Name	Affiliation	Title	Abstract
Eliana Amazo-Gomez	Max Planck Institute for Solar System Research	Comprehensive Analysis of Simultaneous Photometric and Spectropolarimetric Data in a Young Sun-like Star: Rotation Period, Variability, Activity & Magnetism.	Combined and simultaneous observations of high-precision photometric time-series acquired by TESS observatory and high-stability, high-accuracy measurements from ESO/HARPS telescope allow us to perform a robust stellar magnetic-activity analysis. We retrieve information of the photometric variability, rotation period and faculae/spot coverage ratio from the gradient of the power spectra method (GPS). In addition magnetic field, chromospheric activity and radial velocity information are acquired from the spectropolarimetric observations. We aim to identify the possible correlations between these different observables and place our results in the context of the magnetic activity characterization in low-mass stars.
Tim Bedding	University of Sydney	Asteroseismology of High-Frequency Delta Scuti Stars with TESS	Asteroseismology is a powerful tool for probing stellar interiors and has been applied with great success to many classes of stars. It is most effective when there are many observed modes that can be identified and compared with theoretical models. Among evolved stars, the biggest advances have come for red giants and white dwarfs. Among main-sequence stars, great results have been obtained for low-mass (Sun-like) stars and for hot high-mass stars. However, at intermediate masses (about 1.5 to 2.5 $M_{\odot}$), results from the large number of so-called delta Scuti pulsating stars have been very disappointing. The delta Scuti stars are very numerous (about 2000 were detected in the Kepler field, mostly in long-cadence data). Many have a rich set of pulsation modes but, despite years of effort, the identification of the modes has proved extremely difficult. One problem is that only a seemingly random subset of possible modes are excited, making it difficult to identify a regular pattern. This is compounded by rapid rotation and by the low radial orders, both of which tend to spoil the regularity. TESS observations have finally led to a breakthrough. We have focussed on the higher-frequency delta Scuti stars (above about 30 c/d), since these seemed to offer the best hope for identifying regular patterns. The large set of TESS short-cadence light curves are ideally suited to this. We have been able to identify dozens of delta Scuti stars with very regular pulsation spectra. For the first time, we can identify the modes (assigning n and l values) and compare the frequencies with theoretical models. These results will enable TESS to open up intermediate-mass stars to the power of asteroseismology, allowing us to place strong constraints on masses, ages and internal rotation. We are currently preparing a paper for Nature or Nature Astronomy.
Francois Bouchy	Geneva Observatory	Mass Measurement with ESPRESSO of Rocky Worlds Detected by TESS	TESS follow-up efforts using high-precision spectrographs are ongoing to characterize transiting planets with radii below $4R_{earth}$, however still with a limited scope: only the more massive planets on shorter-period orbits are amenable to robust mass measurements. ESPRESSO is the new highly-stabilized and high-resolution spectrograph in operation at ESO/VLT since last September. ESPRESSO represents a breakthrough in this field: its 2-magnitude gain and improved radial velocity precision with respect to HARPS-like instruments allows a thorough exploration of the rocky world population with radii below $1.8R_{earth}$ detected by TESS. We

			will present an overview of the ESPRESSO performances, describe the TESS targets selected for the ESPRESSO Guarantee Time Observing program, and the first results obtained.
Luke Bouma	Princeton University	The Early Arrival of WASP-4b	In a search for timing anomalies in previously known hot Jupiter systems, one object has stood out: WASP-4b transited 81.6 ± 11.7 seconds earlier than expected, based on data stretching back to 2007. Its orbital period also appears to be shrinking, by 12.6 ± 1.2 milliseconds per year. The period change could be caused by tidal orbital decay, apsidal precession, or the gravitational influence of a third body. Confirming whether any of these processes are at work would be interesting because it would teach us about the forces that govern the lives and potentially ultimate fates of hot Jupiters. Though more data are needed to understand the specific case of WASP-4b, further TESS observations should enable broader timing studies of the hot Jupiter population. Such studies will likely improve our understanding of both planet-planet and planet-star interactions.
Dominic M. Bowman	Instituut voor Sterrenkunde, KU Leuven	Low-Frequency Gravity Waves in Massive Stars Revealed by High-Precision K2 and TESS Photometry.	Almost all massive stars inevitably end their lives in a violent supernova explosion and form a black hole or neutron star. Supernovae enrich the interstellar medium with chemical elements and impact the next generation of star formation and the evolution of their host galaxy. However the mass of the compact remnant and the supernova chemical yield depend strongly on the internal physical properties of the progenitor star, which are currently not well-constrained from observations. The large theoretical uncertainties in the models of massive star interiors accumulate throughout stellar evolution, with the lack of a robust theory of stellar structure and evolution being particularly pertinent for evolved massive stars such as blue supergiants. Asteroseismology of stellar oscillations allows us to uniquely probe stellar interiors, yet inference from massive stars has been limited by a dearth of detected pulsations in such stars until recent space photometry missions. In this talk, I report on the diverse pulsational variability discovered in a large sample of massive stars observed by the K2 and TESS space missions. The discovery of coherent pulsation modes and stochastic low-frequency gravity waves in numerous blue supergiants allow the interior properties of massive stars to be mapped from the main sequence to the later stages of their evolution. Asteroseismic modelling provides important constraints on ages, core masses, interior mixing, rotation and angular momentum transport, which are essential input parameters in stellar evolution models. The discovery of pulsational variability in space photometry of blue supergiants provides a necessary first step towards a data-driven empirical calibration of theoretical evolution models for the some of most massive and short-lived stars in the Universe.
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, 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 Tmag<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.
Theron Carmichael	Harvard University	Using TESS to Understand the Brown Dwarf Population	Brown dwarfs are defined as objects with masses between 13 and 80 times the mass of Jupiter. These limits are somewhat arbitrarily chosen to be the mass at which deuterium fusion takes place ($13M_{jup}$) and the mass at which hydrogen fusion takes place ($80M_{jup}$). Though motivated by physical processes, these mass limits—particularly the lower mass limit—do not provide much insight on the formation mechanisms of the objects at these masses. To better understand brown dwarf formation mechanisms, we look to the brown dwarfs that orbit main sequence stars to examine their physical and orbital properties. Brown dwarfs that transit stars are quite rare with only 19 published and so we seek to find more like these with the transit method. Given the nature of the internal pressure support mechanisms of brown dwarfs (electron degeneracy pressure), we expect them to be between at least the size of Saturn and Jupiter, but they may be even more inflated if they are younger than a few million years. This means that for most main sequence stars and even stars that are slightly evolved, the transit depths produced by brown dwarfs will be well within the sensitivity of the premier transit survey mission for the next decade: the TESS mission. Additionally, because it is fully sensitive to short-period brown dwarfs that transit bright stars during its primary mission, TESS is well-suited to characterizing a parameter space of the brown dwarf population that has very few known objects. Transit light curves allow us to calculate a brown dwarf's radius while we rely on follow up spectra and radial velocity measurements of the host star to determine a brown dwarf's mass. These spectra also allow us to derive the metallicity and effective temperature of the star while a sequence of radial velocity measurements reveal the eccentricity of the brown dwarf orbit. Together, the mass, radius, and orbital eccentricity of a brown dwarf hold valuable information in testing substellar evolutionary models and help us understand how the evolution of a brown dwarf might be different when it orbits a star. Ultimately, these models help connect the evolution of a brown dwarf to how it formed, so, as we study this population, we should reconsider the arbitrary mass limits used to define brown dwarfs and base them instead on their formation histories. In this presentation, we report the detection and characterization of a brown dwarf from TESS Cycle 1 and we discuss its importance to the population of transiting brown dwarfs. This brown dwarf, along with a few others discovered by K2, falls in the middle of the driest part of the so-called "brown dwarf

			desert". We show where substellar evolutionary models agree and disagree with observations of brown dwarfs and discuss some possible explanations why.
Ashley Chontos	Institute for Astronomy, University of Hawaii	Exoplanets Orbiting Asteroseismic TESS Stars	Individual studies of exoplanets orbiting asteroseismic stars have allowed for some of the most precisely characterized systems currently known to date. In addition, ensemble studies have yielded unprecedented insights into proposed mechanisms for planet formation and evolution. The Transiting Exoplanet Survey Satellite (TESS) is expected to double the number of planets found around asteroseismic stars, thus providing stronger constraints for physical processes that occur in planetary systems. Here we present the discovery of TOI 197.01, the first transiting planet identified by TESS for which asteroseismology is possible. Combining asteroseismology with transit and radial velocity observations, we show that the bright ($V = 8.2$ mag) subgiant is orbited by a hot Saturn every 14.3 days. With a planet density measured to better than 15%, TOI 197.01 is one of the best characterized Saturn-sized planets to date, demonstrating the power of TESS to characterize exoplanets and their host stars using asteroseismology. Furthermore, we present additional planet candidates from the first systematic search of asteroseismic TESS host stars from sectors 1-9.
Agnieszka Cieplak	NASA GSFC	Photometric Lightcurve Signatures of Black Holes and Neutron Stars with Main Sequence Stellar Companions	Gravitational microlensing, paired with Doppler Beaming and Ellipsoidal Variations, is a new method of detecting black holes (BHs) and neutron stars (NSs) in binaries with main sequence stars. The TESS dataset with its precise photometry is especially well-suited to search for these self-lensing binaries (SLBs). I describe our search for these SLBs using TESS and present our model for these lightcurve signatures used to fit potential BH/NS candidates. I present possible examples of lightcurves with some of these signatures found through our search in the TESS dataset.
Ryan Cloutier	University of Toronto	Present and Future Efforts for the PRV Characterization of Southern TESS Planets Through the HARPS M dwarf Program	The hi-resolution HARPS spectrograph has been operating at the ESO 3.6-m telescope in La Silla, Chile for nearly two decades. In that time, HARPS has consistently achieved sub-m/s radial velocity precision that makes it particularly well-suited to the characterization of sub-Neptune-sized planets in the southern sky. On behalf of members of the on-going HARPS M dwarf program, I will present results obtained thus far into TESS's lifetime which includes the precise characterization of a number of warm terrestrial planets representing some of the closest transiting M dwarf planetary systems to the solar system. I will also discuss future plans to expand our program by obtaining simultaneous near-IR radial velocities using the NIRPS spectrograph starting in 2020. An upgrade that will further solidify HARPS + NIRPS as dominant instruments for the precise characterization of planet masses around nearby small stars.
Karen Collins	CfA/SAO	TFOP SG1 Ground-based Time-series Photometry: Goals, Status, Results and Your TESS Paper	The TESS Follow-up Observing Program Working Group (TFOP WG) is a mission-led effort organized to efficiently provide follow-up observations to confirm candidates as planets or reject them as false positives. The TFOP WG is organized as five Sub Groups (SGs). This talk discusses TFOP SG1, the ground-based time-series photometry Sub Group. TESS has 21 arcsec pixels and photometric apertures with radius ~1 arcmin, which are often contaminated with

			many stars. The primary goals of the SG1 team are to determine the source of a TESS detection and/or identify photometric false positives prior to conducting observations with more precious follow-up resources that produce high-resolution imaging and precise radial velocities. SG1 observations also improve the precision of TESS ephemerides, confirm the accuracy of TESS deblended transit depths, and/or provide transit time variation (TTV) measurements. For planet validation efforts, SG1 observations often constrain the source of the TESS detection to within a small follow-up photometric aperture, and measure transit depths in multiple filter bands to place limits on chromaticity. In addition to describing the TFOP SG1 goals, strategy, and current status, I will discuss how to access, interpret, and make use of TFOP SG1 data in your TESS paper.
Ian Crossfield	MIT	Spitzer Transits and Eclipses of TESS Planets	Soon JWST will launch and become the world-leading facility in the atmospheric characterization of transiting exoplanets. One of the key goals of TESS is to provide JWST with the best exoplanet targets for detailed characterization. I will report on our ongoing Spitzer program to measure precise transits and eclipses of the most interesting TESS planets for atmospheric study. Early results include secondary eclipses of several planets with a range of sizes, precise transit timing, and IR radii for many new systems. This program is setting the stage for HST and JWST spectroscopy of some of TESS's most intriguing new discoveries.
Jason Curtis	Columbia University	Searching for Young Exoplanets in Dispersed Clusters Guided by Gyrochronology	Knowing stellar ages is essential in this era of precision astrophysics. Our current inability to provide confident ages for stars negatively impacts the development of theories for planet formation and evolution. The K2 mission alleviated this by targeting star clusters and associations, with planets discovered in Upper Sco (10 Myr), Praesepe (670 Myr), the Hyades (730 Myr), NGC 6811 (1 Gyr), and Ruprecht 147 (2.6 Gyr). Unfortunately, the Pleiades (130 Myr) was exhaustively searched and no exoplanets were found. Clusters might then seem to be ideal targets for TESS; however, their often crowded environments combined with TESS's large pixels makes this difficult in most cases. Fortunately, Gaia offers an alternative route: a variety of spatially dispersed groupings of stars are found in DR2 including nearby stellar streams, tidal tails associated with clusters (e.g., Hyades, Praesepe, Coma Ber), and known and new young moving groups. Each brings new prospects for finding young planets in benchmarkable systems by virtue of their spatially dispersed positions compared to dense cluster cores, which mitigates the crowding challenge. We validate candidate members for these various systems by comparing the rotation periods we measure from TESS light curves to the cluster period distributions inherited from the Kepler/K2 era (i.e., ensemble gyrochronology). For example, we confirm the existence of the Hyades tidal tail observed during Cycle 1 by showing that its stars follow the same rotation period distribution as the cluster core. Regarding the cluster-planet age gap between Upper Sco and Praesepe, consider Pisces-Eridanus (Psc-Eri), a nearby (d = 80-226 pc) stellar stream stretching across 120 degrees of the sky, which was recently discovered with Gaia by Meingast et al. (2019). We measured rotation periods for over 100 members observed so far by TESS and found that it

			has a rotation period distribution nearly indistinguishable from that of the Pleiades, indicating that they are coeval. This makes the Psc-Eri stream an exciting source of young stars and exoplanets located in a more diffuse environment that is distinct from that of the Pleiades and of other dense star clusters. Indeed, we determined that HD 1160 is a member and host to a directly imaged object near the hydrogen burning limit, and we already discovered a multi-planet system transiting a G dwarf member with TESS. Our characterization of Psc-Eri is the first gyrochronology study using TESS data, and it confirms that TESS will be an exciting mission for stellar astrophysics. This is especially true given how TESS records and releases FFI data. The existence of this stream was not known prior to the TESS Cycle 1 call for proposals, and yet the FFI data were ready for us to analyze immediately following the stream's discovery.
Drake Deming	Univ. of Maryland	A Bayesian Look at the Planet Occurrence Rate from TESS	Although TESS is not a statistical mission, the TESS data are amenable to statistical analyses using Bayesian techniques. We are engaged in a two-phase analysis of the planet occurrence rate in TESS data. First, we use occurrence rates from Kepler, as well as other astrophysical information, as priors to estimate the prevalence of false-positives and real planets among the TESS candidates. As the validation process by the TESS team becomes more complete, our analysis will enter a second phase wherein we derive TESS occurrence rates independently, and compare to Kepler and the ground-based surveys.
Nardiello Domenico	Universita degli Studi di Padova (Italy)	PATHOS: a PSF-based Approach to TESS High Quality Data Of Stellar Clusters	The TESS mission will observe about 85% of the sky in two years giving us the possibility to search for new variable stars and exoplanets in many Galactic fields. During the mission a huge sample of dense stellar systems (open and globular clusters and young associations) will be observed in Full Frame Images mode and 30-minute cadence. The most difficult challenge is the extraction of high-precision photometry of stars located in such crowded environments. In this context, we took advantage of our expertise gained by working with HST and Kepler data to develop a PSF-based method for the extraction of high-precision light curves from TESS images. This innovative technique, mainly based on the use of empirical PSFs and high-angular resolution input catalogs (like Gaia DR2), allows us to subtract neighbor sources to a target star and measure its real flux minimizing the contamination due to the neighbors. In this way we can obtain high-precision photometry for stars located in crowded fields or too faint (T>14) to be measured using simple aperture photometry. The project PATHOS is mainly focused on finding exoplanet candidates in stellar clusters. Moreover, our work shall be intended as preparatory for the high-precision photometry and light curve extraction on data from future space-based missions, such as PLATO.
Diana Dragomir	MIT	The HD 21749 System: A Temperate Sub-Neptune and the First Earth-Sized Planet Discovered with TESS	I will present the discovery of an exoplanet system that highlights the state-of-the-art capabilities of TESS in the context of both time coverage and photometric precision. HD 21749 is a K4.5 dwarf star located just 16 pc away from the Sun, and is newly known to host two small transiting planets. Planet b is an unusually dense sub-Neptune in a 35.6-day orbit, with a radius of $2.6 R_{earth}$ and mass of $22.7 M_{earth}$. It

			was possible to measure this planet's period in large part thanks to the four-sector TESS time series for this star. Planet c orbits the star with a period of 7.8 days and measures $0.9R_{earth}$, demonstrating that TESS can easily detect Earth- and sub-Earth-sized planets around bright stars. It is noteworthy that (in addition to the TESS data) this discovery was made possible almost entirely by existing ground-based spectroscopic and photometric observations that were generously contributed by several teams. Since the HD21749 system is a prime target for comparative studies of planetary composition and architecture in multi-planet systems, I will discuss a few exciting follow-up avenues that are currently, or will soon be, within reach.
Nora Eisner	University of Oxford	Planet Hunters TESS: People-Powered Exoplanet Discovery in TESS Data	I will present new results from the Planet Hunters TESS project, which exploits the power of citizen science to find transit events in the TESS data by engaging tens of thousands of volunteers. While most planets in the transit survey data will be found using purpose-built algorithms and software, some are unavoidably missed – in particular if the signals are somehow unusual. Results from the Kepler version of Planet Hunters showed that humans can outperform the automated detection pipelines for certain types of transits, especially single (long-period) transits, as well as aperiodic transits (circumbinary planets) and planets around rapidly rotating, active stars (young systems). I will discuss the benefits and challenges of using citizen science to find transit signals; how we make use of the vast numbers of user classifications; and how we evaluate the sensitivity of our planet search using simulated transit signals. I will also briefly outline the role of discussion forums, moderators, and researcher feedback in ensuring a positive user experience, as well as in highlighting interesting systems quickly. Finally, I will provide an overview of the planet candidates that we have found so far.
Zahra Essack	Massachusetts Institute of Technology (MIT)	Low Albedo Surfaces of Lava Worlds.	Hot super Earths are exoplanets with short orbital periods ($<$ 10 days) whose rocky surfaces reach temperatures high enough to become molten. There are a few hot super Earths that exhibit high geometric albedo values ($>$ 0.4) in the Kepler band (420-900 nm). Sources of reflected light that may contribute to the high albedos include: Rayleigh scattering in an atmosphere that may contain visible wavelength absorbers, reflective clouds, and/or the planetary surface. In this study, we focus on reflection from planetary surfaces. We aim to determine whether specular reflection from molten lava and quenched glass (a product of rapidly cooled lava) on the surfaces of hot super Earths may be a source of reflected light that contributes to the high geometric albedos. We experimentally measure the specular reflection from rough and smooth textured quenched glass, and survey non-crystalline solids literature for specular reflectance values from molten silicates as a proxy for specular reflectance values for lava. Integrating the empirical glass reflectance function and non-crystalline solids reflectance values over the dayside surface of the planet at secondary eclipse yields an upper limit for the albedo of a lava-quenched glass planet surface of ~ 0.1. We conclude that lava planets with solid (quenched glass) or liquid (lava) surfaces have low specular albedos, and hence a negligible contribution to the geometric albedos of hot super Earths. Literature values for diffuse

			reflectance from planetary glasses also result in low planetary albedos. TESS has discovered 11 hot super Earth candidates that are awaiting follow-up observations and future characterization as potential lava worlds.
Michael Fausnaugh	MIT	Type Ia Supernovae Observed in the First Six Sectors of TESS Data.	I will present early time light curves of 18 Type Ia supernovae observed in the first six sectors of TESS data. For eight of these objects with sufficient dynamic range (greater than 3.0 mag from detection to peak), I will detail results from characterizations of the initial explosion and searches for signatures of companion stars. Most of the supernovae are consistent with fireball models where the flux increases as t^2, while two sources display a flatter rise with flux proportional to t. There is no obvious evidence for additional structure such as multiple power law components in the early rising light curves. Assuming a favorable viewing angle, one can place conservative upper limits on the radii of any companion stars of less than $25R_\odot$ for six supernovae and less than $4R_\odot$ for 4 supernovae. If such systems are commonplace, the odds of non-detection in this sample are 38% for companions greather than $25R_\odot$ and 52% for companions greater than $4R_\odot$. At the current rate, TESS will either detect emission from a dwarf companion during its initial two year survey, or place stringent limits on single-degenerate progenitor models. I will also provide an update on this analysis for additional bright supernovae found in the first year of TESS observations.
Adina Feinstein	University of Chicago	The Eleanor Pipeline	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 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.
Juliana Garcia-Mejia	CfA | Harvard-Smithsonian	The Tierras Observatory: An Ultra-Precise Photometer to Characterize Nearby Terrestrial Exoplanets	We are currently building the Tierras Observatory, a 1.3m ultra-precise fully-automated photometric observatory located atop Mt. Hopkins, Arizona dedicated to following up nearby transiting planets discovered by TESS and other surveys, refine estimates of their radii, and find the longer period (and hence more temperate) worlds. Tierras will regularly achieve a photometric precision of 700 ppm, enough to measure the transit of $1R_\oplus$ planets orbiting $0.1 - 0.3R_\odot$ stars with 3σ significance. I will provide an overview of the current state of

			the observatory, as well as the design choices that will enable its science goals. These include: (i) a custom designed four-lens focal reducer and field-flattener to increase the field-of-view (FOV) of the telescope from a 12" to a 0.5 degree diagonal; (ii) a 4K $\times$ 4K pixels deep-depletion low read noise CCD operated in fast frame transfer (shutterless) mode with 80% quantum efficiency at the wavelength of observation (compared to 35% for regular CCDs); (iii) a custom narrow (50 nm) bandpass filter centered at 865 nm to minimize precipitable water vapor errors, known to limit ground-based photometry of red dwarfs; and (iv) a custom-made nano-fabricated beam-shaping diffuser (Stefansson et al., 2017) to mold the focal plane image star into a broad and stable top-hat shape, increasing the dynamic range of our observations while minimizing flat-fielding, guiding, and phase-induced errors due to seeing. Tierras will be on-sky by January of 2020, in time to carry out plenty of follow-up observations of TESS targets in the northern hemisphere. This work is supported by the National Science Foundation, the Ford Foundation, the John Templeton Foundation, and the Harvard Origins of Life Initiative.
Maximilian Guenther	MIT	Stellar Flares and Habitable(?) M-dwarf Worlds: Exploring a New Sample with TESS	Finding and characterizing small exoplanets orbiting M-dwarfs naturally poses the question of exoplanet habitability. A major contributing factor to this might be stellar flares, powerful magnetic reconnection events on the star. Flares can erode or sterilize exoplanets' atmospheres and completely diminish their habitability - but they might also be required to trigger the genesis of life around M-dwarfs in the first place. Here, I will highlight our study of stellar flares from the Transiting Exoplanet Survey Satellite (TESS). In the first few months alone, we already identified hundreds of flaring M-dwarfs, superflares with up to 30x brightness increase, and bolometric flare energies ranging from 10^{31} to 10^{39} erg. I will link our results to criteria for prebiotic chemistry, atmospheric loss through coronal mass ejections, and ozone sterilization. Ultimately, stellar flare studies will aid in defining criteria for exoplanet habitability for the many temperate worlds TESS is set to discover.
Natalia Guerrero	MIT TESS Science Office	TESS Objects of Interest Catalog: Sectors 1-6	The Transiting Exoplanet Survey Satellite (TESS) observed six partially overlapping sectors in the ecliptic Southern Hemisphere from July 2018 to January 2019, as part of its mission to observe $\sim$ 85% of the entire sky in two years and measure masses for 50 planets less than $4R_\oplus$. Each sector covers $\sim$ 5% of the sky and the partially overlapping sectors 1-6 cover 29% of the sky. We describe the process to create the TESS Objects of Interest (TOI) catalog from Sectors 1-6. The catalog consists primarily of planet candidates and known planets. The TESS Follow-Up Observing Program (TFOP) has prioritized and observed TOIs using the Exoplanet Follow-up Observing Program (ExoFOP) to coordinate effort and share data. The TESS data products for sectors 1-6, including the TESS Object of Interest catalog, light curves, full-frame images, and target pixel files, are made available to the public on the Mikulski Archive for Space Telescopes (MAST).
Zhao Guo	Pennsylvania State University	The Variability of TESS Eclipsing	We search for eclipsing binaries with variabilities and deep eclipses in TESS 2-min cadence data. We distinguish between

		Binaries	variabilities from stellar activities such as spots and those from pulsations. Specifically, we focus on the upper-main sequence pulsators in eclipsing binaries, including the F- and A-type Gamma Dor and Delta Scuti stars and the Slowly Pulsating B-stars and Beta Cephei stars. We also identify systems with high eccentrics and possible tidally excited oscillations. A list of promising targets is compiled for follow-up observations
JJ Hermes	Boston University	First Light on Pulsating Compact Objects with TESS	The vast majority of both isolated and binary stars, as well as nearly all known planet hosts, will end their lives as white dwarfs. There are thousands of compact remnants located near enough to Earth that they are bright enough for useful TESS observations, and hundreds of these objects vary on short (minutes to hours) timescales that can be fully characterized by one month of TESS data. I will present some first-light analysis and results from the active working group on compact pulsators within the TESS Asteroseismic Science Consortium, including precision insight into the core composition of a stellar remnant, as well as what we can expect from continued TESS observations.
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.
Matt Holman	Harvard CfA	A TESS Search for Distant Planets	Several lines of evidence, both theoretical and observational, indicate that additional planets in the outer solar system remain to be discovered. We recently developed a novel technique to search for solar system bodies (Holman et al. 2018). This method is particularly well-suited to very slow-moving objects, even those for which the motion within a day might be to small to detect. We present the results of our use of this method to search for distant planets and minor planets in existing TESS data. Perhaps even more important than the search itself is a detailed, quantitative analysis of the survey's

			detection limits and biases. This information is essential for the rigorous interpretation of these survey results. Such simulators have been developed for CFEPS/OSSOS, NEOWISE, and other surveys, leading to detailed results on the small body populations throughout the solar system. We have developed a high-fidelity survey simulator for Pan-STARRS and have extended it to TESS. This simulator takes positions, magnitudes, and rates of motion calculated from a solar system model (Grav et al 2011) at the times and locations of individual exposures. It then inserts synthetic detections into the resulting exposure source catalogs, accounting for the details of the camera, photometric zero point, and other essential details. The source catalogs, including synthetic detections, are then run through our full search pipeline. This approach allows a clear, quantitative statement about the prevalence of distant planets, as seen by TESS.
Thomas Holoien	Carnegie Observatories	ASASSN-19bt: The First TDE Detected by TESS	In January of 2019, the All-Sky Automated Survey for Supernovae (ASAS-SN) discovered a tidal disruption event (TDE) in the TESS Continuous Viewing Zone. The TESS light curve provides unprecedented high-cadence monitoring of the TDE host and the rise of the transient's light curve, allowing us to precisely constrain the time of first light and the rise time, which has never been done before with a TDE. In my talk I will discuss our full dataset, including the TESS light curve, and how the TESS data have allowed us to gain new insights into the physics behind TDE emission.
Chelsea Huang	Massachusetts Institute of Technology	Planets from the TESS Full Frame Images	The TESS Full Frame Images provide a unique opportunity for a magnitude limited sample of planetary candidates. Using the Quick look pipeline, we performed photometric extraction and planet detection on the first 9 sectors of TESS Full Frame Image data. We then selected the planetary candidates using a convolutional neural network based machine learning technique (astronet-tess). We report the planetary candidates detected in stars with Tmag<11, and a preliminary estimation of the detection completeness rate of the pipeline. We will take a first look into the planet population around these bright stars. We will discuss the comparison between the actual yield from our pipeline compare and the pre-launch planet yield simulation, and the implications about planet populations.
Daniel Huber	University of Hawaii	Asteroseismology of Solar-Type Stars with TESS	Asteroseismology is a unique observational tool to probe the interiors of stars, and a benchmark method to determine surface gravities, masses, radii and ages of solar-type stars. TESS enables the powerful extension of asteroseismology to bright stars with independent observational constraints, allowing the systematic investigation of poorly understood physical processes in stellar models such as convective energy transport and mode excitation for hot solar-type stars. In this talk I will present first results from TESS 2-minute cadence observations of solar-type stars allocated to the TESS Asteroseismic Science Consortium (TASC), including an overview of the target selection, an evaluation of the current photometric performance of TESS for asteroseismic studies, and the discovery of oscillations in high-profile targets such as the metal-poor benchmark star nu Indi. I will conclude with an outlook on the expected total yield of asteroseismic detections in the nominal TESS mission, and prospects for

			asteroseismology of solar-type stars with a potential extended mission.
Kate Isaak	ESA	CHEOPS: CHaracterising ExOPlanet Satellite – a mission overview	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 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 ($T_{eff} = 5500$K) 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 ($T_{eff} = 4500$ K) 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 presentation I give an overview of the mission, including science objectives, capabilities and expected performances and the opportunities to use CHEOPS.
Jon M. Jenkins	NASA Ames Research Center	TESS Science Processing Operations Center Pipeline and Data Products	TESS launched 18 April 2018 to conduct a two-year, near all-sky survey for at least 50 of Earth's nearest neighboring exoplanets for which masses can be ascertained and whose atmospheres can be characterized by ground- and space-based follow-on observations. TESS just completed its survey of the southern hemisphere, identifying hundreds of candidate exoplanet systems and unveiling a plethora of exciting non-exoplanet astrophysics results, such as asteroseismology, asteroids, and supernova. The TESS Science Processing Operations Center (SPOC) at NASA Ames Research Center processes the image data downlinked from TESS every two

			weeks to generate a range of data products hosted on the Mikulski Archive for Space Telescopes (MAST). The SPOC science pipeline is modeled on that of NASA's historic Kepler Mission. For each sector (~ one month) of observations, the SPOC calibrates the image data for both 30-min Full Frame Images (FFIs) and up to 20,000 pre-selected 2-min target star postage stamps. A number of time series data products are generated for the 2-min targets, including simple aperture photometry and systematic error-corrected flux time series. The SPOC also conducts searches for transiting exoplanets in the 2-min data for each sector and generates Data Validation time series and associated full, one-page summary, and mini-reports for each transit-like feature identified in the search. The accumulated data-to-date in each hemisphere are also searched for exoplanets to discover longer period planets transiting stars observed over multiple sectors, including those in the James Webb Continuous Viewing Zone (CVZ), which are observed for up to one year. The data products also include co-trending basis vectors (CBVs) and calibration files, such as the Pixel Response Function (PRF) across the field of view of each of TESS's four cameras. To maximize the ease with which the community can use them, the TESS science data products are modeled after those for Kepler and include Target Pixel Files (TPFs) containing original and calibrated 2-min image data, Light Curve files (LCs) containing the photometric time series for each 2-min target, as well as the Data Validation products. In this talk, I describe the SPOC pipeline, the pipeline products, and the chief differences between the TESS and the Kepler pipelines, and the major updates to the SPOC pipeline (4.0) available now to the community at MAST. I also discuss the documentation available to the community to help them in properly interpreting and analyzing the TESS data products. The TESS Mission is funded by NASA's Science Mission Directorate as an Astrophysics Explorer Mission.
James Jenkins	Universidad de Chile	TESS Discovery of the First Ultra-Hot Neptune	In this talk I will discuss our HARPS radial-velocity follow-up observations of candidates detected by TESS, those released as TESS Objects of Interest (TOI) to the community through the TESS Alerts system. In particular, I will focus on the planet candidate orbiting the star LTT9779 (TOI-193), which is a bright (V=9.8 magnitudes), super metal-rich, and Sun-like star. The planet falls in the Neptune desert, yet it has an orbital period of only 19hrs, making it the first such planet ever detected. I will briefly discuss the nature of the system, possibilities for formation and evolution mechanisms for the planet, and how LTT9779b can be a useful laboratory to study the atmospheric physics and chemistry of extreme super Neptunes. Finally, I will give a brief overview of other TOIs that we have observed as part of our HARPS precision radial-velocity follow-up program, discussing other systems we have confirmed and our ongoing efforts in the southern hemisphere.
Cole Johnston	KU Leuven	Coupling Binarity and Asteroseismology: High-Precision Core Masses and	For decades, eclipsing binary systems have been heralded for their ability to provide high-precision constraints on stellar modelling. Indeed with their ability to prove model-independent (dynamical) masses and radii, eclipsing binary systems have long served as calibrators for distances, ages, and theoretical models of stellar structure and evolution. As

		Ages from Kepler and TESS	such, eclipsing binaries are often used in studies to investigate the poorly understood processes of chemical and angular momentum transport in stellar interiors, particularly for intermediate- to high-mass stars born with convective cores. The most glaring difference between theory and observations is the so-called mass discrepancy between evolutionary and dynamical masses. This mass discrepancy is often solved by increasing the core mass in stellar evolution models by introducing additional near-core boundary mixing via rotation, overshooting or penetration, or any combination thereof in stellar models. These phenomena each have the potential to increase the core mass of the star. However, there is much debate as to what the proper implementation and scaling of such mechanisms should be. In this talk, we review the results of using binaries to constrain such interior mixing processes and their effect on the resulting core masses and ages. We discuss the phenomena of rotation, overshooting, penetration and internal gravity waves as mechanisms to induce interior chemical mixing and angular momentum transport, as well how binary modelling can critically constrain such processes. We also showcase the potential of combining contemporary binary and gravity-mode asteroseismic modelling to provide independent cross constraints for the calibration of interior transport processes. Finally, we point out how binary asteroseismology based on space-based photometry, in combination with updated astrometric solutions from future Gaia releases can lead to precise predictions of He-core masses and ages at the end of the main-sequence.
Stephen Kane	University of California, Riverside	TESS Observations of Known Exoplanetary Systems	At the current time, it remains unknown if many of the radial velocity detected exoplanets transit their host stars. Since these host stars are relatively bright, they provide numerous opportunities for detailed characterization of the systems, such as transmission spectroscopy, orbital dynamics, and potential targets for future imaging missions. Our TESS Cycle 1 Guest Investigation conducted high cadence observations of the southern exoplanet host stars, including known transiting planets, and combined these photometry with updated planetary orbits from radial velocity analyses. Our program has searched for transits and phase variations for these systems, refined transit ephemerides, and collaborated with numerous other teams who are using our TESS Cycle 1 program to characterize known exoplanetary systems. In this presentation we provide a summary of TESS science achieved thus far for the known exoplanets, including new results on transit searches, detection of phase variations, and refinement of planetary orbits, particularly for systems observed by TESS over multiple sectors. We provide details for both Cycle 1 and 2 statistics regarding overall expectations for TESS detections in known systems and how these discoveries contribute to the overall TESS yield in terms of exoplanet demographics.
Eliza Kempton	University of Maryland	How to Determine Whether M-Dwarf Terrestrial Planets Possess Atmospheres	The promise of the TESS mission is that it will detect legions of planets for which atmospheric characterization will be possible with JWST. Perhaps the most exciting among these planets are the rocky ones, which up until now have not been accessible to atmospheric studies. Yet small rocky planets will still be challenging targets for JWST, so the question arises of how best to use JWST to make tangible progress toward

			understanding the atmospheres of terrestrial bodies. We posit that JWST is best suited to distinguish between rocky planets that do and do not possess atmospheres by photometrically observing the secondary eclipses of these objects. The argument is as follows. The day side temperature of a tidally locked planet will always be reduced by the presence of an atmosphere, either because the atmosphere transports heat to the night side of the planet or because atmospheric scatterers such as clouds will increase the planet's Bond albedo. There is therefore a maximal secondary eclipse depth that is representative of a hot dayside hemisphere with no atmosphere present. We focus on planets orbiting M stars because these are the ones that will be discovered in large numbers by the TESS mission, they are within the observational grasp of JWST, and there is considerable skepticism as to whether these planets can retain atmospheres at all given the high-energy irradiation environment around their host stars. I will present the results from a multi-institution collaboration investigating the promise and the limits of secondary eclipse photometry as a test for candidate atmospheres on rocky M-dwarf planets. We have developed a suite of general circulation models (GCMs) and radiative-convective atmospheric structure models, and have developed our understanding of rocky planet surface geochemistry, in order to address this topic. We have focused our efforts on three warm transiting super-Earths that will be ideal targets for secondary eclipse investigations with JWST — GJ 1132b, TRAPPIST-1b, and LHS 3844b. The final planet on this list is a TESS-discovered super-Earth that is likely representative of a larger number of such objects that will be discovered over the remainder of the mission. Finally, we have quantified the modest amount of JWST observing time that is required to distinguish between planets with and without atmospheres using secondary eclipse photometry. This will be compared against the time required to perform the same test using phase curves and the more traditional transit spectroscopy techniques. Being able to do so is important, because it will allow us to make the most efficient use of JWST's limited resources in the exploration of rocky exoplanet atmospheres.
Laura Kreidberg	Harvard University	The Thermal Phase Curve of LHS 3844b	TESS is rapidly discovering the best planets in the sky for detailed atmosphere characterization. One of these new discoveries is LHS 3844b, a terrestrial planet in an 11-hour orbit around a nearby M-dwarf. We recently measured a thermal phase curve of LHS 3844b with the Spitzer Space Telescope. In this talk, I will present the data and discuss constraints on the planet's atmospheric properties based on the observed phase variation.
David W. Latham	Center for Astrophysics | Harvard & Smithsonian	Masses and Radii of Exoplanets from Kepler, K2, and TESS	The population of planets orbiting solar-type stars is dominated by planets smaller than 4 Earth radii, the size of Neptune. Mass determinations for transiting planets identified by Kepler and K2 have suggested that most planets smaller than about 1.8 Earth radii have bulk densities that are consistent with internal structures and compositions similar to the terrestrial planets in the Solar system. One of the primary goals of the TESS mission is to determine masses and bulk densities for more than 50 planets smaller than $4R_{earth}$, to improve our understanding of the transition between rocky

			planets and those more like Neptune. We will show the progress towards this goal.
Elisabeth Matthews	MIT	High-Resolution Follow-Up of TESS Candidate Planets with 8m-Class Telescopes	I will report on our large-scale program of high-resolution imaging of TESS candidates with 8m class telescopes. This effort is essential in order to check for blended stars which can (at best) dilute the TESS light curves and bias the measured planet radii of the observed planet, or (at worst) indicate an astrophysical false positives. I will present initial results from our diffraction-limited optical+infrared imaging using Gemini and VLT, which are sensitive to stellar companions at just a few 10s of milliarcseconds. Our data have already identified blended companions to several TOIs, while verifying that most TOIs are free from contamination by nearby stars. I will also describe our work combining our high-resolution imaging with GAIA data to measure the multiplicity of TESS planet hosts across a range of planetary and stellar properties.
Amber Medina	Center for Astrophysics | Harvard and Smithsonain	Flare Statistics and High Resolution Spectroscopy of a Volume Complete Sample of Mid-to-Late M dwarfs within 15 Parsecs	Main-sequence stars with masses less than 30% that of the Sun are fully convective and are the most abundant stars in the galaxy. The question of how fully convective stars generate their magnetic field is of intrinsic interest and also bears upon the habitability of their orbiting planets. We are currently undertaking a multi-epoch high-resolution spectroscopic survey in addition to obtaining (through a TESS GI program) two-minute cadence data of a volume-complete sample of stars with masses between 0.1-0.3 the solar value and within 15 parsecs. The stars in the sample are well characterized with accurate masses and radii, and photometric rotation periods from the MEarth project. We will determine the statistics of flares on all mid-to-late M dwarfs within 15 parsecs. We will use our complementary high-resolution spectroscopic measurements of rotational velocities, H_α equivalent widths, along with our galactic space motions (calculated from our measured radial velocities) to correlate the ages and activity levels of this population to the flare rates, luminosities, and durations.
Kristo Ment	Harvard University	Uniting TESS Data and a Decade of Ground-Based Observations by the MEarth Project	For 11 years, the ground-based MEarth survey has been monitoring nearby M dwarfs in pursuit of transiting Earth-like planets. The MEarth target sample has a significant overlap with the TESS Candidate Target List. This provides a unique opportunity to complement high-precision TESS photometry with the long temporal base line of MEarth data. TESS has already provided high-quality photometric data for the two MEarth-discovered terrestrial planets orbiting LHS 1140 (Dittmann+ 2017, Ment+ 2019). Conversely, MEarth data helped to independently confirm the ultra-short-period TESS planet around LHS 3844 (Vanderspek+ 2018) and demonstrated that the star was inactive and spinning with a long rotation period of 128 days. We are currently undertaking an extensive phase-folded search of the accumulated MEarth data to identify new planets, and confirm or rule out TESS planet candidates. Combining MEarth and TESS data paves the way for assembling the first-ever volume-complete list of transiting planets within the habitable zones of nearby mid-to-late M dwarfs. This work has been supported by the National Science Foundation, the David and

			Lucile Packard Foundation, and the John Templeton Foundation.
Travis Metcalfe	Space Science Institute	Disentangling the Rotation and Activity Variations of 94 Aqr from Asteroseismology with TESS	Previous efforts to calibrate how rotation and magnetic activity depend on stellar age and mass have relied on observations of clusters, where stellar evolution models are used to determine the properties of the ensemble. Asteroseismology employs the same models to measure the properties of an individual star by matching its normal modes of oscillation, yielding the stellar age and mass with much higher precision. We use 27 days of photometry from the Transiting Exoplanet Survey Satellite (TESS) to characterize the solar-like oscillations of a G8 subgiant in the 94 Aqr triple system. The resulting stellar properties, along with a reanalysis of 35 years of activity measurements from the Mount Wilson HK project, allow us to disentangle the rotation and activity variations observed in the system. The derived age agrees with gyrochronology for the cool dwarfs in the system, but the rotation period of the subgiant is much shorter than expected from standard models of angular momentum evolution. I will discuss these results in the context of recent evidence that gyrochronology is less useful for stars beyond the middle of their main-sequence lifetimes, and outline how asteroseismic calibration of an empirical activity-age relation could provide reliable ages for stars beyond middle-age.
Marco Montalto	Universita di Padova	Mining TESS Full Frame Images (FFIs) to Analyze the Brightest Dwarf and Sub-Giant Stars of the Sky.	The TESS satellite is revolutionizing the field of time domain astronomy since, for the first time, an unbiased sample of nearly all sky sources can be studied with unprecedented photometric precision. While boosting our knowledge on exoplanetary systems, the lightcurves extracted from TESS data will also represent an important legacy upon which forthcoming characterization (e.g. CHEOPS, JWST, ARIEL) and planet hunting missions (e.g. PLATO) will base their future target selection strategies. In this talk I will focus on the analysis of a broad sample of carefully selected FGKM dwarf and sub-giant stars monitored by TESS during its first year of observations. I will present a customized pipeline apt to mine TESS FFIs, extract optimized, homogeneous, multi-sector photometry and search for transiting planets. Finally, I will discuss the planet candidate yield and statistics as well as the on-going efforts to promote follow-up analysis.
Benjamin Montet	University of Chicago	Turning Planet Candidates into Planets in the TESS Full-Frame Images	While considerable attention has been given to those targets targeted at two-minute cadence in the TESS mission, the vast majority of planet candidates are expected to be found in the TESS Full-Frame Images. With one million stars observed per sector, these images provide an opportunity to understand planet occurrence in different stellar environments, around stars of different masses and ages. However, this dataset also provides unique challenges for finding, characterizing, and validating planet candidates. I will provide an update on planet candidates detected through the eleanor pipeline for light curve extraction from the TESS Full-Frame Images and strategies for turning these candidate transit signals into bona fide planets with TESS data, including our strategies to incorporate machine learning into planet validation.
Elisabeth Newton	Dartmouth College	DS Tuc Ab: A 45 Myr Old Planet in	We present the first results from the TESS Hunt for Young and Maturing Exoplanets (THYME) Project: the discovery of

		the Tuc-Hor Young Moving Group	DS Tuc Ab, a transiting planet in the 45 Myr Tucana-Horologium young moving group. We first identified transits using photometry from the Transiting Exoplanet Survey Satellite (TESS; the candidate was alerted as TIC 200.01). The host star, DS Tuc, is a visual binary and is unresolved in these data; we use our follow-up observations to demonstrate that the transit signal derives from the primary component, DS Tuc A (HD 222259A, G6V). Using a suite of new and archival data, we improved the stellar parameters and validated the planet. We find no additional stellar or planetary signals in the data. We highlight two unusual properties of the planetary system. First, the close-in planet is larger than Neptune but smaller than Saturn ($5.7 R_{earth}$), falling in a sparsely populated region of the radius--period diagram. Second, the host star's spin axis, the planet's orbital axis, and the visual binary's orbital axis are likely aligned to within 10 degrees.
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.
Louise D. Nielsen	Geneva Observatory	TOI-125: Precise Mass Determination of Three Level-1 TESS Planets	We present intensive HARPS radial velocity follow-up of the transiting multi-planet system TOI-125 (TIC 52368076) validated by Quinn et al. 2019. TOI-125 is a bright, $V = 10.9$, K0 dwarf star, which hosts three mini-Neptunes detected in TESS Sector 1 and 2 data. TOI-125b has an orbital period of 4.65 days, a radius of $2.76 \pm 0.09 R_e$, a mass of $8.8 \pm 0.48 M_e$, yielding a mean density of ~ 2.26 g cm^{-3}. With an orbital period of 9.15 days, TOI-125c is near the 1:2 mean motion resonance with its inner companion. It has a similar radius of $2.79 \pm 0.10 R_e$ and a mass of $7.3 \pm 0.61 M_e$, implying a mean density of 1.53 g cm^{-3}. The outer transiting planet, TOI-125d, has an orbital period of 19.98 days. With a radius of $2.94 \pm 0.16 R_e$, mass $12.0 \pm 1.0 M_e$, it is denser than the two inner planets ($\rho \sim 2.59$ g cm^{-3}). Our joint analysis of the RVs and TESS light curves also provides upper mass limits for the two low-SNR planet candidates reported by Quinn et al. 2019; TOI-125.04 ($R = 1.36 R_e$), an ultra-short period super-Earth with a period of 0.53 days, and TOI-125.05, a planet with an estimated radius of $4.4 - 13.5 R_e$ possibly sitting between TOI-125c and TOI-125d at 13.28 days. We cannot confirm the presence of TOI-125.04, for which we find a mass upper limit of 1 Me. We find no evidence of TOI-125.05 in our RVs, and estimate a mass upper-limit of $3 M_e$, which excludes it as a viable candidate in the system. We discuss the internal structure of the three confirmed planets, as well as possible formation and evolution scenarios with and without the two additional candidates, which cannot be confirmed with our present data.
Ryan	Vanderbilt University	Differenced	Our team has released high-precision, difference imaging

Oelkers		Images, Light Curves, and Variability Metrics for All Stars Observed in TESS Full Frame Images	light curves, differenced images, TESS Input Catalog stellar parameters, Lomb-Scargle periodicity information, Box-Least-Squares eclipse information, and basic variability metrics for more than 50 millions stars observed in TESS full-frame-images. We released these data products, through the Filtergraph visualization portal at the URL https://filtergraph.com/tess_ffi, providing users a unique opportunity to interact with the data. Filtergraph allows its users to quickly plot light curves, visualize stellar parameters, and investigate trends in a single portal. These data products have been shown to be as precise as official NASA data products, and have already led to independent community discoveries. I will provide a brief description of the reduction, and a short tutorial of the public data release on Filtergraph.
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.
James Owen	Imperial College London	Testing the Photoevaporation Model with TESS Multis	Photoevaporation of natal H/He envelopes is one of the leading theories to explain the radius gap observed to separate close-in, super-Earth and sub-Neptunes sized planets. However, without measurements of planetary masses and with planet radius data alone, testing the photoevaporation model is difficult. Fortunately, TESS will provide a large sample of planets for which radial velocity follow-up to constrain their masses is possible. I will describe the unique power of multi-planet systems that contain both super-Earth and sub-Neptune sized planets in testing the photoevaporation model, wherein the photoevaporation model predicts minimum masses for planets in the system. The power of multi planet systems arises because one of the critical uncertainties in testing the photoevaporation model is the XUV activity history of the star; however, in multi-planet systems, one knows all planets orbit the same star and experience the same XUV history. Given a multi-planet system with measured radii, I will demonstrate how the photoevaporation model predicts the planet's minimum masses, which can then be tested with targeted radial velocity follow-up. Kepler only provided a handful of systems for which this analysis can be done; however, TESS should provide a large sample of systems to test the photoevaporation model qualitatively. As a demonstration, I will present predicted minimum masses for planets in the TOI-270 system. Finally, I will argue that consideration of photoevaporation's predictions in selected systems for radial velocity follow-up can maximise the scientific value of the data. This usefulness is because photoevaporation's predictions are minimum

			masses, so even a non-detection can still be used to refute the photoevaporation model.
Andras Pal	Konkoly Observatory	TESS in the Solar System	Although TESS observes fields further away from the Ecliptic in its primary mission, thousands of minor planets are observed in each of these sectors that otherwise have inclinations higher than a few degrees. In this presentation, we review the most essential aspects of Solar System studies using TESS as a photometer for the analysis of known minor bodies. Photometry of these objects are performed from an unusual perspective: the computation of apparent position as well as the efficient selection of objects appearing in a certain field-of-view also imply some non-trivial issues. Based on the light curves of these asteroids, one could not only conclude the fundamental physical characteristics (such as rotation period and shape constraints) in an unbiased manner, but variations on the longer timescales lead us to a deeper understating of surface properties. Regarding to the more sophisticated photometric processes, we present algorithms -- along with the bottlenecks in the respective implementations -- which will allow us to see and characterize objects which are fainter than the single-frame detection limit of the TESS cameras. Since the main-belt asteroids form the most prominent sample of such objects of the Solar System, it is important to investigate whether our observations are biased or not in terms of the distribution of the proper orbital elements. Therefore, we also summarize briefly how the various dynamical families are sampled in the primary mission due to the avoidance of the vicinity of the Ecliptic. Besides the aforementioned statistical analyses, some particular objects are also displayed which exhibit prominent features if one investigates the corresponding light curves in details. One of these examples is the candidate for the largest and brightest tumbling asteroid, where this tumbling nature has been revealed by such long, uninterrupted and well-sampled light curves which can now only be provided by TESS.
Enric Palle	Instituto de Astrofisica de Canarias	A Planetary System Around the Nearby M Dwarf Gl 357	We report the detection of a transiting Earth-size planet around Gl357, a nearby M2.5V star, using data from the Transiting Exoplanet Survey Satellite (TESS). The newly discovered planet Gl 357b (TOI-562.01) is a transiting hot Earth-like planet with a radius of $R = 1.17 \pm 0.06 R_e$ and an orbital period of $P = 3.93$ day. Precise stellar radial velocities from CARMENES as well as archival data from HIRES, UVES, and HARPS, also display a 3.93-day periodicity, confirming the existence of the planet and leading to planetary mass of $M = 1.63 \pm 0.30 M_e$. In addition to the radial velocity signal for Gl 357b, a second periodicity with $P = 9.12$ day indicates the presence of a second, non-transiting planet candidate in the system, Gl 357c, with a minimum mass of $M = 3.59 \pm 0.50 M_e$. The star is relatively inactive and exhibits a photometric rotation period of $P = 78 \pm 2$ days. Gl 357b is the second closest transiting planet to the Sun; its brightness makes it a prime target for further investigations, such as atmospheric spectroscopy and is, to date, the best terrestrial transiting planet suitable for atmospheric characterisation with the upcoming JWST and the ground-based ELTs.

Anna Payne	Institute for Astronomy, University of Hawaii	The Spanish Dancer Puts on a Show: The 2018 Outburst of NGC 1566.	In late June 2018, increased hard X-ray emission was detected from NGC 1566. Soon after, UVOT data collected using the Neil Gehrels Swift Observatory showed a significant brightening, in tandem with the ASAS-SN light curve showing dramatic variability. Combining data taken using TESS, Swift, ASAS-SN, and Las Cumbres Observatory, we analyzed 4263 photometric observations spread out over ~100 days following the flare. Swift's X-ray and UV/optical, ASAS-SN's g-band, and TESS's redder filter make an ideal combination for continuum reverberation mapping studies because it provides broad wavelength coverage. We will discuss our measurements of inter-band correlation and lag used to ultimately test and constrain continuum-emission disk accretion models. In the era of TESS, our goal is to perform this analysis on a large scale. By discovering and studying variable AGN with TESS in combination with others including ASAS-SN, we will be able to create a robust sample to investigate the cause of variability. This will ultimately shed light on the nature of black holes and their surrounding high-energy environment.
Geisa Ponte	Centro de Radioastronomia e Astrofisica Mackenzie (CRAAM) - Universidade Presbiteriana Mackenzie	Photometric Variability and Magnetic Activity in Young Suns	We investigate the impact of the chromospheric activity on precise 2 minute-cadence NASA/TESS lightcurves of a selected sample of young solar twins (with ages between 50 to 500 Myr). These stars were also monitored by benchmark planet hunter ESO/HARPS spectrograph over the course of, at least, one rotational period. We estimate photometric variability of lightcurves due to rotational modulations and explore its correlations with classical spectroscopic indicators of chromospheric activity (such as Ca II lines), ages and rotational periods. This valuable dataset will help us to understand the implications of magnetic activity variability in exoplanetary searches and the concept of habitability. This work is an integrant part of a larger effort aimed at characterizing comprehensively (photometrically and spectroscopically) the magnetic fields in young suns.
Stefanie Raetz	Institute for Astronomy and Astrophysics (IAAT) Tuebingen	The Rotation-Activity Relation of M dwarfs: From K2 to TESS and PLATO	Studies of the rotation-activity relation of late-type stars are essential to enhance our understanding of stellar dynamos and angular momentum evolution. Photometric observations with space telescopes such as the K2 and TESS missions provide rotation periods even with low amplitudes as well as a wealth of activity diagnostics. We currently study the rotation-activity relation with K2 for M dwarfs where it is especially poorly understood. Our study is based on the Superblink proper motion catalogue of $\sim$ 9000 bright and nearby M dwarfs by Lepine and Gaidos (2011).The rotation-activity relation based on photometric activity indicators revealed, that, at a critical rotation period of $\sim$ 10 d, the activity level changes abruptly. This phenomenon represents an open problem within the framework of dynamo theory. Despite the outstanding capabilities of K2, the short observational baseline and the low cadence allows us to detect only short rotation periods and long duration flares which represents a strong bias for such activity studies. TESS observes in its two years main mission almost all bright M-dwarfs from the Superblink catalogue. Although TESS observes one sector for only $\sim$ 27 d, it will provide up to thirteen 27d-light curves for $\sim$ 2% of the targets due to the overlap of the sectors. TESS drastically enlarges our sample of continuous high cadence

			monitored bright M-dwarfs and allows us to study in depth the activity and in particular the morphology of flares. In the future, the PLATO mission with its unprecedented precision, short cadence and long observational baseline, allows us to study the magnetic activity indicators in up to now unrivaled detail. In my talk I will explain the results of our K2 study and show the application of the activity analysis methods to TESS data. Furthermore, I will describe how a higher cadence and a longer duration improves the determination of rotation periods and the detection of stellar flares.
George Ricker	MIT	The TESS Mission: History, Present Status, and Future Prospects	In this talk, a brief history will be related as to how and why the TESS project came to be. The current status of the mission will also be summarized. Finally, as we jointly celebrate the exciting results from TESS in its initial year--as well as the prospects for TESS in its first extended mission -- an attempt will be made to foresee a few of the exciting possible future discoveries that TESS may make in the coming decade(s).
Ryan Ridden-Harper	Australian National University	Discovering Rapid Transients in the TESS Background Survey	TESS offers an exciting opportunity to search for new and exotic transients with lifetimes less than a day. Due to that large field of view, TESS will serendipitously observe many transients, that may go undiscovered. Through the TESS: Background Survey, we are able to systematically search all TESS TPFs and FFIs to provide the largest high cadence survey to date. I will discuss the TESS: Background Survey, and present the unique objects that were discovered in these surveys alongside new rates for short lived exotic transients.
Joey Rodriguez	Center for Astrophysics | Harvard & Smithsonian	Using TESS to Understand Giant Planet Migration	Nearly a quarter century since the discovery of the first hot Jupiters, we are still trying to understand their underlying evolutionary mechanisms. The orbital eccentricities of hot Jupiters hold clues to their formation and dynamical evolution, but most of these planets reside on very close orbits, which circularize quickly due to tidal interaction with the host stars. Hot Jupiters with periods longer than about 5 days experience weaker tidal forces and can retain eccentricity for many billions of years. We refer to these systems where the circularization timescale is longer than the system's age as "dynamically young Jupiters". Unfortunately, there are only a few of these planets known and fewer still have precise eccentricity measurements. NASA's TESS mission is well-suited to discover these longer period hot Jupiters since ground-based surveys struggle to obtain the phase coverage necessary for initial detection. Using the Full Frame Images (FFIs) from TESS combined with ground based RV and photometric observations, we have already discovered and measured precise eccentricities for 3 Jupiters with periods longer than 5 days. We are actively observing another 6 candidates from both the FFIs and pre-selected 2 minute cadence targets. I will present our recent discoveries and discuss the current hot Jupiter population in the context of evolutionary mechanisms.
Surangkhana Rukdee	Harvard College Observatory/Pontificia Universidad Catolica de Chile	TARdYS: An Upcoming Exoplanet Hunter in Southern Hemisphere	The relatively close habitable zone to the host stars of the very common cool-low mass stars makes M dwarfs attractive for finding habitable planets. We developed TARdYS, a spectrograph for the observation of cool stars in the southern hemisphere, where few high-resolution near-infrared spectrographs are available. TARdYS is a dual fiber fed,

			white pupil Echelle and with an image slicer can yield R>50,000 in the Y band ($0.843 - 1.117\mu m$). It will be installed at the Tokyo Atacama Observatory TAO 6.5 m telescope. I will discuss the overall instrument system design and ongoing development of this upcoming exoplanet hunter in the southern hemisphere, and its capability for characterizing TESS exoplanets.
Sarah Jane Schmidt	Leibniz Institute for Astrophysics Potsdam (AIP)	Initial Results From the TESS Ultracool Dwarf Survey	Ultracool dwarfs are a class of objects that include both the smallest stars and the warmest brown dwarfs, spanning spectral types M7 and later. They are intrinsically variable sources due both to the properties of patchy clouds on their surfaces, and to magnetic activity that gives rise to surface spots and dramatic flares. This magnetic activity is found on the majority of ultracool dwarfs, because fast rotation periods and strong magnetic fields persist to older ages than for main sequence stars. We present initial stellar properties, rotation periods, and flare frequency distributions for the brightest 77 ultracool dwarfs (spanning spectral types M6-L3) observed with TESS through Sector 8 as part of our two-minute cadence sample. We measure rotation periods for half these dwarfs, spanning a few hours to a few days. We also use the flare finding code AltaiPony to identify 177 flares on 39 targets, and present initial flare frequency distributions.
Lizhou Sha	MIT	Does WASP-47 e Have a Friend? Refining the Occurrence Rate of Inner Companions to Hot Jupiters Using TESS Full-Frame Image Data	To date, WASP-47 e remains the only known inner companion to a hot Jupiter (Becker et al. 2015). This apparent scarcity is broadly in line with the hypothesis that most hot Jupiters form beyond the ice line and move inwards via high-eccentricity migration (HEM). However, statistical evidence based on the dearth of super-eccentric hot Jupiters in Kepler data suggests that HEM does not explain the formation of all hot Jupiters, leaving the possibility for some hot Jupiters to have close-in planets (Dawson et al. 2015). TESS brings a golden opportunity to study the occurrence rate of hot Jupiter companions in terms of both quality and quantity: not only does TESS have enough photometric precision to detect super-earths around bright stars, but its full-frame images will also provide more than double the number of high-precision light curves for hot Jupiters compared to Kepler and K2 combined. Using the first eight sectors of TESS full-frame images, we generate light curves for ~ 80 confirmed and candidate hot Jupiters brighter than the 11th TESS magnitude with the MIT Quick Look Pipeline. Having carefully removed the known planet signal, we perform a uniform BLS search for companions in order to derive a constraint on the occurrence rate of such planets. Combining this constraint with the ones derived from Kepler and K2 hot Jupiters, we arrive at a refined upper limit on the occurrence rate of inner companions to hot Jupiters. We then discuss the implications of this newly calculated occurrence rate and how it informs current discussions on the formation theories of hot Jupiters.
Krista Lynne Smith	KIPAC at SLAC, Stanford University	The TESS-Fermi Blazars	I will present the first results of the multiwavelength monitoring program of four gamma-ray bright Fermi blazars. These beamed relativistic AGN jets have been monitored for a full year in the optical, UV, X-ray, and gamma rays by TESS, Swift, and Fermi. The cross-correlation analysis of such light curves offers insight into the emitting regions within relativistic jets, and whether the physical origin of the

			high-energy emission arises from hadronic or leptonic processes. I will also discuss the expansion of this project in TESS Cycle 2, which includes radio data.
Jamie Tayar	Institute for Astronomy, University of Hawaii	Calibrating Stellar Models in the TESS Era	Different grids of stellar models predict different temperatures and luminosities for stars of the same mass and age. In the past, these differences were much smaller than the measurement uncertainties, and could therefore be ignored. However, in the era of TESS and Gaia, the systematic uncertainties resulting from the choice of stellar model grid can now be significantly larger than the formal measurement uncertainties when inferring the masses and ages of planet host stars. I will show how these uncertainties vary as a function of luminosity, temperature, and metallicity and discuss ways of accounting for this effect. While these uncertainties are a problem for planet characterization, they represent an opportunity for improving our understanding of stellar evolution. I will therefore also show that asteroseismic measurements of TESS dwarfs and subgiants, as well as legacy data from the Kepler mission, can be used to constrain stellar physics, including the effects of rotation and convection, and discuss how these constraints will improve with future TESS data.
Johanna Teske	Carnegie Observatories	The Magellan-TESS Survey	Recent results on the characterization of small planets have presented two questions: (1) Do super-Earth ($\sim 1 - 1.6 R_{earth}$) and sub-Neptune ($\sim 2 - 3 R_{earth}$) planets form the same or differently? and (2) What is the precise *and* accurate planet mass-radius relation in the $<4 R_{earth}$ regime? In this talk I will describe the methodology behind the Magellan-TESS Survey, designed to address these questions in a statistically robust, open framework by measuring the masses, host star compositions, and system architectures of $\sim$ 30 small TESS planets across a range of insolation fluxes. I will also share results thus far and lessons learned that may be applicable to analogous programs in the Northern Hemisphere.
Roland Vanderspek	MIT	TESS Observations: Looking to Year 2	The first year of the TESS prime mission has been completed, and Year 2 observations of the northern ecliptic hemisphere have begun. Because of the orientation of the TESS orbit, with apogee in the southern ecliptic hemisphere, scattered light from the Earth and moon will play a more prominent role in Year 2 observations. I will review the prospects for Year 2 observations, which include changes in spacecraft pointing in Sectors 14 and 15. In addition, I will touch on tweaks in spacecraft operations that will lead to better overall scientific performance.
Steven Villanueva Jr.	MIT	Searching for Long-Period Planets in TESS	I will discuss the progress in confirming and characterizing TESS long-period (P ≳ 20 days) planets, specifically those identified as single-transit events (STE). I will discuss the efforts to identify and vet STEs, including an overview of our identification pipeline. STEs require more careful planning and lengthier follow-up campaigns for confirmation than multiply transiting or short-period planets, but can yield some of the longest-period planets that TESS can find. I will discuss some of the strategies and challenges specific to confirming STEs, and I will give an overview of the known STEs and give an update on their status.
Jennifer Winters	Center for Astrophysics |	Three Red Suns in the Sky of the	The only terrestrial planets that will be spectroscopically accessible in the near future will be those that orbit nearby

	Harvard & Smithsonian	Nearest Planet Transiting an M Dwarf	mid-to-late M dwarfs. We present the discovery from TESS data of LTT-1445Ab, a terrestrial planet transiting an M dwarf only 6.9 parsecs away. Remarkably, the host stellar system is composed of three mid-to-late M dwarfs in a hierarchical configuration which are blended in one TESS pixel. We use follow-up observations from MEarth and the centroid offset analysis in the TESS data validation report to determine that the planet transits the primary star in the system. From high-resolution spectroscopy and imaging, we rule out the presence of additional stellar or brown dwarf companions. We derive a preliminary orbit for the bound BC pair that reveals an edge-on and highly eccentric configuration. The planet has a radius 1.4 times that of Earth, an orbital period of 5.4 days, and an equilibrium temperature of 428 K. With radial velocities from HARPS, we place a three-sigma upper mass limit of $2.75M_{earth}$ on the companion, confirming its planetary nature. The system is particularly favorable for ground-based observations to study the planetary atmosphere, as the companion stars provide a valuable calibration source with the same spectral type as that of the primary star. This work is supported by grants from the National Science Foundation and the John Templeton Foundation.
Rob Wittenmyer	University of Southern Queensland	MINERVA-Australis: A Southern TESS Follow-Up Machine	MINERVA-Australis at the University of Southern Queensland's Mount Kent Observatory is the only southern hemisphere precise radial velocity facility wholly dedicated to follow-up of TESS planets. Mass measurements of these planets are critically necessary to maximise the scientific impact of the TESS mission, to understand the composition of exoplanets and the transition between rocky and gaseous worlds. MINERVA-Australis is a partnership between MIT, UNSW Australia, George Mason University, University of Louisville, Nanjing University, UC-Riverside, University of Texas, and the University of Florida. The array is now fully operational, with five of the planned six 0.7m telescopes in place. I give an overview and update of operations, and I present our precise radial velocity results and orbital solutions for several TESS planets.
Ian Wong	MIT	Phase Curve Studies of Known Transiting Systems with TESS	In addition to the huge yield of new planets, TESS will provide many science opportunities for known transiting systems. Following the legacy of similar work carried out with Kepler data, we seek to take advantage of the continuous, long-baseline photometry provided by the TESS mission to study phase curves. From a full-orbit phase curve, we can place constraints on such physical quantities as: (1) the planet's dayside temperature and Bond albedo, through measurement of the secondary eclipse depth in the TESS band; (2) the efficiency of day-night recirculation of incident stellar irradiation, via the amplitude and phase shift of the atmospheric brightness modulation across the orbit; and (3) the response of the host star to the gravitational interaction with the orbiting planet, as expressed by the phase curve signals due to Doppler boosting of the star's light and tidal distortion of the stellar surface. As an exemplary demonstration case, we recently published our analysis of the phase curve of WASP-18 from TESS Sectors 2 and 3 (Shporer, Wong, et al. 2019), which reveals a strong secondary eclipse signal and high signal-to-noise phase curve modulations attributable to atmospheric brightness variation

			and ellipsoidal distortion, as well as a weak but physically consistent measurement of Doppler boosting. Since then, we have expanded our efforts into a unified and systematic light curve analysis of all known transiting systems with predicted detectable secondary eclipses and/or phase curve signals. I will present the latest results from this work and discuss them in the context of emergent trends in exoplanet atmospheric dynamics and comparisons with the predictions of theoretical phase curve modeling.
Deb Woods	LL	Asteroid Detection in TESS Full Frame Images	In the first year of operations, the Transiting Exoplanet Survey Satellite (TESS) has delivered on its promise of high quality photometry of nearby stars for exoplanet discovery, as well as provided valuable data for applications beyond its main mission. With a wide (96 □ 24 deg2) field of view and persistent coverage for the 27 day duration of each observing sector, the TESS full frame images (FFIs) offer a unique opportunity for the discovery and characterization of asteroids in our solar system. Recognizing the substantial risk to Earth from asteroid impact, a Congressional directive to NASA was issued in 2005, instructing NASA to detect, track, catalog, and characterize Near-Earth Objects (NEOs) of size 140 meters in diameter or larger with a perihelion distance of less than 1.3 AU from the Sun. In support of these objectives, the NASA NEO Observations Program, within the Planetary Defense Coordination Office, has funded the development of an asteroid detection pipeline to run on TESS data as part of the Lincoln Laboratory Near-Earth Asteroid Research (LINEAR) program. This presentation discusses the methodology of the TESS asteroid detection pipeline, including strategies for image normalization, tracking, and false alarm filtering. The strategies are helpful in pushing the detection limit to fainter objects and reducing the impact from the crowded field. The resulting data set offers the opportunity for executing asteroid population studies and building asteroid light curves, as well as for supporting potential discovery of NEOs.
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 $\beta \sim 2$, 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.

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 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.
Zhuchang Zhan	MIT	Complex Rotational Modulation of Rapidly Rotating M Stars Observed with TESS	We have searched for short periodicities in the light curves of stars with Teff cooler than 4000 K made from 2-minute cadence data obtained in Transiting Exoplanet Survey Satellite sectors 1 and 2. Herein we report the discovery of 10 rapidly rotating M dwarfs with highly structured rotational modulation patterns among 371 M dwarfs found to have rotation periods less than 1 day. Starspot models cannot explain the highly structured periodic variations that typically exhibit between 10 and 40 Fourier harmonics. A similar set of objects was previously reported following K2 observations of the Upper Scorpius association. We examine the possibility that the unusual structured light curves could stem from absorption by charged dust particles that are trapped in or near the stellar magnetosphere. We also briefly explore the possibilities that the sharp structured features in the light curves are produced by extinction by coronal gas, by beaming of the radiation emitted from the stellar surface, or by occultations of spots by a dusty ring that surrounds the star. The last is perhaps the most promising of these scenarios. Most of the structured rotators display flaring activity, and we investigate changes in the modulation pattern following the largest flares. As part of this study, we also report the discovery of 17 rapidly rotating M dwarfs with rotational periods below 4 hr, of which the shortest period is 1.63 hr. Finally we report on the development of a variable star pipeline with machine learning applications and show other interesting objects the pipeline have discovered.
George Zhou	CfA	The Frequency of Hot Jupiters Across the HR diagram from TESS	Nearly 25 years after the discovery of the first hot Jupiter, their formation is still not fully understood. These planets are found in orbits of varying obliquities and eccentricities, orbiting stars ranging from M-dwarfs to A-stars, and receiving incident fluxes ranging over 5 orders of magnitude. One way to unveil for their origins is to survey their

			properties across a range of stellar environments. The properties of planets are intimately linked to the properties of their host stars, and TESS is uniquely positioned to explore this link. We report the occurrence rate for hot Jupiters across the main sequence, as measured via TESS FFI observations. TESS explores large sections of the sky, covering a wide stellar distribution within the Solar neighbourhood. It is also the only survey that has the photometric precision to enable a complete census of planets around stars as large as main sequence A stars. We will present our frequency for hot Jupiters from TESS, and compare them against that of Kepler, RV main sequence and evolved star surveys. Together, these results tell a tale of hot Jupiter evolution through space and time.
Carl Ziegler	University of Toronto	One Hit Wonders: Hunting for the Longest Period TESS Planets	TESS is looking at most of the sky for only 27 days during its prime mission, and it is therefore not sensitive to most long-period transiting exoplanets. Around a thousand of these planets will transit once during the TESS observations many with deep transits that would be detectable from the ground by a sub-meter aperture telescope. However, with largely unconstrained ephemerides, these planets will be difficult to follow-up and it is likely many will be unrecovered in the foreseeable future. The One Hit Wonders survey will hunt the Northern single-transit planets using a robotic half-meter telescope. We use transit models to estimate the orbital period from the TESS light curve and the stellar parameters, then monitor at long-cadence an ensemble of targets with expected transits each night. Images are reduced on-the-fly and the light curves of each target are checked for possible transits which triggers a short-cadence, continuous observing mode. With a subsequent transit secured, the timing of future transits can be determined and further observations outsourced to additional telescopes to further confirm and characterize the planet. We expect approximately twenty planets to be recovered in the first year. These discoveries will fill in a currently sparse regime in the orbital period versus host star magnitude parameter space. These planets will be excellent targets for atmospheric characterization due to their bright hosts. These studies have primarily been performed on short-period planets in the past, in part due to a paucity of potential targets, and consequently little is known about the atmospheres of cooler planets.