'Exoplanet detection, characterisation, occurrence rates, architecture & population studies (ExoChar)' Abstracts

Talks

Automatic search for transiting planets in TESS with RAVEN: Over 100 newly validated planets

Authors

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Abstract

Space-based missions such as TESS are identifying a wealth of short-period (less than 30 days) transiting planets. Despite the growing number of confirmed and candidate planets, the sample is still incomplete and highly biased, challenging demographic studies. Moreover, a large number of candidates remain unconfirmed and may end up being false positives. We apply the new pipeline RAVEN to uniformly search for, vet and validate transiting planet candidates in TESS data. We focus on a magnitude-limited sample of over 2.2 million stars, which includes all main sequence stars present in the TESS Full Frame Images that are well-characterised by Gaia. We look for planets with orbital period up to 16 days. RAVEN detects candidates with a box least squares algorithm, classifies them as planets or false positives using bespoke machine learning models trained with realistic simulations, and performs statistical validation. We newly validate 118 planets, including 31 newly detected here. Within these newly validated planets, we highlight 5 planets in the Neptunian desert, including an ultra-short period (below 1 day) planet deep in the desert, 5 ultra-short period super-Earths, including a newly detected planet with a potential outer companion, and 3 multi-planet systems, one of them newly discovered here. We also vet over 2000 candidates with high planet probability, including about 1000 new candidates.

Our sample of transiting planet candidates represents a major effort towards improving the candidate sample from TESS and provides a uniform, well-defined dataset suitable for robust population studies.

Occurrence Rates of Close-in Planets and the Neptunian Desert Across Stellar Types from TESS

Authors

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Abstract

Understanding the demographics of close-in exoplanets is essential for constraining models of planet formation and atmospheric evolution. We recently measured occurrence rates of close-in (0.5–16 d) planets with radii 2–20 $R_\oplus$ around FGK main-sequence stars using four years of TESS SPOC FFI data cross-matched with Gaia and analyzed with a uniform detection, vetting, and validation pipeline. Applying a hierarchical Bayesian framework, we inferred occurrence rates in the two-dimensional period–radius plane using 10×10 bins, achieving substantially improved statistical precision compared to previous Kepler-based studies.

We find an overall occurrence rate of $9.4^{+0.7}_{-0.6}\%$, with posterior distributions consistent with Kepler results but with an order-of-magnitude smaller uncertainties under identical binning. The hot Jupiter occurrence rate is measured to be $0.39^{+0.03}_{-0.02}\%$, consistent within 1σ with prior FGK estimates. Within the Neptunian desert region, we measure a low overall occurrence rate of $0.08\pm0.01\%$, confirming a pronounced depletion of intermediate-size planets at short orbital periods.

Building on these published results, we present new results focusing on a detailed characterization of the Neptunian desert across different stellar types. We quantify how the desert boundaries in period–radius space vary with host star mass and effective temperature, and model the underlying planet population using parametric and hierarchical approaches. We further investigate correlations with stellar metallicity to assess the role of formation efficiency versus post-formation atmospheric loss in shaping the desert. These results provide new empirical constraints on competing physical mechanisms responsible for the origin of the Neptunian desert and its dependence on stellar environment.

Orbital Decay of Hot Neptunes with NGTS

Authors

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Abstract

I present results of our ongoing long-term orbital period decay program with NGTS, specifically looking at rare hot Neptune planets, which reside in the Neptunian desert parameter space. The formation and evolution of planets within the Neptunian desert is a largely unanswered question. Recent studies have used theories, such as tidally-driven Roche lobe overflow (RLO), to explain the presence of Neptunian desert planets. In this scenario, the inward migration of a planets would generate significant orbital period decay. The predicted changes in period are measurable with transit observations spanning several years. For example, Hallatt & Millholland 2025 propose the theory of 'lossy' RLO and calculate a predicted decay rate of ~0.5 ms/yr for LTT-9779b and TOI-3261b. We have been collecting precise ephemeris measurements for Neptune desert targets with NGTS since 2019 and combining these with results from TESS photometry we are able to achieve upper limits to the migration rates of several hot Neptunes. We compare our results to the predictions and discuss the implications for formation and migration theories.

The MANGOS programme delivers five new giant planets orbiting low-mass stars.

Authors

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Abstract

Planet formation theories predict a low probability for the existence of short period giant planets around M dwarfs; however, in the last few years over a dozen have been discovered calling into question our understanding of how these planets form. In this talk, I will present the latest results of the MANGOS (M dwarfs Accompanied by close-iN Giants with SPECULOOS) programme. It is dedicated to the detection and characterisation of giant objects -planets, brown dwarfs, low-mass stars- orbiting M dwarfs. With data from the ESPRESSO spectrograph, we confirmed the planetary nature of five new giant planets: TOI-3288 Ab, TOI-4666 b, TOI-5007 b, TOI-5292 Ab, and TOI-5916 b. Adding to the sample of known planets in this category allows to discuss possible correlations between stellar metallicity and planet bulk density, as well as potential formation pathways.

The PLATO Exoplanet Analysis System: what will PLATO tell you about exoplanets?

Authors

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Abstract

The Exoplanet Analysis System (EAS) is PLATO's exoplanet data processing pipeline. Developed by the PLATO Mission Consortium, it has two major components: TransitPipe and PlanetPipe. TransitPipe is designed to detect possible transiting exoplanet signals in PLATO light curves, vet those signals to identify instrumental false alarms and astrophysical false positives, determine transit parameters for the remaining candidates, and grade them according to their likelihood of being real exoplanet signals. PlanetPipe is designed to perform full planetary system modelling to characterise the exoplanets found by the mission, both with and without the use of additional data from ground-based follow-up observations, such as radial velocity measurements.

Through these two major components, the EAS will produce not only a list of candidate exoplanets from PLATO, but also a catalogue of fully-characterised exoplanetary systems. All of the pipeline products will be regularly updated on a 3-monthly cycle (corresponding to the PLATO field rotation cadence) over the full lifetime of the PLATO mission through to the end of the post-operations phase. The EAS itself will also be updated throughout the mission, in response to specific scientific needs identified when using analysing real PLATO data during in-flight commissioning and science operations.

We will present the EAS design and the philosophy behind it, give an overview of the major components (TransitPipe and PlanetPipe), discuss the current status of the implementation and testing campaigns, and outline our plans for assessing the completeness and reliability of the EAS and estimating occurrence rates. We will also review the data products that the EAS will produce and highlight which will be delivered to the community.

Introducing ExTEMPO – Exposure Time Evaluation for Mitigation of P-mode Oscillations

Authors

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Abstract

Earth-like planets around Sun-like stars produce RV shifts of about tens of cm/s. However, stellar convection excites pressure-mode (p-mode) oscillations, introducing RV variations from tens of cm/s to several m/s, potentially masking planetary signals. To address this, we've developed ExTEMPO, an open-source tool that estimates the optimal exposure time of spectroscopic observations to average out the p-mode signal. ExTEMPO uses stellar parameters (Mass, Temperature and Luminosity) and their associated errors to simulate the power spectra and RV time series of target stars, thus quantifying the residual p-mode signal as a function of exposure time. We present a comparison with high-cadence HARPS-N observations of the Sun, demonstrating ExTEMPO's ability to guide Extreme Precision Radial Velocity (EPRV) observations. ExTEMPO is also being used in the target selection of the upcoming Terra Hunting Experiment, highlighting its ability to help plan EPRV Surveys.

The radial velocity discovery of BEBOP-5b, a circumbinary planet orbiting a binary containing an evolved primary.

Authors

Aleyna Adamson (1), Amaury Triaud (1), Adams Stevenson (1), The BEBOP Consortium

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Abstract

The environment surrounding binary stars is dynamically complicated, making planet formation and survival challenging. Nevertheless, planets are known to exist in binary systems, either orbiting a single star of the binary, circumstellar planets, or orbiting both stars, circumbinary planets. Circumbinary exoplanets have proven the most difficult to detect, with only 19 currently known orbiting main-sequence binaries. To date, just three circumbinary planets have been discovered using radial velocities, all as part of the BEBOP (Binaries Escorted By Orbiting Planets) survey, a project focused on detecting circumbinary planets with radial velocities. In this talk, on behalf of the BEBOP consortium, I will present the fourth such discovery, BEBOP-5b. HARPS radial velocity measurements collected over three years reveal a 0.9 MJup circumbinary planet following a 85 day period. The planet orbits an unusual binary system within the BEBOP sample, consisting of a fairly evolved 1.7 $M_\odot$ primary and a 0.13 $M_\odot$ full convective M-dwarf secondary still on the Main Sequence. Additionally, the radial velocity data contains a long-term drift suggestive of a second, longer-period companion in this system. BEBOP-5b expands the parameter space where circumbinary planets are known to exist and, for the first time, probes the planet population as stars evolve off the Main Sequence. Describing the discovery of this system is also an opportunity to highlight our novel Bayesian approach to quantity a radial-velocity dataset's sensitivity to exoplanets, a method which promises new developments in measuring occurrence rates, featuring fewer arbitrary choices, and able to incorporate candidate planets in a coherent way.

A comprehensive search for exoplanets around young stars

Authors
Gabriel Consolini (1)

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Abstract
Young stars (age < 1 Gyr) and the planets they host are particularly interesting to understand the mechanisms of formation and evolution of planetary systems. Indeed, observing and comparing planets with different (well constrained) ages in the range 10-1000 Myr allows us to obtain information on the mechanisms of planet formation (e.g. planet-disk interaction), orbital evolution (e.g. tidal circularization), and planetary radius/atmosphere evolution (e.g. photoevaporation, core-powered mass loss).
The detection of exoplanets around young stars is, however, a very challenging endeavour. Young stars are characterized by fast rotation periods, are generally located in dense stellar environments and tend to be, on average, significantly more active than older stars, hampering exoplanet detection. For these reasons, the number of known exoplanets with ages <1 Gyr is small compared to the number of all the exoplanets discovered so far. It is even worse if we look to long-period (>100 d) young exoplanets, where the number of detections is well below 10. However the upcoming PLATO mission will allow us to fill this gap, thanks to the high-precision of the light curves the mission will produce and the long timeline of observations. Meanwhile, it is necessary to develop all the tools for detecting and validating this kind of exoplanets.
Using TESS Full Frame Images (FFIs), I am performing a comprehensive search of exoplanets around young stars, with the goal of producing a reliable list of candidate exoplanets orbiting young stars. In order to tackle the challenges inherent to young stars discussed above, I used a software specifically dedicated to the extraction of light curves from FFIs from stars located in dense environments, pyPATHOS, thanks to its neighbours-subtraction capabilities.
I have applied this technology to a catalogue consisting of almost 400 000 young stars, compiled starting from previous works in the literature, covering the Sectors from 1 to 96. The resulting light curves were detrended and searched for transits using the public package Transit Least Squares. The identified periods were evaluated based on their TLS statistics, and about 90 000 signals were selected for further inspection. These signals are now being vetted using RAVEN, a machine-learning validation pipeline for TESS candidates. As a byproduct of the light curve analysis, I will characterize the variability of the stars, which will then be used as a proxy of stellar age (through, e.g., gyrochronology).
This work aims to deliver a robust sample of young exoplanet candidates, paving the way for follow-up observations and population studies, and preparing the ground for future missions such as PLATO.

Bridging the Gap to Gaia DR4: Discovering and Characterising Long-Period Transiting Exoplanets with TESS and NGTS

Authors

Amber Sedgley (1), Samuel Gill (1), Peter Wheatley (1), Daniel Bayliss (1)

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Abstract

I will present work to discover long-period transiting exoplanets, aiming to overcome the bias of transit surveys to hot, close-in planets with short orbital periods. We find warm Jupiters, with periods of 10–300 days, that bridge the gap between the known exoplanet population and the giant planets of our own Solar System. These worlds occupy a regime where interactions with planetary companions and migration pathways leave detectable imprints on their orbital architectures. Emerging trends in transit timing variations and spin-orbit obliquities point to unseen companions, indicating diverse formation pathways and a demographic landscape richer than previously anticipated. TESS frequently detects only single transits from such planets, and NGTS remains one of the few facilities capable of recovering additional transits from the ground. The upcoming Gaia DR4 release will reveal a large population of long-period giant planets, beyond the probabilistic detection limits of TESS and NGTS, raising the exciting prospect of discovering a crucial sample of cold transiting planets. I will present our latest results and discuss their implications for benchmarking planet formation models and migration pathways. I also place these results in the context of discoveries expected in the coming years - from Gaia, PLATO, and Ariel. The synergies between these missions will be essential for understanding warm giant planets and I conclude with an overview of what the community can expect for this population in the years ahead.

What Will Gaia DR4 Reveal About Known Exoplanet Systems?

Authors

Cameron Kelahan (1), Daniel Bayliss (1)

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Abstract

In December 2026, Gaia DR4 will release 5.5 years of epoch astrometry and photometry for 2 billion stars, as well as spectroscopy for 150 million stars. This will allow us to study exoplanet populations and exoplanetary system architectures. We use detailed simulations to investigate how Gaia DR4 will allow us to probe the known exoplanet systems, in particular focusing on those systems with known TTV signals or RV trends that hint at possible longer-period companions.

Posters

Finding hidden long-period planets with TESS

Authors

Toby Rodel (1), Christopher A. Watson (1), Daniel Bayliss (2), Samuel Gill (2)

(1) Queen's University Belfast
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Abstract

The Transiting Exoplanet Survey Satellite (TESS) has discovered a wealth of transiting exoplanets around nearby bright stars. However, ~95% of discoveries to date are short period planets with P<25 days. We perform new realistic simulations on the TESS-SPOC data using the TIaRA code, finding up to ~700 exoplanets with periods over 25 days may remain undiscovered. >75% of these will have unsolved periods, coming from either a single transit or two or more transits separated by ~2 years between TESS visits (biennial duotransits). The peak in the period distribution of these discoveries also shifts from 25-50d after year 2 to 100-200d after year 5. We also present efforts to identify these missing objects and constrain their orbital periods via follow-up. Recent successes include NGTS-EB-7, a ~198-day eclipsing binary found from TESS biennial duotransit events and TIC-65910228 b, a ~180-day transiting super-Jupiter detected from a single TESS transit.

An Update on the SPECULOOS Survey: Hunting Small Planets Around the Coolest Stars

Authors

Mathilde Timmermans (1)

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Abstract

The SPECULOOS survey has been monitoring the brightness of hundreds of ultracool stars in the past decade. The project aims at discovering new promising targets for atmospheric characterization with JWST by finding small habitable rocky planets transiting their host stars. It uses a network of robotic telescopes (1m-class) located in Chile, Mexico and Tenerife, to target a sample of about 1700 very low-mass stars in a 40 pc volume-limited sample. Such a survey allows to study terrestrial planets orbiting ultracool stars on a population level, as well as understand the activity of these stars thanks to our long-term monitoring strategy. On this poster, I present an update on the status of the survey, and highlight our discoveries since the TRAPPIST-1 system. I also mention the updates of the facilities, the upcoming telescope and new cameras to reach into the NIR to focus on the coldest and faintest systems.

ESSP 4: benchmarking stellar variability mitigation with solar data

Authors

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Abstract

The fourth round of the Extreme Stellar Signal project data challenge is coming to a close. In this round participants were asked to detect injected planets in 3-months long solar datasets, including HARPS-N. We present preliminary results from the comparison of the 15 methods included in the analysis.

Probing the cold planet regime with two new transiting planets from TESS

Authors

Maddy Scott (1), Guy Davies (1), Amaury Triaud (1)

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Abstract

Cold (<255K, ~Earth's equilibrium temperature), transiting planets are inherently difficult to detect due to observational biases and decreasing transit probability with increasing separation from the host star. As such, this region of parameter space is poorly sampled. These planets however are essential to helping understand planet formation and migration relatively far out in protoplanetary disks, specifically at or around the ice line.

Here I will present two new planets, TOI-6478b (a Neptune) and TOI-6981b (a sub-Neptune), which thanks to the cool effective temperatures of their M dwarf host stars (~3200K), occupy this cold temperature regime on relatively short orbits of just ~34 days and ~61 days respectively. I will discuss their importance for cold planet studies and how compared to other cold planets, their relatively short orbits allow for feasible follow-up with e.g. JWST to facilitate studies of cold chemistry in exo-Neptunian atmospheres. These gaseous planets can provide a crucial link between cold exo-Neptunes and the Solar system's ice giants.

Comparing telluric removal methods in their capability to recover injected exoplanet atmosphere signals with high resolution emission spectroscopy

Authors

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Abstract

Correction of telluric lines beyond the use of standard stars is essential to achieve good precision and unbiased measurements of atmospheric abundances and temperatures of exoplanets via high resolution cross-correlation spectroscopy. We use our own publicly available algorithm called Astroclimes to remove telluric lines from archival CARMENES observations of tau Bootis and compare its performance to PCA in the context of exoplanet emission spectroscopy. We carry out injection and recovery tests with model planetary signals of different strengths and find that Astroclimes can recover the signal with similar SNRs as the PCA cases with a higher number of components, while being less aggressive on the injected signal. Besides assessing how PCA alters the injected planetary signal as we add more PCA components, we explored cases of different planetary orbital velocities, which should pose harder challenges on both detrending methods studied. We also combine tau Bootis observations from multiple nights to verify whether we can confirm the water detection reported in Webb et al. (2022) when employing Astroclimes or PCA.
Further development is ongoing to apply the algorithm to transmission spectroscopy as well, which is a more demanding task given the typically smaller radial velocity separation between telluric and planetary signals. The first application would be to analyse archival CARMENES data of HAT-P-11 that hasn't been used for atmospheric characterisation and carry out a full retrieval analysis to determine the atmospheric composition of HAT-P-11b. This work would provide further insights on the nature of the atmosphere of HAT-P-11 b, which has had both detections (Basilicata et al. 2024) and non-detections reported in the literature (Masson et al. 2026).

A Bayesian approach to the detection sensitivity of exoplanets in radial velocity data.

Authors

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Abstract

Traditional methods of injection recovery tests can be time intensive and are often restricted in terms of the number and extent of parameters that are considered. We propose an alternative, bayesian approach, using the kima python package which utilises a diffusive nested sampler. Here, it is not required to 'inject' any additional signals into the existing data. Simply, we force the nested sampler to explore models with a higher number of planets than is present producing a map of signals that are compatible with the data. This method has many advantages to the traditional injection recovery. Firstly, the exoplanet signals are assumed to be Keplerian rather than sinusoidal. Secondly, eccentricity is a free parameter instead of usually being fixed to zero. Thirdly, the nested sampler can marginalise over all parameters and phases. Ultimately, we are answering the question: what signals are compatible with our data? instead of can a specific signal be detected? In this talk I will describe our method, present comparisons with injection recovery tests, and explain how these sensitivity maps can be used to calculate occurrence rates.

Optimising Small Telescopes for Small Exoplanet Observations

Authors

David Arnot (1), Professor Ulrich Kolb (1), Dr Jo Barstow (1)

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Abstract

Space-based observatories for exoplanet science are resource-limited and highly oversubscribed, while ground-based facilities are more widely available, offering significant opportunities for research, provided sufficient photometric precision can be achieved. This becomes increasingly challenging when probing the shallow transit depths of small planets (sub-Neptunes and super-Earths). We present ongoing work optimising exoplanet transit observations using the Open Science Observatory at the IAC Observatorio del Teide, focused on extending the accessible parameter space toward small (<3 Re) targets within the Ariel Mission Candidate Sample using our 0.5m-class autonomous robotic optical telescopes (PIRATE and COAST). We demonstrate that such facilities can achieve exoplanet transit depths below 0.2 mmag, and down to ~1.3 Re, under favourable conditions, with further improvements in progress. These optimisation strategies also provide potential for measurable gains in precision for larger transit-depth observations.

A Non-Stationary Gaussian Process for Modelling Stellar Activity in Exoplanet Detection

Authors
Valentina Tardugno (1), Suzanne Aigrain (1)

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Abstract
Detecting Earth-like planets around Sun-like stars remains a major challenge due to complex stellar variability that can conceal or mimic planetary signals, and the intrinsically small amplitudes characteristic of Earth-like planets. Gaussian Process (GP) models are often employed to model stellar variability, but they struggle to capture long-term activity cycles. In this work, we develop a non-stationary, multidimensional GP that extends traditional multi-GP approaches by incorporating a time-dependent function to modulate the kernel. This modulation is designed to capture long-term stellar activity cycles, with the goal of improving the modelling of stellar variability and enhancing the recovery of low-amplitude signals from Earth-like planets. We will test the model on both simulated and real data, and apply it to solar observations to assess its ability to recover known activity cycles. We will also perform injection–recovery tests to assess its impact on the detectability of Earth analogues. Performance will be evaluated against traditional multi-GP methods using leave-one-out cross-validation.

Constraining Wide Companions to 18 close-in Neptunian Exoplanets using Combined Datasets

Authors

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Abstract

The current lack of Neptunian planets on short orbits in the confirmed exoplanet population may be explained by such planets forming at wider separations then undergoing migration. Large outer companion objects such as Jupiter-like planets, brown dwarfs or binary stars are strong candidates for causing High Eccentricity Migration, pushing ice giants from formation regions beyond the snow line towards shorter orbital periods. Determining the likelihood of finding a wide companion in these systems probes the contribution of this evolutionary pathway to the population of Neptunian planets. However, even with extensive follow-up observations and/or non-detections, there exists significant regions in orbital period – mass parameter space where migration-inducing companions cannot be ruled out. Using up to 14 years of continuous radial velocity (RV) monitoring from CORALIE and SOPHIE, along with additional ESO archival data, we search for wide companions in 18 systems hosting short period Neptunian planets. In 4 systems, we find resolved orbits for 4 wide companions. Additionally, we implement MOLUSC, a Monte Carlo framework which assesses simulated companion survival rate by combining RVs and high-resolution imaging contrast curves with Gaia astrometry and photometry. As a result, we constrain the mass-period parameter space for both planetary and stellar companions for all 18 systems. These constraints will allow for preliminary investigation into the occurrence rate of companions in systems hosting Neptunian planets.

Planet Hunting with Machine Learning

Authors

Sofia Platymesi (1), Suzanne Aigrain (1), Chris Lintott (1)

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Abstract

Planet Hunters TESS is a large-scale citizen science project in which volunteers have, for over seven years, contributed to the classification of lightcurves from NASA's Transiting Exoplanet Survey Satellite (TESS). These classifications have enabled the discovery of exoplanets, multi-stellar systems, and anomalous signals that we are still trying to understand.

In this work, we develop a machine learning framework that leverages citizen scientist classifications to model human decision-making in the identification of astrophysical signals. Rather than replacing human input, the approach is designed to prioritise targets for follow-up by distinguishing between likely astrophysical events and noise, while retaining sensitivity to rare or ambiguous phenomena. The framework integrates human-derived labels, inter-model uncertainty, and ensemble-based scoring within a unified prioritisation pipeline.

We present initial results from applying this human-in-the-loop system to TESS observational data, demonstrating its utility in triaging large-scale datasets. Such hybrid approaches are increasingly essential in the context of next-generation surveys, where data volumes exceed the capacity for manual inspection. This work illustrates how we can effectively combine citizen science, expert analysis, and machine learning to accelerate discovery and improve the identification of novel astrophysical phenomena.

Predicting and Purging PLATO's Planet Pretenders with RAVEN

Authors

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Abstract

RAVEN (Ranking and Validation of ExoplaNets) is a vetting and validation pipeline that utilises two machine learning (ML) classifiers to distinguish true planetary signals from a variety of astrophysical false-positive scenarios. Unlike other vetting/validation frameworks, RAVEN combines ML vetting with statistical validation and is trained via simulated data, reducing biases introduced when vetting pipelines are trained on pre-classified candidates. RAVEN has achieved an accuracy of 91% when tested on pre-classified TESS Objects of Interest (TOIs) and a precision of 97% when a 0.9 probability threshold is applied. RAVEN's success, having recently validated more than 100 new planets and identified over 2000 new candidates, demonstrates the pipeline's effectiveness in candidate classification and its potential for further development. This performance suggests RAVEN is well suited to assist the characterisation of exoplanet candidates due to be observed by upcoming high-sensitivity missions such as ESA's PLATO mission. With the launch of PLATO soon approaching, a variety of vetting and validation pipelines will be essential to perform accurate candidate classification. Developed for TESS exoplanet candidates with orbital periods up to 16 days, RAVEN will require further adaptation to be able to vet and validate PLATO exoplanet candidates, given that PLATO will also detect planets with orbital periods of over 100 days focusing on terrestrial planets with orbital periods of around one year. We present RAVEN modified for PLATO and trained on a simulated PLATO dataset produced with a PLATO-adapted synthetic light curve simulation pipeline and injected into PLATO light curves. Our training set was generated using both inferred occurrence rate and uniform planet period/radii sampling to ensure RAVEN is prepared for the variety of systems PLATO will detect. RAVEN was trained on transiting-planet light curves spanning orbital periods from 0.5 to 500 days and planetary radii from 0.5 to 16 Earth radii. The simulations were generated for PLATO target stars obtained from the PLATO Input Catalogue and include multiple false-positive scenarios, such as eclipsing binaries and blended systems that can mimic planetary signals. I will summarise the PLATO-adapted pipeline's test-set performance so far, compare it to the pipeline's performance for TESS and identify which scenarios are likely to dominate the false positives in PLATO's data. Finally, I will discuss the remaining adaptations to improve the pipeline in vetting long-period terrestrial planets, outline ongoing work on multi-planet scenarios and further applications to other exoplanet detection missions (e.g. NASA's Roman telescope).

Decoding the radius valley with young planets

Authors

Cynthia Ho (1)

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Abstract

The radius valley (i.e. a dearth of small planets between 1.5-2 Earth radii) offers crucial insights into planet formation and evolution. However, our current understanding of the radius valley is based on analysing mature planets (~> 1 Gyr), since very few young small planets with reliable ages have been discovered, due to the stellar hosts being more active and hence masking subtle planetary transit signals in the stellar variability. We are performing a ongoing large-scale young planet search using state-of-the-art algorithms, incorporating robust data cleaning steps, as well as modelling stellar variability simultaneously with transit detection. We apply these algorithms to known young exoplanet systems, and have identified several promising signals consistent with additional small planetary companions, that have previously been undiscovered. This work will increase the sample of currently known young small exoplanets, enabling us to further understand the radius valley, and small planet formation and evolution.

Missed or Missing? Searching for circumbinary planets in TESS

Authors

Jenni French (1), Amaury Triaud (1)

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Abstract

For exoplanets orbiting single stars, it is unclear whether the planet has formed in-situ or undergone disc migration to occupy its observed orbit. For circumbinary planets, this formation mechanism uncertainty is removed. Most circumbinary planets are found on close orbits corresponding to a region of disc turbulence where planets could not form due to perturbations from the central binary. Disc migration is thus the only viable formation channel. There is also a lack of small, long period circumbinary planets and it is unclear if we have missed these due to observational biases and limitations, or if they are missing for astrophysical reasons.

Currently, only 17 circumbinary planets have been confirmed, of which 14 transit their host stars. With such a small sample, it is difficult to perform population studies that could reveal exoplanetary properties which are specific to circumbinary planets. We have developed a pipeline to analyse TESS eclipsing binaries and identify additional events that could be produced by the presence of a third body, aiming to increase the number of circumbinary planet cadidates. I will present how this pipeline works, with initial results from the search, including candidate systems with events caused by an unknown third body.