet population in this region favours a bimodel distribution over a unimodel one with a reduction in BIC of 19.9, highlighting the gap significance. We discuss several processes which could generate such a feature in the planet distribution, including a pileup of planets above the gap region, tidal interactions with the host star, dynamical interactions with the disk, with other planets, or with accreting material during the formation process. Future TESS discoveries will allow a homogenous study of the gap in much greater detail. |
| 53 | Belinda Nicholson | University of Southern Queensland | Single Transit Follow up with Minerva-Australis | Single transit events represent planets that are in temperate environments on longer orbits, and are thus far a poorly sampled area of parameter space of exoplanet system architectures. We present the radial velocity measurements from the University of Southern Queensland's Minerva-Australis facility for a selection of single transit planet candidates from TESS. Using these radial velocity measure we are able to confirm these planet candidate, constraining the orbital periods and estimating the planet masses. These also provide interesting candidates for follow up studies such as atmospheric characterisation and system architectures. |
| 54 | Stella Kafka | AAVSO | Contributions of the AAVSO to Year 1 of TESS | This poster depicts contributions that the (AAVSO) American Association of Variable Star Observers) and its members have made during the first year of TESS' operation. With its well-known legacy and contributions in the area of variable star observing, the AAVSO added in early 1996 an additional focus, that of exoplanet observing. This was done in recognition of the valuable data such amateur astronomers were providing in helping to candidate exoplanets, as well as in the refinement of the ephemerides of known exoplanets. An AAVSO Exoplanet Section was thus established at that time to provide a "home" for such observers where they could be trained in "best practices," share ideas, and foster communication with the professional community. Over 125 AAVSO members have since completed an Exoplanet |

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| | | | | Observing Course that covers such best practices, as well as an introduction to the AstroImageJ (AIJ) software. When TESS began its science operation this past year, a cadre of AAVSO members were then well-trained to participate in TESS' Follow-up Program (TFOP) Subgroup-1 (SG1), the "Seeing Limited Subgroup." With SG1's primary objective being to help in the confirmation of candidate exoplanets, especially by ruling out false positives, AAVSO members have and continue to contribute to this objective. This poster depicts where in the TESS pipeline these observations are made, as well as examples of some of the methods used to identify true exoplanet transits from false positives. Because systems such as near-by eclipsing binaries (NEBs) can contaminate TESS' relatively large aperture, a means was needed to reliably eliminate stars near a TESS target that, when blended with the target, could mimic an exoplanet transit. For example, it was found that for some targets, there could potentially be hundreds of near-by stars that needed to be cleared as potential false positives. In order to automate what was a manual process that could take an hour or more and to provide a more comprehensive analysis using Gaia's Data Release 2 data, the AAVSO liaison to SG1, Dennis Conti, developed an add-on to AIJ that completed this evaluation in minutes. This poster then also displays this automated "NEB clearing" process. |
| 55 | JJ Hermes | Boston University | Student Exploration of TESS Data Guided by Planethunters.org | The citizen-science interface at planethunters.org enables a hands-on introduction to TESS data for users of any background. This interface allowed undergraduate non-major students at Boston University the chance to be the first humans to set eyes on a number of new light curves (and planet candidates) with very recently collected TESS data. Students were split into groups of roughly eight, and each student was asked to flip through a roulette of at least 100 light curves, saving as a "favorite" their most interesting objects. Each student then proposed 1-2 favorite objects. The instructor selected one object for each group to adopt and analyze in two subsequent laboratory periods, using the TIC on MAST, SIMBAD, Vizier, Gaia DR2, and other resources. Using editable Jupyter notebooks hosted on the Google Colaboratory, as well as the open-source asteroseismology code Period04, students interacted directly with the full TESS light curve. Students presented their results during two lecture periods, including the discovery of a candidate transiting M dwarf not in the TOI catalog, as well as comparing the period and thus distance to a galactic Cepheid to its precise Gaia parallax. |
| 56 | Eunkyu Han | Boston University | Searching for and Discovering new Low-mass Eclipsing Binary Stars in the TESS Full-Frame Images | Double-lined (SB2) eclipsing binaries (EBs) offer the best way to empirically determine self-consistent mass-radius-luminosity relationships forM dwarf stars. However, empirical measurements from the SB2 EBs often show larger than expected radii for their measured mass, metallicity and age. One proposed mechanism for this radius inflation involves strong magnetic fields arising from the rapid stellar rotation that inhibit internal convection and create starspots. Another possible explanation for inflated radii involves inaccurate modeling and quality of the data. There is a disagreement between different groups' measurements arising from using different sets of data and the EB fit-ting |

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| | | | | mechanism (Han et al. 2017). From this study, it is possible that other Mdwarf EBs that show hyper-inflation are not inflated, and the masses and radii are inaccurate. Furthermore, our recent work on the Kepler EBs shows that the empirically determined masses and radii of the component stars are consistent with predictions from stellar evolutionary models (Han et al. (submitted)).Four eclipsing binaries with Kepler data and high-resolution near-infrared spectra from recent study by Han et al. (submitted) do not contain the scatter seen in ground-based EBs. This suggests that the scatter present in ground-based EBs may be due to the lower-quality of photometric data. Because these measurements directly inform the physical properties of exoplanets found to orbit isolated stars, it is important to constrain the relationships among the stellar parameters of M dwarf stars.Using TESS 2-min short cadence data and FFIs from all sectors available up-to-date, we searched for and discovered new low-mass EBs. We used machine-learning algorithms to classify TESS light curves. For the classifications, we used parameters such as BLS period, amplitude ratio between periods and eclipse shape to describe the shape and features of EB light curves. The ultimate goal is to compile a catalog of TESS EBs which will increase the number of known low-mass EBs at least by an order of magnitude. Ground-based follow-up radial velocity observations will be conducted on the newly discovered TESS low-mass EBs, which will then be used to determine the best possible mass-radius relation for M dwarf stars. |
| 57 | Anders Justesen | Stellar Astrophysics Centre, Aarhus University | TESS Binaries as Probes of Tidal Circularization and its Impact on Planet Formation | Tidal forces play a critical role in shaping the orbits of short-period planets and binaries. Despite their importance, tidal forces are poorly understood. The strength of tidal interactions and the corresponding tidal time scale is unknown to within several orders of magnitude. We plan to address this problem by using a large sample of TESS eclipsing binaries. The rate of tidal circularization may be constrained by measuring eccentricities over a range of periods and stellar types. Eccentricity is typically determined via radial velocities. The time-intensive follow-up, incomplete sampling of phase curves, precision of data and other factors make it difficult to perform a large, homogeneous analysis of eccentricities derived from radial velocities. However, by measuring the relative timing between the primary and secondary eclipses, the eccentricity is constrained through the parameter $e \cos \omega$ directly from the light curve. This technique is readily applied to eclipsing binaries in a homogeneous fashion and has been successfully used to study Kepler eclipsing binaries (Van Eylen et al. 2016). TESS will significantly increase the sample of bright, nearby eclipsing binaries across the entire sky. Compared to Kepler, TESS offers a larger, more diverse sample of bright eclipsing binaries, encompassing a larger range of spectral types. By identifying eclipsing binaries in TESS data and performing stellar characterization using photometric colors and Gaia parallaxes, we constrain the rate of tidal circularization as a function of stellar type by measuring the fraction of eccentric systems as a function of orbital period. Here we present our sample, technique and results. |
| 58 | Patcharapol | Mahidol | MWC 882 Debris | MWC 882(BD-22 4376, EPIC 225300403) is an 8000 K A- |

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| | Wachiraphan | University, Thailand | Disk | type star observed by the Kepler observatory during the extended K2 mission. MWC 882 has a highly unusual set of deep photometric transits once every 72 days, with each transit lasting 14 days at ~7% depth. The periodicity and transit nature of the system were confirmed by prediscovery observations from ASAS photometry. Ground-based photometric follow-up by Hereford Arizona Observatory (HAO) and Perth Exoplanet Survey Telescope (PEST) confirmed the period (Zhou et al. 2018). One explanation is that the transits are caused by a debris disk around the secondary star. This system will become a binary star system with an accretion disk. We designed a spectroscopic observing campaign using the MRES instrument on the 2.4m Thai National Telescope (TNT) to characterize the transit of debris disk of MWC 882. We obtained spectroscopic data for 18 days to study our target in different phases of the transit. After the data are reduced, we aim to study the gas and dust components of the disk by measuring absorption features, use radial velocity to constrain the mass of the secondary object, and to measure changes in the rotational broadening profile of primary star to map the morphology of the debris disk. |
| 59 | Kaiming Cui | National Astronomical Observatories, Chinese Academy of Sciences | Long Rotation Period Main-Sequence Stars from the Space Telescope. | Stellar rotation plays a key role in the stellar activity. The rotation period could be detected through light curve variations caused by starspots. High-quality photometric data provided from space telescope like Kepler and TESS contain two types of light curves, one is the Pre-search Data Conditioning (PDC) light curves, the other is the Simple Aperture Photometer (SAP) light curves. Compared with the PDC light curves, the SAP light curves keep the long-term trend, relatively suitable for searches of long period signals. However, SAP data are inflicted by some artefacts such as quarterly rolls and instrumental errors, making it difficult to find the physical periods in the SAP light curves. We explore a systematic approach based on the light curve pre-processing, period detection and candidate selection. We also develop a simulated light curve test to quantify our detection limits for the SAP data. After applying our method to the raw SAP light curves, we found more than 1000 main-sequence stars with the period longer than 30 days. Our results allow us to study the stellar activity at long rotation period, which shows a large scatter in the variation versus period diagram. The scatter is reduced significantly in the variation versus Rossby number. We note that some objects in the unsaturated region are more active than previously expected, possibly caused by some unknown mechanisms such as turbulent effect. |
| 60 | Henggeng Han | National Astronomical Observatories, CAS | Stellar Cycles as Revealed by Beat Phenomenon of Light Curves of Kepler | Empirical relations have previously been found that length of stellar cycle $P_{\rm cyc}$ is positively correlated with rotation period $P_{\rm rot}$ along two segregated branches, which are called active" branch and inactive" branch. In this work we study the modulation of amplitudes, i.e., beat patterns of light curves provided by the Kepler mission. We find that for most of the targets analysed in this work, beat periods $P_{\rm beat}$ and $P_{\rm rot}$ obey similar empirical relations, suggesting that beat phenomena are associated with stellar cycles. Some targets lie on the short-cycle" branch which was supposed by Ferreira Lopes et al, indicating that this branch is physical. |

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| 61 | Viktor Khalack | Universite de Moncton | Detection of Slowly Rotating Chemically Peculiar Magnetic Stars with TESS | We present results of an analysis of TESS photometric data for known slowly rotating magnetic chemically peculiar (mCP) stars. Slowly rotating mCP stars usually possess a hydrodynamically stable stellar atmosphere where a magnetic field can amplify the atomic diffusion and lead to horizontal and vertical stratification of chemical abundances. In the frame of the oblique magnetic rotator model, the patches of an enhanced abundance of chemical elements can generate a signal at the frequency of a stellar rotation and its first harmonics. Using this approach, we have compiled a list of slowly rotating mCP stars with periods more than 2 days from the analysis of photometric data provided by TESS for the first eight sectors. For each star, we have analyzed the light curves and measured frequencies and amplitudes of periodic signals with high precision. For the bright candidates, we have used their available spectra to derive $v \sin(i)$. |
| 62 | Hiroyuki Maehara | National Astronomical Observatory of Japan | Simultaneous Photometry and Spectroscopy of an Active M dwarf YZ Canis Minoris with TESS and OISTER | Solar and stellar flares are rapid releases of magnetic energy in the solar/stellar atmosphere. They produce not only the electromagnetic radiations at all wavelength from radio to X-rays but also prominence eruptions and coronal mass ejections. Such plasma ejections into interplanetary space are thought to affect the planet's atmosphere. However, in the case of other stars than the Sun, plasma ejections associated with stellar flares are not well studied. Therefore, further time-resolved simultaneous photometry and spectroscopy of stellar flares are needed to understand the properties of plasma ejections associated with stellar flares. We carried out time-resolved simultaneous photometry and spectroscopy of an active M dwarf YZ CMi in the frame work of the OISTER (Optical and Infrared Synergetic Telescopes for Education and Research) collaboration during the TESS Cycle-1 Sector-7 observing period. During our observations, we detected two different types of flare events. The first one is a gradual-rise and slow-decay of Balmer line intensity without a photometric flare. During this event, the intensity ratio of $H\alpha$ to $H\beta$ were almost constant. Time-resolved medium resolution (R=7500 at $H\alpha$ line) spectroscopy during this event shows the blue asymmetry in $H\alpha$ line profile. The second one is a rapid-rise and exponential-decay of Balmer line intensity associated with a flare. The bolometric energy of this flare estimated from ground-based g'-, Rc-, and TESS Ic-band photometry is approximately $10^{31}$ erg. The raise and decay time scales of Balmer line intensity are similar to those of continuum intensity. The amplitude of intensity change in $H\beta$ line is ~5 times larger than that in $H\alpha$ line. No blue/red asymmetry in $H\alpha$ line profile was observed during this flare. In this presentation, we introduce the results from the OISTER/TESS observations of YZ CMi and future plan for OISTER campaign observations of flare stars simultaneously observed with TESS. |
| 63 | Yuta Notsu | LASP, University of Colorado Boulder | APO3.5m Spectroscopic Monitoring Observations of a M-dwarf Superflare Star YZCMi with | Flares are magnetic intense energy releases in the solar/stellar atmosphere, and they have strong emissions in whole wavelengths over radio, optical, UV, and X-ray. Kepler space telescope optical observations have found many large flare events ("superflares") and their statistical properties have been investigated in detail. However, not only photometric observations but also spectroscopic observations and multi- |

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| | | | TESS and ARCSAT0.5m Photometric and NICER Soft X-ray Observations | wavelength observations are strongly needed to understand how superflares occur and how large mass ejections occur during superflares. These new understandings (especially mass ejections) are also important for evaluating the impacts on planets from superflares. In this study, we conducted APO3.5m telescope high dispersion spectroscopy campaign observations of a nearby M-dwarf flare star YZCMi, which is simultaneously observed TESS Cycle-1 Sector 7 (optical photometry), ARCSAT0.5m telescope (u,g,r,i,V-band multicolor photometry), and NICER soft X-ray telescope. The TESS Cycle-1 Sector 7 24.5-day photometric data of YZCMi shows the clear 2.8 day rotational modulations and frequent (>20) flare events with amplitude larger than 1%. During the three-night campaign observation period (UT2019Jan26-28), we detected the following two remarkable events. The first event occurred on UTJan26 and TESS photometric data shows the increase of amplitude with ~3%. Balmer lines ($H\alpha$ & $H\beta$ lines) also show some intensity enhancements with their durations less than 1 hour, and we discuss this optical flare-like event including theARCSAT0.5m multi-color photometry data. The second event occurred on UTJan27. In this event, Balmer lines ($H\alpha$ & $H\beta$ lines) in spectroscopic data show intensity enhancements (amplitude ~20% at the line center) with their durations longer than 4 hours, and NICER soft X-ray data also shows the intensity enhancements with their durations at least 2 hours. However, TESS and ARCSAT0.5m optical photometric data do not show any clear intensity changes. It is considered that this event is a flare without optical emission or other some activities in the M-dwarf choromosphere and corona. In this poster, we introduce ongoing results on the analyses of these two events and mention some future prospects for the next step multi-wavelength observations of flare stars simultaneously observed by TESS. |
| 64 | Eduardo Nunes Velloso, L. de Almeida, A. C. Mattiuci, P. Beck, S. Saar and J.-D. do Nascimento Jr. | Universidade Federal do Rio Grande do Norte, UFRN, | Periodicities, Rotation and Activity of Young Suns as Seen by TESS | The Transiting Exoplanet Survey Satellite (TESS) is providing us with an all-sky survey of more than 200,000 targets at short and continuous cadence. In contrast with Kepler's 4-year coverage of the same part of the sky, most TESS targets will not be observed for more than a few consecutive months. In fact, just like with the K2 mission, this presents a challenge to retrieve periodicities in the light curve at longer time scales, especially for older stars. In this work, we select 10 known bright solar analogs which were already observed by TESS (most of them during a single 27-day sector) and investigate the ability to retrieve stellar rotation. In the TESS delivered light curves, we find contamination issues in some cases and based on our tools we reextracted those light curve from a new mask. Together with traditional methods to detect signal periodicities (e.g. the generalized Lomb-Scargle periodogram and the autocorrelation function) we also use a spot modeling framework to infer rotation patterns with solutions well constrained by spectroscopic observations (e.g., $v \sin i$). We find good fits for most active stars, with rotation periods ranging between 7 and 11 days, indicating that TESS is a powerful observational tool to characterize rotation periods for young sun-like stars. |
| 65 | Padi Boyd | NASA's GSFC | M Dwarf Flares Across the | M-dwarfs are abundant and frequently host small planets, and TESS's exoplanet discovery space focuses on small planets |

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| | | | Electromagnetic Spectrum | orbiting M-dwarfs. While smaller than the Sun, these stars are known to be many times more magnetically active. Superflares from small stars such as DG CVn have been measured in excess of 10,000 times more powerful (an estimated X 100,000) than the largest known solar flare (an X 45 flare recorded on November 4, 2003). Any planets hosted by M-dwarfs are thus subjected to significantly more radiation than we experience from the Sun; just how much this affects their habitability is an open question. A Swift key project is now underway, with the goal of monitoring M-dwarfs with ages from 10 Myr to 10 Gyr across the electromagnetic spectrum. A pilot study was undertaken on Wolf 359 (CN Leo) with simultaneous Swift and K2 data. In TESS Cycle 1, a total of 45 M-dwarfs will be observed simultaneously with Swift and TESS, including nearby stars such as Proxima Cen and Barnard's Star. Swift X-ray, and UV observations can be combined with simultaneous high-precision optical data from TESS, to investigate the energetics of M-star flares, and compare spectral energy distributions of the stars during flaring versus quiescence. The combined data provides a more complete picture of M dwarf activity, and may ultimately help us to identify environments conducive to harboring habitable planets. |
| 66 | Derek Buzasi | Florida Gulf Coast University | TESS Observations of Spots and Flares in Active Binary Systems | Active binary stars are cool stars characterized by strong chromospheric, transition region, and coronal radiation. Activity is typically seen in the optical as excess emission in Ca II H+K line cores as well as in the Balmer lines; the active lines are sometimes rotationally modulated, and in the most active cases, emission can extend above the continuum (Zhang & Gu 2008). As in the Sun, a dynamo mechanism converts the energy of rotation and convection into magnetic energy, which powers the various forms of activity visible. However, in active binaries tidal interactions between the components mean that the stellar rotation rates are much faster than in solar-like field stars, and activity levels consequently much higher, making these stars ideal laboratories for the study of stellar activity. In Cycle 1, we used TESS to observe 50 RS CVn and BY Dra systems in short cadence. In this poster, we present preliminary results of those observations, focusing on starspot sizes and distributions and flare frequencies. |
| 67 | Naylynn Tanon Reyes | San Diego Mesa College | M Dwarf Light Curve Morphologies from TESS | Low-mass stars are the most common stars in the Galaxy and are prime targets to search for and characterize small, Earth-like planets. These stars are highly active, exhibiting frequent flares and energetic particle emission that can be detrimental to planetary habitability. We have created light curves for hundreds of low mass stars observed by TESS in the Southern Hemisphere, taking care to separate brightness variability due to eclipsing binaries that creep into the stellar apertures. We present a first look at the wide diversity of light curve morphologies from M dwarfs as seen by TESS, and discuss efforts for using the outcome of TESS stellar activity analyses as input into exoplanet atmosphere models. |
| 68 | Stefanie Raetz | Institut fuer Astronomie and Astrophysik Tuebingen | A TESS View on the Flaring Activity of the Young Solar- | A former member of the Hyades cluster, $\iota$ Horologii ( Hor) is a 625 Myr old Sun-like star which displays the shortest coronal activity cycle known to date ($P_{cyc} \backsimeq 1.6$ yr). Apart from the Sun, this X-ray activity cycle is also the only one |

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| | | | Analog iota Horologii | identified on a single star so far. While the general properties of this cycle have been studied in some detail, little is known regarding the flaring activity of the star, which is expected to significantly contribute to the observed cyclic behavior. Here we present an analysis using TESS data of $\iota$ Hor (Sectors 2 and 3) aimed at identifying any flares in the photometric data, and determine general properties of its flaring activity (ie., rates, energies). While we could not detect any flares in the TESS light curve of $\iota$ Hor, we are able to place limits on the maximum flare energies occurring during the time of the TESS observations, and in relation with the activity cycle state of the star. Finally, by determining the flare rate occurrence of $\iota$ Hor and that of a sample of Kepler super flare stars, we conclude that $\iota$ Hor cannot be excluded to exhibit rare super flare events. |
| 69 | Huiqin Yang | National Astronomical Observatories, CAS | The New Expression on Activity--Rotation Relation across H-R Diagram | We present a statistical study of flares based on the whole data set of the Kepler mission, which could enable us to gauge the activity--rotation relation from the view of flares. We calculate the flare activity of more than 3400 flaring stars from A-type to M-type. It is found that the activity--rotation relation in the late-type star is clear—that is, a saturated regime with a high activity level and an exponential decay regime with a low activity level corresponds to fast rotators and slow rotators, respectively. The slope of the unsaturated regime is $\beta \backsim 2$, which is consistent with previous studies. However, as we consider this relation across H-R diagram, one interesting fact is that the two regimes gradually become dispersive as the temperature increases and the activity--rotation relation nearly disappears in the early-type stars. Combined with the Gyrochronology, we find that the mixing of stars of two different dynamos gives rise to the dispersion. We thereby propose a scenario on understanding the activity–rotation relation across the H-R diagram. Based on the scenario and the correspondence of dynamo with regard to activity and rotation, we suggest a new expression on the activity–rotation relation, in which the segmentation is on the basis of the dynamo rather than the rotation period. |
| 70 | Emily Gilbert | University of Chicago | M Dwarf Flares Through Time with TESS | As the most common planet-hosting stars, M dwarfs are essential for understanding the occurrence, evolution, and potential habitability of exoplanets. M dwarf stars make up more than 70% of stellar content in our galaxy and are a large focus of the TESS mission. These stars are smaller, cooler, and more active than our own Sun, but their activity is not well understood. Since these stars are highly magnetically active, the planets they host are subjected to significantly more radiation than we experience from the Sun. Just how much this affects their potential habitability remains unsolved. We present our new flare detection and characterization software that allows us to study relationships between stellar parameters such as age, rotation, and spectral type on flare activity. We will then use this information to asses the effects of this activity on the exoplanet population. We present early results on the flare energy distribution for two active stars, AU Mic and YZ CMi, and discuss our plan to characterize hundreds of additional M dwarfs observed by TESS spanning a wide range of masses and ages. |
| 71 | Ofer Cohen | University of | Exoplanet | The search for exoplanets in the radio bands has been focused |

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| | | Massachusetts Lowell | Modulation of Stellar Coronal Radio Emission | on detecting radio emissions produced by the interaction between magnetized planets and the stellar wind (auroral emission). Here we introduce a new tool to predict the ambient coronal radio emission and its modulations induced by a close planet. We explore the radio flux modulations using a limited parameter space of idealized cases by changing the magnitude of the planetary field, its polarity, the planetary orbital separation, and the strength of the stellar field. We find that the modulations induced by the planet could be significant and observable in the case of hot Jupiter planets—above 100% modulation with respect to the ambient flux in the 10-100 MHz range in some cases, and 2%-10% in the frequency bands above 250 MHz for some cases. Thus, our work indicates that radio signature of exoplanets might not be limited to low-frequency radio range. The new radio tool, when applied to real systems, could provide predictions for the frequency range at which the modulations can be observed by current facilities. |
| 72 | Bartlomiej Debski | Jagiellonian University | Starspot Trek. The Motion Picture | This work is focused on the starspot migration in (near)contact binaries. With our new methods we are analysing the intrinsic variability of light curves in the long timebase photometry data. We have obtained the information on the starspot migration in more than one thousand Kepler binaries: if the spot migration is present, what is the migration rate, what is the direction of the migration and in case of selected binaries, how to pinpoint if the spot is cooler or hotter than it's host star photosphere. All of the analysis process can be automatized with a several simple tasks and applied to large databases without the need of any numerical modeling. Here we are presenting some of the highlights of the methods and the statistical results obtained for the sample of about 420 close binaries in the Kepler mission. In the end we show what can be expected from the observations made with the TESS space telescope |
| 73 | Laszlo Molnar | Konkoly Observatory, MTA CSFK | First TESS Results on Cepheid and RR Lyrae Stars: Towards Asteroseismic Inferences | TESS offers the opportunity to observe a large collection of Cepheid stars, and the nearby population of RR Lyrae stars. Although the mission only provides us with snapshots for classical Cepheids, due to their long pulsation periods, the combination of multiple sectors can produce valuable data sets for targets like the very bright classical Cepheid, beta Dor, or the LMC population. TESS will also be transformative for the rare and less understood anomalous Cepheid class. We discovered the first strong non-radial mode in one of their prototypes, the overtone star XZ Cet. The mode seems to be the exact analogue of the family of additional modes observed in many overtone RR Lyrae and classical Cepheid stars, indicating a common origin. We identified low-amplitude non-radial modes in a large fraction of RR Lyrae stars. Unlike many Kepler stars, these are prime candidates for detailed follow-up both with multicolor photometry and spectroscopy to identify the detected modes. Although the discovery of these modes calls the classical single- and double-mode nomenclature into question, we show that mode amplitudes still differentiate between the groups. We also noticed differences in the distribution of the additional modes between the TESS sample and the OGLE Bulge RR Lyraes. This raises the possibility that physical |

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| | | | | differences between the nearby, field RR Lyraes and the Bulge population may affect mode selection in these stars. |
| 74 | Viktor Khalack | Universite de Moncton | Unique Variability of HD27463 Found Form the Analysis of TESS Data. | The new photometric data on HD27463 obtained recently with the Transiting Exoplanet Survey Satellite (TESS) are analysed to search variability. Our analysis shows that HD27463 exhibits two types of photometric variability. The low frequency variability with the period P=2.834274 d can be explained in terms of axial stellar rotation assuming the model of oblique magnetic rotator, while the detected high-frequency pulsations characterise this object as a $\delta$ Scuti variable. From the analysis of Balmer line profiles visible in two FEROS spectra of HD27463 we have derived its effective temperature and surface gravity that are close to the values published for this star in the TESS Input Catalogue (TIC). Our best fitting model of the observed pulsation modes results in the values of global stellar parameters that are well consistent with the data reported in the TIC and with the data derived from the simulation of Balmer line profiles. We have found that amplitudes and phases of pulsation modes with highest amplitudes are modulated with time. |
| 75 | Klaus W Hodapp | University of Hawaii, IfA | The EXor Outburst Lightcurve of ESO-Ha 99 | The process of accreting mass onto a forming young stars usually proceeds at an accretion rate that is insufficient to accumulate a typical stellar mass in the time commonly thought to be available for this process. However, this relatively quiescent state of low accretion occasionally gets punctuated by much more intense accretion events that manifest themselves as photometric outbursts and that may be responsible to much of the final mass of a star. Gaia alert 18dvz first noted a substantial rise in brightness of young stellar object ESO-H_alpha 99 embedded in the dense high-extinction cloud Sandqvist~1, which is seen against the RCW~27 HII region in Vela. ATLAS archival data allowed to trace the light curve back several years and indicate a prior, but minor flux maximum. Optical (Faulkes Telescope) and infrared spectroscopy (IRTF) show prominent emission lines, the characteristics of an EX Lupi (EXor) outburst event. Based on UKIRT and IRIS data, ESO-H_alpha 99 is associated with a reflection nebula and one molecular hydrogen emission knot, indicating past jet activity. TESS has covered ESO_Halpha 99 in sector 8 of its southern hemisphere survey and gave a detailed light curve with a temporal resolution of an hour. This light curve covers an intermediate dip in brightness a few weeks prior to reaching the brightness maximum of ESO-H_alpha 99 and shows unprecedented detail of the temporal evolution of the accretion luminosity with flickering down to timescales of hours. |
| 76 | Kaiming Cui | National Astronomical Observatories, Chinese Academy of Sciences | Stellar Activity and Gyrochronology with LAMOST | We use the LAMOST spectra of rotators from Kepler and TESS data to study the chromospheric and photospheric activity based on the Ca II H&K lines and the light curve variabilities. With those activity proxies, our results are consistent with the previous results of the relation between activity level and Rossby number. We also use the gyrochronology to study their age distributions and found the mixture of two different dynamos could explain the different dispersion from late-type to early-type stars in the activity-Rossby relations. Our results confirmed the new expression of |

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| | | | | the activity-rotation relation. For the old stars, we combine the gyrochronology and chromospheric activity-age methods to put forward a new expression for estimating stellar ages. |
| 77 | Eric Gaidos | University of Hawaii at Manoa | TESS-ting Models of Planet Formation and Destruction by Observation of Occulting Circumstellar Dust from Planets, their Precursors, or their Remnants | Not just planets occult their stars. Observations by the Kepler spacecraft during the Kepler and especially the K2 mission, as well as predecessor observations by the CoRoT and Spitzer spacecraft have revealed variability due to intervening circumstellar matter, i.e. dust from protoplanetary disks around young stars, evaporating planets around main sequence stars, disintegrating planetesimals around white dwarfs, and star-grazing exocomets". Observations of these phenomena permit tests of models of planet formation, as well as potential destruction: Much of this is very difficult or impossible to observe from the ground, although there are precedents amoung Young Stellar Objects, i.e. the UX Orionis variables. TESS is broadening our grasp of these phenomena to the entire sky, and a more diverse central stars, although for shorter intervals. Here we describe several members of nearby Young Moving Groups or unrelated young field stars that exhibit transient dimming events or dips" detected by TESS and followed up with ground-based observations. These ~100 Myr-old systems allow investigations of the final stages of planet formation as well as potential catastrophic rearrangements of orbital geometries. We also describe preliminary results from a machine-learning-based approach to anomaly" detection in TESS lightcurves which will permit a systematic exploration of transients at levels of photometric precision where instrumental and local astrophysical artifacts are a problem. In addition to the phenomena described above, this tool will be used to detect single tranists of planets, extending teh reach of TESS to longer orbital periods. |
| 78 | Ann Marie Cody | NASA Ames | A TESS Monitoring Survey of Young Intermediate-Mass Stars | One of the many types of targets observed by TESS are young stars in clusters and associations. With the mission's focus on relatively bright sources, observations of the more massive Herbig Ae/Be stars (HAeBes) are leading to a unique set of high-precision light curves. Hundreds of HAeBes appear in TESS's fields of view during its first two years of observation. We have undertaken a comprehensive photometric monitoring survey of these objects and their diskless cousins. The goals of our survey include a study of variability patterns and relationship to circumstellar material among HAeBes, a search for transiting planets and eclipsing binaries, as well as an assessment of the presence of starspots. These results will be compared with our results for lower mass stars analyzed during the K2 Mission. We present here a description of the dataset, our approach to full frame image data reduction, and a collection of HAeBe light curves obtained to date. |
| 79 | Nestor Espinoza | Max-Planck-Institut fuer Astronomie | A Juliet View of Limb-Darkening on TESS Exoplanet Transit Lightcurves | Stellar limb-darkening is usually treated as a nuisance parameter in transiting exoplanet lightcurves, where there is conflicting views as to how much trust one should put on stellar model atmospheres which aim at predicting this effect. In this talk, we will present empirical limb-darkening coefficients obtained from transit lightcurve fits using juliet --- a versatile transit fitting tool to be presented in this talk as well --- to more than 50 known transiting exoplanets from Sectors 1 to 5 and their comparison with estimates from stellar model atmospheres. Significant deviations are observed |

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| | | | | from predictions of both ATLAS and PHOENIX model atmospheres, which suggest caution should be taken when using those predictions as inputs when fitting TESS photometry. This highlights the impressive precision the mission has not only for exoplanetary science, but for precision stellar science as well. |
| 80 | Kevin Hardegree-Ullman | Caltech/IPAC-NExScI | Spectra of Cool Stars in the TESS Northern Continuous Viewing Zone | Accurate exoplanet properties necessitate precise characterization of host stars. Properties for a majority of stars in the TESS Input Catalog have been derived from photometry alone, which can suffer from systematic uncertainties. Moderate resolution spectra give us much more information about stars and allow us to determine spectral type, effective temperature, surface gravity, metallicity, and stellar activity. Using the Stefan-Boltzmann law, we can combine effective temperatures, photometry, and parallax measurements to compute stellar radii with uncertainties of only a few percent, minimizing uncertainties on radii of transiting planets. We have conducted a spectroscopic survey at red optical wavelengths of over 1,000 photometrically identified cool stars in the TESS northern continuous viewing zone using Hydra on WIYN. We will present spectra and results from this survey. All of our spectra and derived stellar properties will be made publicly available on ExoFOP-TESS in order to aid in exoplanet candidate characterization. These spectra can also be used to facilitate future comparative studies of planet host versus non-host populations and planet occurrence rate calculations. |
| 81 | Jake Clark | University of Southern Queensland | Can Stellar Abundances Help Explain the Architecture of Planetary Systems Discovered by TESS? | Ever since the exoplanet era began, we astronomers have come across some truly bizarre and diverse exoplanetary systems. The physical and chemical processes that produce these systems, along with planetary atmospheres, surfaces and bulk compositions are incredibly complex. Yet, there seems to be some tantalizing evidence suggesting that stellar abundances are playing an integral role in determining certain aspects of the chemical, geological and physical constraints of exoplanets and exoplanetary systems. For example, C/O ratios of stellar hosts and planetary atmospheres could potentially aid us in understanding the formation mechanisms of hot-Jupiters whilst Mg/Si and Fe/Si ratios can help determine the geological and chemical structure of larger terrestrial and smaller gassier worlds. Obtaining high precision measurements of stellar chemical abundances, in addition to stellar physical properties, is crucial for this understanding. However, relative uncertainties in stellar properties, some as high as 100% (e.g TESS Candidate Target List), hinders astronomers and planetary scientists alike in accurately shaping an exoplanetary system's structure. Until now. By cross-matching stars from Australia's GALactic Archaeology with HERMES (GALAH) with stars within the TESS Candidate Target List, we have derived the stellar mass and radii of 40,000 potential planet-hosting stars to 3-5% precision using high resolution spectra. The self-consistent stellar parameters ($T_{eff}$, logg, $v \sin i$, Radius, Mass, Age etc.) combined with the chemical abundances for 30 elements ([X/Fe]) including iron, silicon, magnesium, carbon, oxygen, aluminium, nickel to name a few, will assist follow-up teams to determine the chemical and geological makeup of newly |

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| | | | | found exoplanets like never before. This newly derived catalogue already contains several planet-hosting stars, which I will summarise general patterns with other known planet hosts from the K2-HERMES survey. Lastly, I describe how the Southern Hemisphere's only dedicated observatory to TESS follow-up, Minerva-Australis, is aiding other astronomers in determining stellar abundances from spectra used to discover and confirm TESS candidates. |
| 82 | Mikkel N. Lund | Aarhus University | TESS Data for Asteroseismology: The TASOC Light Curve Correction Pipeline | With data from the Transiting Exoplanet Survey Satellite (TESS) the seismic community is faced with a new set of challenges concerning the preparation of data. The TESS Asteroseismic Science Operations Center (TASOC) is tasked with delivering light curves ready for asteroseismic analysis to the TESS Asteroseismic Science Community (TASC) for each target observed by TESS. Following the photometric extraction of targets observed in the TESS full-frame images, the next step is to correct for systematic signals in the light curves while preserving the intrinsic stellar variability. This is achieved using a custom-built, Open Source, pipeline produced within the TASC community by the coordinated activity "TESS Data for Asteroseismology" (T'DA). For TESS sectors 1 and 2 the first full release resulted in over 1.7 million light curves, which have been released to the community via the TASOC and MAST websites, and many more are to come. |
| 83 | Andrew Tkachenko | Institute of Astronomy, KU Leuven | TESS Data for Asteroseismology (T'DA): The TASOC Classification Pipeline | TESS will deliver tens of millions of high-precision light curves of stars across the entire sky during the 2 years of its nominal mission. Lessons learned from the recently retired Kepler mission allow us to say that the vast majority of targets observed by TESS will be in- or/and extrinsically variable over time. Given the total amount of light curves that will become available, (astro)physical information encoded in stellar variability, and the importance of ensemble studies, it is highly beneficial to classify stars according to the type of their variability and to do it in a highly automated and homogeneous approach. In this contribution, we will present the concept of the T'DA classification pipeline whose task is to sort out stars in the first place as well as to provide a feedback to the TASOC Photometry pipeline as to how to improve upon correction of light curves for non-astrophysical signals. This classification is realised by means of supervised and unsupervised machine learning algorithms, and comes in two subsequent stages: 1) general classification (g-mode pulsators, p-mode pulsators, eclipsing/transiting objects, classical pulsators, etc.), and 2) detailed classification (gamma Dor vs. SPB stars, RR Lyrs vs. Cepheids, etc.). |
| 84 | Derek Buzasi | Florida Gulf Coast University | Light Curves for Asteroseismology from Full-Frame Images | The 30-minute cadence full-frame images collected by TESS during the nominal mission provide an invaluable resource for science ranging from stellar astrophysics to exoplanets. Drawing on the Kepler experience, the TESS Asteroseismic Science Consortium (TASC) has formed a collaborative effort to use TESS data for asteroseismology, and established a TESS Asteroseismic Science Operations Center (TASOC) to produce light curves from full-frame images. In this talk, we will present the TASOC pipeline for producing light curves from full-frame images, including light curve extraction from the FFIs, light curve correction for instrumental effects, |

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| | | | | automated stellar variability classification, and verification of absolute time for the resulting photometry. We will describe the TASOC FFI data releases for the first TESS sectors which include millions of light curves down to $T_{mag}$<15, and present comparisons of TASOC FFI light curves to other community-driven efforts such as image-subtraction and the eleanor pipeline. Finally, we will highlight a broad range of asteroseismic detections across the HR diagram enabled by FFI light curves. |
| 85 | May Gade Pedersen | KU Leuven | Probing Internal Mixing in Massive Stars with Combined TESS/Kepler, Gaia and Spectroscopic Data | The evolution of massive stars born with a large convective core is heavily dependent on the amount of chemical mixing occurring in the core boundary layers and in the envelope. The surface abundances of massive stars reveal that a significant amount of mixing is required throughout the stellar envelope in order to explain the observed abundances of CNO elements. Mixing induced by rotation has been offered as a viable explanation, yet it fails to predict the surface nitrogen excess for about half of the B-type stars. In general, the internal chemical mixing profiles remain poorly calibrated by surface abundances and additional spectroscopic observables, given their large uncertainties. Asteroseismology offers a new tool to probe the deep interiors of massive stars. Their gravity modes in particular are highly sensitive to the amount of mixing occurring in the core boundary region of those stars. Gravity-mode asteroseismology offers the best way to calibrate the deep mixing inside massive stars, but it requires light curves with a duration of at least one year in order to reach the required frequency precision to resolve and carry out detailed asteroseismic modelling for this type of modes. Unfortunately, due to the choice of the nominal field-of-view, relatively few massive stars were observed with Kepler and only few of them delivered suitable gravity modes to perform asteroseismic modeling. TESS is remedying this situation by providing more than a hundred-fold increase in the number of massive stars with high-precision, high-cadence and long time-base space photometry needed to carry out detailed gravity-mode asteroseismic modeling. With this talk we present new results on the calibration of internal mixing profiles, exploiting the synergies between asteroseismology based on Kepler data, surface abundances, and Gaia astrometry. Furthermore, we demonstrate how TESS will improve upon these results by allowing for an ensemble study of hundreds of massive stars covering a wide range in mass, age, rotation, and metallicity. |
| 86 | Joey Mombarg | Institute of Astronomy, KU Leuven | High-Precision Mass and Age Estimates of A- and F-type Stars from Asteroseismology | One can only understand an exoplanet as well as one can understand its host star. Stars of spectral types A and F are known to harbor exoplanets, while they also cover an instability region where gravity-mode (g-mode) oscillations are excited. These g modes are most sensitive to the conditions near the convective core, and precise observations of their frequencies allows for precise modelling of their interior structure, including rotation and mixing. By combining asteroseismology with high-resolution spectroscopy, the stellar mass, radius, age, and metallicity can be inferred. Modelling the period spacings between g modes of consecutive radial order is done to extract the near-core rotation rate, as well as the so-called buoyancy radius. This |

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| | | | | buoyancy radius is then combined with the effective temperature and surface gravity from ground-based spectroscopy as observables to determine the stellar properties with a precision much higher than methods that do not rely on asteroseismology. In this talk, I will present the modelling results of g-mode pulsators using the buoyancy radius, effective temperature, and surface gravity. Asteroseismic modelling requires extensive grids of stellar models, covering a high dimensional parameter space and including various levels of microscopic and macroscopic mixing. Using statistical model representations, one can encapsulate the dependency of the aforementioned observables to the free parameters in the stellar models. I will explain how such statistical representations can be used to assess a star's properties from its g-mode pulsations, and discuss the determination of precise stellar masses, core masses, and ages of A- and F-type stars with the TESS mission data. |
| 87 | Timothy Van Reeth | Institute of Astronomy, KU Leuven, Celestijnenlaan 200D, 3001 Leuven, Belgium | Asteroseismic Modelling of Magnetic Main-Sequence Stars with Gravity-Mode Pulsations | Angular momentum transport in the deep stellar interior has considerable influence on stellar structure and evolution. However, it is known to be underestimated in stellar evolution models. In main-sequence stars with a convective core, internal magnetic fields are a prime candidate to resolve this discrepancy. In this talk, we show how the magnetic field strength in the deep stellar interior may be constrained for intermediate- to high-mass main-sequence stars, thanks to the high quality and quantity of the data provided by space missions such as TESS. We evaluate the influence of magnetic fields on the periods of gravity-mode pulsations, which probe the deep stellar interior. We find that the effects of magnetic fields on gravity-mode pulsations differ significantly from those of rotation. They depend on the pulsation mode geometry and increase with pulsation period. We characterise these effects for a range of different stellar models, with, e.g., varying mass, age, near-core mixing, (uniform) rotation rate and magnetic field strength. |
| 88 | Samuel Grunblatt | University of Hawaii Institute for Astronomy | Planets Around Red Giant Stars with TESS | Every Sun-like star will eventually evolve into a red giant, a transition which can profoundly affect the evolution of a surrounding planetary system. The timescale of dynamical planet evolution and orbital decay has important implications for planetary habitability, as well as post-main sequence star and planet interaction, evolution and internal structure. We demonstrate how photometric surveys preceding TESS have vastly improved our understanding of evolved planetary systems. We then describe initial results from the first asteroseismic census of known red giant planet hosts using TESS full frame images (FFIs). We also discuss all red giant planetary system candidates discovered by TESS to date. Finally, we illustrate the potential of FFIs from the full 2-year primary TESS mission to increase the known transiting planet population of red giants by more than an order of magnitude, and advocate for continued all-sky coverage at a 30 minute cadence or higher to maximize the potential to understand late-stage planetary evolution with TESS. |
| 89 | Qinan Wang | Department of physics and astronomy, Johns | TESS EXtragalactic Alert System (TEXAS) | The continuous 30 minute cadence of TESS provides critical early time data of SN and other transients, probing a window that is inaccessible to traditional ground-based surveys. Still, complementary early follow-up spectroscopic and |

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| | | Hopkins University | | photometric observation are crucial. We are developing the TESS EXtragalactic Alert System (TEXAS), triggering on any publicly available new transient within the TESS footprint, and providing supplemental information essential for prioritizing the follow-up. Our system will be comprised of a few standalone modules: (1) a listener daemon for collecting real-time transient alerts from external servers (e.g. TNS), (2) a catalog of nearby extragalactic sources (with z < 0.04), from NED and other databases, and a set of open-source routines for calculating the likelihood of a transient event being associated with a specific host, and (3) collect any other useful data, e.g. GRB alerts. We show the photometric and spectroscopic follow-up on several nearby transients in the TESS FOV triggered by TEXAS. |
| 90 | Derek Buzasi | Florida Gulf Coast University | Searching for Gamma-Ray Burst Progenitors Using TESS FFIs | Gamma-ray bursts (GRBs) are the brightest electromagnetic events known to occur in the universe, and are characterized by brief flashes of gamma-ray energy concentrated from 0.1 to 1 MeV. Bursts are variable, non-thermal, and short-lived, with initial burst lifetimes typically less than 100 s. The GRB itself is typically followed by longer-lasting afterglow radiation at wavelengths ranging from X-ray to radio. However, in the majority of cases, the progenitor to the GRB (in many models, anticipated to be a supernova) must be inferred rather than observed, because the GRB field was not being monitored prior to the burst. In this paper, we report on an effort to use the TESS fields to search for visible progenitors to GRBs detected during and immediately following TESS FFI observations, taking advantage of the large field of view and systematic observing pattern of TESS in an attempt to find such progenitors directly. |
| 91 | Harrison James Abbot | Australian National University | Real Time Detection of Shock Physics in TESS | By utilising ground based telescopes to discover supernovae (SNe) that occur within the TESS fields, we have triggered early spectroscopic time series of young SNe, allowing us to see the spectral signatures of shocks unfold before peak brightness. The high cadence photometry of TESS enables us to produce exquisite light curves of these shocks in real time; a feat which has seldom been successful in the past. In this talk, I will present the work done to date in finding these shock signatures and subtle features in exotic transients. |
| 92 | Patrick Vallely | The Ohio State University | TESS and SALT Observations of ASASSN-18tb, A Most Unusual Type Ia Supernova | We present photometric and spectroscopic observations of the unusual Type Ia supernova ASASSN-18tb, including a series of SALT spectra obtained over the course of nearly six months and the first observations of a supernova by TESS. We confirm a previous observation by Kollmeier et al. (2019) showing that ASASSN-18tb is the first relatively normal Type Ia supernova to exhibit clear broad ($\backsim$ 1000 km s$^{-1}$) $H\alpha$ emission in its nebular phase spectra. Despite the strong $H\alpha$ signature at late times, we find that the early rise of the supernova shows no evidence for deviations from a single-component power-law. We find that the $H\alpha$ luminosity remains approximately constant after its initial detection at phase $+37$ d, and that the $H\alpha$ velocity evolution does not trace that of the Fe~III $\lambda$4660 emission. These suggest that the $H\alpha$ emission arises from circumstellar medium rather than swept up material from a non-degenerate companion. However, ASASSN-18tb is strikingly different from other known CSM-interacting Type Ia supernovae in a number of |

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| | | | | significant ways. Those objects typically show an $H\alpha$ luminosity two orders of magnitude higher than what is seen in ASASSN-18tb, pushing them away from the empirical light curve relations that define "normal" Type Ia supernovae. Conversely, ASASSN-18tb exhibits a fairly typical light curve and luminosity for an underluminous or transitional SN Ia, with $M_R \approx 18.1$ mag. Moreover, ASASSN-18tb is the only SN Ia showing $H\alpha$ from CSM interaction to be discovered in an early-type galaxy. |
| 93 | Joseph Twicken | Science Processing Operations Center (SPOC) | First Year (Southern Hemisphere) Threshold Crossing Events in the TESS SPOC Transit Search | The Transiting Exoplanet Survey Satellite (TESS) mission was designed to survey bright stars in the greater Solar neighborhood in search of transiting exoplanets. Science operations began in the southern (ecliptic) hemisphere on July 25, 2019. Observation sectors overlap at the ecliptic poles so that target stars near the poles in each hemisphere may be observed continuously for one year. Data are acquired at a 2-minute cadence for 16,000-20,000 pre-selected target stars in each observation sector. In addition, full frame images (FFIs) are acquired at a 30-minute cadence. The 2-minute target data are processed in the Science Processing Operations Center (SPOC) pipeline at NASA Ames Research Center. The photometry pipeline produces a systematic error corrected light curve for each target star. Light curves are searched for transiting planet signatures in the Transiting Planet Search (TPS) component of the SPOC pipeline. Light curves are searched by sector for all target stars, and separately for target stars observed in multiple sectors. Potential transit signals for which the pipeline transiting planet detection threshold is exceeded and for which a series of transit consistency tests is passed are referred to as Threshold Crossing Events (TCEs). Light curves with TCEs are processed in the Data Validation (DV) component of the pipeline. TCEs are characterized in DV with limb-darkened transiting planet models. The residual light curves after transits are removed are iteratively searched for signatures of additional transiting planets. We present an overview of the single- and multiple-sector results of the SPOC pipeline transit search in the southern hemisphere as of July 2019. The full TCE population and the population of SPOC TCEs that were later identified as TESS Objects of Interest (TOIs) are both highlighted. Characteristics of the TCE populations implied by the transiting planet model fits are also presented. SPOC pipeline archive products are delivered to the Mikulski Archive for Space Telescopes (MAST; archive.stsci.edu/TESS) for access by the community; these include DV products by target and TCE. Funding for the TESS Mission has been provided by the NASA Science Mission Directorate. |
| 94 | Jeffrey Smith | SETI Institute | Finding Every Planet We Can: TESS SPOC Pipeline Transit Detection Modeling and Tuning | With the primary development of the TESS SPOC Science Processing Pipeline complete and almost a year's worth of data available and processed we can now begin the arduous task of tuning the pipeline to maximize planet detection. We present here methods used to tune the Pre-Search Data Conditioning and Transiting Planet Search components of the SPOC pipeline to maximize the yield of 1-4 Earth radii planets. Quality of light curves and predicted recovery rates are presented based on flight data, simulated data and current models. |

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| 95 | Lorenzo S. Colombo | Universita degli Studi di Padova | DELICE - DEtrending LIght Curves of Exoplanets A New Pipeline for Light-Curve Detrending | I have developed a new pipeline to correct for systematic effects harming the photometric precision of light curves (LCs) in crowded environments. I developed DELICE starting from Kepler-2.0 (K2) mission data, and then applied it to the TESS mission sectors. The two spacecrafts have many similarities: both TESS and K2 observe large areas of the sky and have a low angular resolution. The Kepler and TESS mission observed (and will observe) a large number of stellar clusters. The Padova group has a long expertise in high precision photometry of stars in crowded environments, and developed an innovative technique to extract accurate light curves of stars in stellar cluster both from Kepler and TESS images. However, these raw LCs are affected by systematic effects that need correction, and DELICE takes advantage of the large number of available LCs (cotrending) and exploits the precise reconstruction of star positions on the detector (detrending), preserving the true astrophysical signals of the targets. The cotrending corrects systematic effects that are common to many LCs (e.g. heater cycles), while the detrending corrects for systematic effects on single stars (e.g. flux - spacecraft pointing drift correlation). The goal of DELICE is to provide an easy-to-use and effective tool for the removal of systematic effects harming the LCs, thus enabling the search for planet candidates and the characterization of stellar variability. DELICE is completely general, and can be applied to similar large LCs datasets, like the past K2 mission campaigns or the TESS mission sectors and, in the future, the PLATO light curves. |
| 96 | Susan Mullally | STScI | Integrating the TESS Science Archive Into Your Python Code | The Mikulski Archive for Space Telescopes (MAST), home of the TESS science data, provides many different ways to retrieve and interact with that data. We give a quick overview of what is available, including a set of Jupyter notebooks that teach how to use the MAST programmatic interface to interact with TESS data. Because of the size of the data set, one of the most powerful and flexible ways is to access the data programmatically. We will discuss some of the high-level information about how MAST stores its data. Then we demonstrate how to use the MAST Astroquery code to search for TESS observations, FFI cutouts, community contributed products and TESS Input Catalog. We do this by reproducing or expanding on recent TESS science papers as a way to show scientifically interesting ways to use these tools. By becoming comfortable with these tools, users will have all of the MAST holdings available at their fingertips within their analysis code, including HST, Kepler and eventually JWST data. Since TESS is an all-sky survey mission, these synergies will likely be abundant. |
| 97 | Adina Feinstein | University of Chicago | The Eleanor Software | During its two year prime mission the Transiting Exoplanet Survey Satellite (TESS) will perform a time-series photometric survey covering over 80% of the sky. This survey comprises observations of 26 24x96 degree sectors that are each monitored continuously for approximately 27 days. The main goal of TESS is to find transiting planets around 200,000 pre-selected stars for which fixed aperture photometry is recorded every two minutes. However, TESS is also recording and delivering Full-Frame Images (FFIs) of each detector at a 30 minute cadence. We have developed an open-source software, eleanor, will provide light curves for 26 |

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| | | | | million sources in the TESS Input Catalog brighter than I=16 throughout the Southern Hemisphere. eleanor is also available for users to generate their own light curves. I will describe the methods used in eleanor to produce light curves that are optimized for planet searches. The tool performs a background subtraction, aperture and PSF photometry, decorrelation of instrument systematics, and cotrending using principal component analysis. I will specifically discuss the most recent improvements to these methods and the next steps we plan on taking to maximize the photometric capabilities of the TESS FFIs. |
| 98 | Tim White | The Australian National University | Observing the Brightest Stars with TESS | TESS is providing a wonderful opportunity to observe the brightest stars in the sky, stars that have a long and rich history of observation. However the brightness of such stars present unique challenges, with saturation of the TESS cameras leading to long bleed columns that may bleed off the edge of the CCD. Stars brighter than 2nd magnitude are not being calibrated through the TESS Science Processing Operations Center pipeline, and there may still be difficulties with fainter stars. I will discuss artefacts that may be present in the light curves of these bright stars, such as transit-like signals caused by insufficient background correction during Earth and Moon shine events. I will present our methods for overcoming these issues and first science results from these light curves, including the detection of solar-like oscillations in the stars Procyon and beta Hydri. Our improved light curves for the brightest stars will enable numerous science applications, including the detection of transiting planets orbiting naked-eye stars, pulsations in massive stars, tests of asteroseismic scaling relations for red giants, and studies of interacting binaries. |
| 99 | Emil Knudstrup | Stellar Astrophysics Centre, Aarhus University | Detecting Astrophysical Events in TESS Data Using Deep Learning | One of TESS' primary objectives is to discover and characterize 50 Earth-like planets and it is the hope that these planets will be found among the 200,000 preselected targets observed with a cadence of 2 minutes. The standard routines for automatic planet detection (e.g., the box least squares (BLS; Kovacs et al. (2002)) method) are excellent at picking out planets (both Earth-sized and bigger) transiting multiple times and orbiting stars with modest variability, they are not as well suited for detecting the oddballs like evaporating planets, single transiting planets (monotransits), etc. An oddly shaped transit or any other atypical astrophysical phenomenon is traditionally (and often easily) identified by a trained human eye. These events are naturally very interesting, however, eyeballing all stars is a daunting task, especially as the TESS data is not only comprised of the 200,000 stars observed in 2 minute cadence, but also a set of full-frame images (FFIs) covering the entire field of view (FOV) for a given sector, yielding light curves for millions of stars observed with a cadence of 30 minutes. This is why an automatic way of characterizing these systems is desirable. We are therefore training a {\it convolutional neural network} (CNN). It identifies the oddballs and will support traditional detection algorithms (such as BLS). It will label a light curve as one of the following: planetary candidate, eclipsing binary, variable star, oddball (i.e., a weirdly shaped or monotransit), or seemingly featureless. Here we present our results for the available TESS data and highlight some particular systems. |

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| 100 | Dr Hugh Osborn | Laboratoire d'Astrophysique de Marseille | Rapid Classification of TESS Planet Candidates with Convolutional Neural Networks | As space-based survey missions such as TESS provide more and more planet candidates, accurately and rapidly classifying transiting exoplanets from photometry is a goal of growing importance. Here I present results from on-going collaboration between machine learning and astronomical researchers to perform this work using neural networks. This includes results as obtained on real Kepler planet candidates from DR24 (98% average precision, Ansdell et al 2018), and results from 4 sectors of high-fidelity, pixel-level TESS simulations data (97% average precision, Osborn et al 2019). I will also present the first application of a neural-network based classifier to real TESS data, from which we recover 61% of TOIs coincident with candidates, and propose a further 200 TCEs as planet candidates for which follow-up is ongoing. |
| 101 | Sascha Grziwa | RIU-PF, at the University of Cologne, Germany | EXOTRANS for the Advanced Detection and Evaluation of Transiting Planets in the Era of TESS. | EXOTRANS was developed by the Rhenish Institute for Environmental Research (RIU-PF) to detect planetary transits in stellar light curves monitored by space telescopes. The pipeline was first applied to the stellar light curves from the CoRoT space mission (2006-2013). Improved versions of the pipeline were used to detect candidates in light curves of KEPLER and K2 as part of the KESPRINT collaboration. (*) Now TESS is an even bigger challenge providing a huge number of light curves, 'Target Pixel Files' and "˜Full Frame Images' to be searched for planetary candidates. The KESPRINT collaboration uses several "˜competing' pipelines to maximize the number of detected candidates, to check for false positives and to select the best candidates for follow-up observation. For this challenge our detection pipeline was further improved. EXOTRANS uses wavelet-based filter methods to separate stellar variation and systematic instrumental effects from light curves to detect faint transits. The improved 'Advanced-BLS' detection algorithm searches light curves in multiple cycles removing previously detected transits to detect additional fainter transits. The detected transits are modelled automatically to estimate system parameters and evaluated using a neuronal network to identify false positives. In this way it is possible to provide the best candidates for follow-up observation inside our KESPRINT collaboration. Results from our KESPRINT collaboration will be presented. (*) The KESPRINT collaboration was founded during the K2 mission to bring together scientists around the world with expertise in several fields of exoplanet research for the detection, modelling and confirmation of exoplanets. |
| 102 | G. Bruce Berriman | Caltech/IPAC-NExScI | Science-Grade Co-Added Mosaics Of TESS Full-Frame Images | The TESS images, aimed primarily at driving Exoplanet science, are also a valuable resource in studying diffuse emission in the Universe. We describe how we are using the Montage Image Mosaic Engine, a mature Open Source toolkit, to create deep, co-added image mosaics, flux calibrated with the TESS point sources, of all FFIs of the southern hemisphere that will be released from Mission Year 1. The mosaics are science-ready, in that they preserve the calibration and astrometric fidelity of the input images. A proof-of-concept co-added mosaic of Camera 4 for sectors 1-5 demonstrated the feasibility of the project and informed the processing requirements needed for it. The effort showed that a spatial over-sampling at 6 arcsec (3.5x the native image |

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| | | | | sampling) preserved all the information where images overlapped. Montage uses global models of the background radiation to rectify it to a common level across all the images (an approach unique to Montage), the mosaics do show residual artifacts, such as rings of scattered light near the south ecliptic pole, and what resembles vignetting or scattering near the edges of the images. We are therefore creating custom tools for analyzing these residual backgrounds on local rather than global spatial scales, rectifying their effects across the images and thence determining the optimum way of achieving the deepest coverage of the sky. Stripes associated with the strapping in the CCDs are seen in the mosaics, localized to specific pixel columns. We are developing a one-dimensional smooth background removal algorithm that will leave the extended objects unaffected. When the analysis and tool development is complete, the mosaics will be ready for cutting-edge research on diffuse extended emission; e.g. derivation of the halo mass profiles of galaxies; identification of galaxy cannibalism leftovers; derivation of stellar halo fractions for different mass and morphology galaxies; identification of local stellar streams that cross over sectors and other galaxy cannibalism leftover; searches for supernovae remnants and planetary nebulae. The proof-of-concept mosaic is freely available through the NExScI TESS ExoFOP web site at https://exofop.ipac.caltech.edu/tess/contributed/TESSMosaic/. Future mosaics will be served through this web site as well. All dedicated software tools created in this project will be made freely available through the ExoFOP and as part of the Montage distribution. In accord with the Montage design, all the tools will be written in C for performance, and will be made accessible through Python 3 environments. |
| 103 | Ethan Kruse | NASA Goddard Space Flight Center | Making the Most of Planets in the Continuous Viewing Zone | Stars in TESS's continuous viewing zone will have the longest baseline observations, allowing for planets to be found at smaller radii and longer periods than other regions of the sky. Transit timing variations and other dynamical interactions may also be found with the longer baseline. However, the vast majority of the ~100,000 stars in the CVZ will only be observed with long cadence FFIs, reducing the potential science yield for any planets around these stars. In this talk I describe our efforts to identify planet candidates in the CVZ using FFI data from early sectors; our goal is to get as many planet candidates added to the short cadence list as possible for the remaining sectors. I present planet candidates found in our search and early science results from this effort. |
| 104 | Simon Ebo | University of Central Lancashire | MOSES: MHT Optical Star and Exoplanet Survey | We present MOSES: MHT Optical Star and Exoplanet Survey, a new stellar variability and exoplanet survey using the University of Central Lancashire's 0.7-m PlaneWave CDK700 Moses Holden Telescope (MHT). Since September 2018 the MHT has been used to intensively survey a region of 7-square degrees in the constellation of Cassiopeia. The survey region is produced by tiling an array of 4 a— 4 pointings of the 40.2 a— 40.2 arcmin FoV. This observing strategy ensures repeat 60-s exposures of each individual tile are obtained with a cadence of around 24 min. In total the survey is monitoring the photometry of >40,000 stars with V-band magnitudes in the range of 12-17.25 mag. A database directory containing unique time series data files for every |

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| | | | | star in the MOSES field has been created, using the WCS to identify unique stars. The database is populated by a separate python code which performs aperture photometry on every object in a given frame. As new data is collected, the code recognises whether a star has been previously observed and adds the new data to the respective file or creates new files for every new star observed. This will gradually build up increasingly long timebase light curves for every star observed. These data will be used to confirm (or detect) exoplanets in parallel with data from the latest generation exoplanet space mission, the Transiting Exoplanet Survey Satellite (TESS). Unlike previous missions, TESS is performing a full-sky survey with four cameras observing the sky in strips for 27 d. This 27-d timebase may not record sufficient numbers of transits to confirm certain exoplanets' existences, therefore ground-based follow up observations are essential to lengthen the TESS light curves. The MOSES database will contain these necessary ground-based observations, allowing the confirmation of a greater number of exoplanets. |
| 105 | Knicole Colon | NASA GSFC | An Overview of Targets Observed by Both Kepler and TESS | Last year, 2018, was momentous for (at least) two reasons. First, the Kepler spacecraft officially ceased operations and retired. Second, TESS launched and successfully began science observations. While the spacecraft only overlapped in their operations for a short period of time, the synergy between the two is strong. By virtue of its wide field of view and nearly-all-sky survey, TESS sky coverage spans a majority of the Kepler prime mission field and dips ever so slightly into fields that were covered by the K2 mission. Here, we present an overview of the variety of targets that have been observed by the Kepler and K2 missions and have been (or will be) observed by TESS. |
| 106 | Mma Ikwut-Ukwa | Center for Astrophysics \| Harvard & Smithsonian | The K2 + TESS Synergy | In its 2-year primary mission, the on-sky TESS footprint complements that of the K2 mission, with the former offset from the ecliptic plane and the latter forced to observe only near the ecliptic. However, the K2 fields extend far enough from the ecliptic plane that parts of those fields have already been or will be observed for 27 days by TESS. Using observations from both missions, we are able to further study the known exoplanetary systems discovered by K2 and vet new exoplanet candidates from TESS. The combined data set will also prove valuable for various aspects of stellar astrophysics. We will present results from the TESS and K2 overlap analysis, including the observations of known planets and TESS candidates, and discuss the value of K2 observations in the era of TESS. |
| 107 | Xinyu Yao | Lehigh University | Precovery of TESS Single Transits with KELT | During the Transiting Exoplanet Survey Satellite (TESS) prime mission, 74% of the sky area will have an observational baseline of only 27 days. For planets with orbital periods longer than 13.5 days, TESS can capture only one or two transits, and the planet ephemerides will be difficult to determine from TESS data alone. Follow-up observations of transits of these candidates will require precise ephemerides. We explore the use of existing ground-based wide-field photometric surveys to constrain the ephemerides of the TESS single-transit candidates, with a focus on the Kilodegree Extremely Little Telescope (KELT) survey. We |

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| | | | | insert simulated TESS-detected single transits into KELT light curves and evaluate how well their orbital periods can be recovered. We find that KELT photometry can be used to confirm ephemerides with high accuracy for planets of Saturn size or larger, with orbital periods as long as a year, and therefore span a wide range of planet equilibrium temperatures. We also demonstrate that by incorporating small amounts of simulated RV follow up data, the recovery rate can be increased significantly. The resulting ephemerides can be used for follow-up observations to confirm candidates as planets, eclipsing binaries, or other false positives, as well as to conduct detailed transit observations with ground-based or space-based facilities. |
| 108 | Ward S. Howard | UNC Chapel Hill | Superflares with TESS and Evryscope | We search for superflares from 4,068 cool stars in over 2 years of Evryscope photometry, focusing on those with high-cadence data obtained by both Evryscope and TESS. The Evryscope array of small telescopes observed 576 large flares from 285 flare stars, with a median energy of $10^{34.0}$ erg. Since 2016, Evryscope has enabled the detection of rare events from all stars observed by TESS through multi-year, high-cadence continuous observing. We report ~2X the previous largest number of $10^{34}$ erg flares observed from nearby cool stars at high cadence. We find 8 flares that increased the stellar brightness by at least 3 g' magnitudes, with the largest flare reaching 5.6 magnitudes and releasing $10^{36.2}$ erg. We also observe a $10^{34}$ erg superflare from TOI-455, a mid-M star with a rocky planet candidate. We measure or constrain the annual superflare rate of each TESS flare star, and explore the dependence of superflare occurrence upon stellar age, rotation, and spectral type. We find a saturation in superflare rates for quickly-rotating cool stars. We explore the effects our super-flaring stars may have on ozone loss to planetary atmospheres: we observe 1 superflare with sufficient energy in the UV to photo-dissociate all ozone in an Earth-like atmosphere in a single event, and 24 other superflares that reach at least 10% of this energy. We also find 17 stars that may deplete an Earth-like atmosphere via repeated flaring; these emit at least 1 flare of $10^{34}$ erg every 10 d. Of the 1690 stars around which TESS may discover temperate rocky planets, we observe 49 to exhibit large flares. |
| 109 | Daniel Bayliss | University of Warwick, Coventry, United Kingdom | The NGTS Project - Enhancing the Science from TESS | The NGTS facility consists of twelve 20cm-telescopes situated at Paranal Observatory. Each telescope is coupled to a red-sensitive CCD camera and an extremely precise guiding system that maintains sub-pixel stability. The combination of these design features gives NGTS the most precise time-series photometry of any ground-based transit survey. I will present some of the exciting results from the NGTS facility, focusing on the discoveries of rare and interesting planetary systems. I will then discuss the power of NGTS to enhance the science output from the TESS mission, particularly with respect to long period transiting planets and planets transiting very bright host stars. These enhancements to TESS stem from the ability of NGTS to deliver longer duration monitoring, higher spatial resolution imaging, and higher time cadence imaging. I will conclude by outlining the results we may expect over the coming years from the combined power of NGTS and TESS. |

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| 110 | Jan van Roestel | Caltech | The ZTF-TESS survey | The Zwicky Transient Facility is a ground-based synoptic survey telescope with a field-of-view of 47 square degrees located at Mount Palomar (CA). With TESS set to observe the northern sky, ZTF will start dedicated nightly observations of the TESS sectors. ZTF will complement the TESS observations with a smaller pixel scale (1"), multicolour observations (g&r), and deeper limiting magnitude ($\sim$ 20.5). ZTF will release an 'alert' for any source that is visible in the difference images as soon as the data has been processed, which allows for the early detection of transients in the TESS fields. Lightcurves for all sources in the ZTF images will be released as soon as TESS completes its observation of a particular sector. These mutlicolour lightcurves will be especially useful for variable star science in crowded regions. |
| 111 | Ana M. Heras | ESA | ESA's PLATO Mission: Searching for Habitable Exoplanets Orbiting Sun-like Stars | PLATO is the third medium-class mission in ESA's Cosmic Vision programme. Scheduled to launch in 2026, PLATO will combine the detection and characterisation of exoplanets using the transit method, with the study of their host stars by asteroseismology. PLATO's core observing sample will consist of bright Sun-like stars of V < 11, which will enable us to determine with unprecedented accuracy stellar ages and the bulk properties of small planets, including their masses from radial velocity measurements at ground-based observatories. For statistical studies, PLATO will also monitor a large sample of Sun-like stars with V < 13 and a sample of cool late-type dwarfs with V < 16, along with a small sample of bright stars distributed over the HR diagram observed in two colour bands. To achieve the main objective of studying Earth-size planets orbiting up to the habitable-zone of Sun-like stars, the baseline plan is to observe two sky fields for two years each. Alternative scenarios include the observation of one sky field for three or four years, and a sequence of shorter pointings at several sky fields. To profit from PLATO's photometric capabilities in as many areas of astronomy as possible, the general community will be invited to submit proposals on complementary science topics in the framework of a guest observer's programme. The PLATO payload consists of four groups of six cameras each, pointing at different directions of the sky with overlapping regions, and covering a total field of about 2250 deg2 with four different sensitivities. Two additional cameras are dedicated to the brightest stars in the samples, providing two-colour information and acting as fine guidance sensor. The satellite will operate in an orbit around the second Lagrange point, L2. |
| 112 | Kate Isaak | European Space Agency/ESTEC | CHEOPS: CHaracterising ExOPlanet Satellite – Community Access to CHEOPS | CHEOPS (CHaracterising ExOPlanet Satellite) is the first exoplanet mission dedicated to the search for transits of exoplanets by means of ultrahigh precision photometry of bright stars already known to host planets. The first S- or small-class mission in ESA's Cosmic Vision 2015-2025, the mission is a partnership between Switzerland and ESA, with important contributions from 10 other member states. It will provide the unique capability of determining accurate radii for a subset of those planets in the super- Earth to Neptune mass range, for which the mass has already been estimated from ground- based spectroscopic surveys. It will also provide precision radii for new planets discovered by the next generation of ground- and space-based transit surveys. By combining known masses with CHEOPS sizes, it will be |

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| | | | | possible to determine accurate densities of subsaturn size planets, providing key insight into their composition and internal structure. By identifying transiting exoplanets with high potential for in-depth characterisation – for example, those that are potentially rocky and have thin atmospheres - CHEOPS will also provide prime targets for future instruments suited to the spectroscopic characterisation of exoplanetary atmospheres. The high photometric precision of CHEOPS will be achieved using a photometer covering the $0.35 - 1.1\mu$m waveband, designed around a single frame-transfer CCD which is mounted in the focal plane of a 30 cm equivalent aperture diameter, f/5 on-axis Ritchey-Chretien telescope. CHEOPS will reach a photometric precision of 20 parts per million in a 6 hour observation of a v-band magnitude 9, G-type ($T_{eff}$ =5500K) dwarf, commensurate with measuring the transit depth of an Earth-size planet transiting the same star to a signal-to-noise of 5. In the case of fainter stars, CHEOPS will reach a photometric precision of 85 parts per million in a 3 hour observation of a v-band magnitude 12, K-type ($T_{eff}$ =4500K) dwarf. CHEOPS will launch in the timeframe of October-November 2019. 80% of the observing time in the 3.5 year nominal mission lifetime will be taken by the Guaranteed Time Programme, defined by the CHEOPS Science Team. The remaining 20% will be available to Guest Observers from the Community through a competitive proposal submission process, comprising annual Calls and a discretionary time component. In this poster we give an overview on Community access to CHEOPS, with an emphasis on the ESA-run Guest Observers Programme. |
| 113 | Didier Queloz | U. Cambridge | CHEOPS Guarantee Time Observation Program | TBD |
| 114 | Billy Edwards | University College London (UCL) | An Updated Study of Potential Targets for Ariel | Thousands of exoplanets have now been discovered with a huge range of masses, sizes and orbits. However, the essential nature of these exoplanets remains largely mysterious: there is no known, discernible pattern linking the presence, size, or orbital parameters of a planet to the nature of its parent star. We have little idea whether the chemistry of a planet is linked to its formation environment, or whether the type of host star drives the processes controlling the planet's birth and evolution. Progress with these science questions demands a large, unbiased spectroscopic survey of exoplanets and Ariel has been selected as ESA's M4 mission for launch in 2028. By studying a large and diverse population of exoplanetary atmospheres, Ariel will provide insights into planetary formation and evolution within our galaxy. I will present the latest study of potential targets for Ariel in which we assessed the suitability of currently-known exoplanets and predicted TESS yields. This list of planets has been utilised to form an example Mission Reference Sample (MRS) to demonstrate that Ariel's mission goals could be met from this planetary population. I will also present the results from the latest studies into the expected scientific capability of Ariel, particularly simulations of planets found by TESS thus far. |