PLATO German Community Meeting

Report of Contributions

Contribution ID: **16** Type: **not specified**

Southern deep-field monitoring and northern all-sky follow-up: PLATO plans at AIP

Monday 17 April 2023 16:20 (15 minutes)

We will provide two robotic facilities dedicated to PLATO science. The southern-hemisphere facility is a 30cm wide-field CCD imaging photometer at Cerro Armazones in Chile sampling a FOV of 52 square degrees with 2.5 arc second pixels. It will start full robotic operation in 2023/24 and aims for continuous monitoring of the PLATO southern deep field for 200 nights per year. The northern-hemisphere facility is the 2×1.2m STELLA robotic telescope observatory in Tenerife. By 2024, STELLA-II will feed three R=50,000 echelle spectrographs for the wavelength range 380—980nm simultaneously. The visual spectrograph is stabilized and suited for RV precision of 1-2 m/s, the blue spectrograph will monitor Ca II H&K, and the red-optimized spectrograph the near infrared spectrum with lowered RV stability but high throughput. In this presentation, we present the current and planned status of both facilities and sketch the future observing capabilities for PLATO follow-up.

Primary author: STRASSMEIER, Klaus

Presenter: STRASSMEIER, Klaus

Session Classification: Contributed Talks (part 1)

Contribution ID: **18** Type: **not specified**

Activity monitoring telescope network in preparation of PLATO

Monday 17 April 2023 16:35 (15 minutes)

Main PLATO targets exhibit short- and long-term activity variability. Knowledge about a star's activity pattern, e.g., cycle length and amplitude, and the momentary status of activity within this pattern during PLATO observing campaigns, is fundamental for the correct interpretation of photometric variability, RV follow-up, and estimates of stellar age. Together with WP 145, we are planning observing campaigns with a telescope network to monitor CaII H&K emission of a large number of potential PLATO targets. Active participation of the German community is an opportunity to collect a relevant amount of information for the PLATO mission, and to initiate an efficient network of small telescopes.

Primary author: REINERS, Ansgar (Georg-August-Universität Göttingen)

Presenter: REINERS, Ansgar (Georg-August-Universität Göttingen)

Session Classification: Contributed Talks (part 1)

Contribution ID: **19** Type: **not specified**

The transition between super-Earths and sub-Neptunes: Interior and atmosphere modelling of the low-mass planet population

Tuesday 18 April 2023 11:05 (15 minutes)

Low-mass exoplanets are showing a diversity in their densities and irradiation conditions, ranging from highly irradiated planets to temperate worlds. To estimate their composition, we have developed an interior structure model that includes self-consistently an atmosphere in radiative-convective equilibrium for water and CO_2 envelopes. We use the model within a Bayesian adaptive Markov Chain Monte Carlo (MCMC) to estimate the uncertainties of the core and water mass fraction for a sample of multiplanetary systems, which gives us clues about their possible formation site in the protoplanetary disk and their formation mechanisms, as well as assess their observability with JWST.

Primary author: ACUNA AGUIRRE, Lorena (Max Planck Institute for Astronomy)

Presenter: ACUNA AGUIRRE, Lorena (Max Planck Institute for Astronomy)

Session Classification: Contributed Talks (part 3)

Contribution ID: **20** Type: **not specified**

Stellar flares with PLATO & synergies with TESS and eROSITA

Tuesday 18 April 2023 09:30 (15 minutes)

The advent of modern photometric monitoring space missions has boosted studies of stellar flares. Such events are key signatures of magnetic activity on late-type stars, and important diagnostics for our understanding of coronal physics as well as the evolution of planet atmospheres. These latter ones are irradiated and heated by flares, possibly to the point of atmospheric erosion and altered atmospheric chemistry.

Flares will be identified within the PLATO pipeline MSAP1 both in order to remove stellar variability from the light curves and to extract astrophysically important information. In this talk I provide a brief summary of the work carried out under my lead in the PLATO WP 123 700 (”Stellar flares”).

Moreover, I will present the potential of TESS and eROSITA in characterizing the magnetic activity of PLATO targets. These missions have over the last few years both performed an almost full-sky survey in the optical and in X-rays, respectively. I will show preliminary results from a first match between the PIC 1.1.0 and data obtained from TESS and eROSITA, and how the information obtained is beneficial for studies of exoplanets.

Primary author: STELZER, Beate (University of Tuebingen)

Presenter: STELZER, Beate (University of Tuebingen)

Session Classification: Contributed Talks (part 2)

Contribution ID: **21** Type: **not specified**

Approaches to characterize Astrophysical Noise Sources (PLATO WP115100)

Tuesday 18 April 2023 09:00 (15 minutes)

The goal of the PLATO WP 115100 “Astrophysical Noise Sources” is to understand the effects that astrophysical noise, in particular manifestations of stellar activity, has on the radial velocity follow-up of planet candidates discovered by PLATO, and to outline mitigation procedures.
I will present a possible approach informed by X-ray observations of stars, including the multi-year all-sky scans of the eROSITA mission. X-ray observations are a sensitive tool to quantify stellar activity, and can be used for a variety of exoplanetary considerations. I will show how repeated X-ray measurements (in this example originally collected to estimate atmospheric evaporation rates of exoplanets) can be used to identify magnetically quiet periods of stars that may be used to schedule particularly efficient radial velocity follow up campaigns.

Primary author: POPPENHAEGER, Katja (AIP; Potsdam University)

Presenter: POPPENHAEGER, Katja (AIP; Potsdam University)

Session Classification: Contributed Talks (part 2)

Contribution ID: **22** Type: **not specified**

The detection and characterization of faculae- vs spot-dominated stars

Tuesday 18 April 2023 10:20 (15 minutes)

The rotation period is in general easy to detect in regular and well-modulated light curves of young and active stars. However, despite the success of the Kepler and TESS missions, reliable information on rotation periods for Sun-like stars is still lacking (as in about 75% of stars in the Kepler field). Stars with solar-analog variability exhibit non-periodic light curves, low variability contrast, short lifetime evolution, and random emergence of magnetic features. In this work, we show that the profile of the gradient of the power spectra (GPS) can be used to determine rotation periods even for stars with complex brightness variations, like the Sun. By characterizing the shape generated by facular or spot transits from models, as well as, recorded in the total solar irradiance, we quantified whether the stellar surface was dominated by facular or spot regions. We found that Sun-like stars are distributed between three different regimes, spot-dominated, faculae-dominated, and stars in a transition between the two. Moreover, we performed a spectroscopic and polarimetric analysis of the stellar activity for a sample of twin stars and compared these results with the photometric characterization. Our findings shed light on the question of what makes a star's surface preferentially facula- or spot-dominated. This analysis will provide valuable insights for characterizing the rotation, surface features, and activity of stars observed by future missions like PLATO.

Primary authors: AMAZO-GOMEZ, Eliana M. (Leibniz Institute for Astrophysics Potsdam, AIP); POPPENHAEGER, Katja (AIP; Potsdam University)

Presenter: AMAZO-GOMEZ, Eliana M. (Leibniz Institute for Astrophysics Potsdam, AIP)

Session Classification: Contributed Talks (part 3)

Contribution ID: **23** Type: **not specified**

Tidal orbital decay with PLATO

Tuesday 18 April 2023 10:35 (15 minutes)

The orbits of hot Jupiters are expected to decay through tidal interactions between the planet and host star, and this has been observationally confirmed for at least one system. Measuring this tidal orbital decay via transit timing variations allows us to determine the stellar tidal quality factor, Q. *This poorly-understood parameter governs the timescale of many tidal processes, such as the recircularisation and coplanarisation that occurs after dynamic migration. As such, improving our knowledge of Q* is vital in order to fully understand planet formation and migration, as well as in calculating the lifetimes of these extreme planetary systems. PLATO will observe with high precision a large number of transits for many targets, making a vital contribution in this area.

Primary author: SMITH, Alexis (German Aerospace Center (DLR) (Institute of Planetary Research))

Presenter: SMITH, Alexis (German Aerospace Center (DLR) (Institute of Planetary Research))

Session Classification: Contributed Talks (part 3)

Contribution ID: **24** Type: **not specified**

The World of PLATO Transits

Monday 17 April 2023 16:50 (15 minutes)

We summarize how we can reach the goals of PLATO in characterization of exoplanets. We show how the instrumental and stellar noise can be removed from the light curves, how PLATO Exoplanet Analysis System will work and how the algorithms defined in Plato Science Management and how the responsible work package WP 114 works.

Primary author: CSIZMADIA, Szilard (DLR)

Presenter: CSIZMADIA, Szilard (DLR)

Session Classification: Contributed Talks (part 1)

Contribution ID: **25** Type: **not specified**

Performance Team

Tuesday 18 April 2023 09:15 (15 minutes)

tbd

Primary author: CABRERA PEREZ, Juan (DLR)

Presenter: CABRERA PEREZ, Juan (DLR)

Session Classification: Contributed Talks (part 2)

Contribution ID: **26** Type: **not specified**

PMC Calibration and Operation Team

Tuesday 18 April 2023 09:45 (15 minutes)

The PMC Calibration and Operation Team (PCOT) provides the required support of the PMC to the calibration and operation of the payload as well as monitoring its health. The PCOT Manager (PCOTM) contributes to the Payload System/AIV Support Team and is responsible for all matters related to e.g. Payload User Manual, TM/TC database, calibration parameters and (together with PPT) inputs related to performance engineering. The PCOT is also part of the PMC contribution to the Science Ground Segment (together with PDC and PSM) due to its role in the operation and performance monitoring activities.

We will give an overview on the current and planned activities of the PCOT.

Primary author: EIGMÜLLER, Philipp (DLR, Institut für Planetenforschung)

Presenter: EIGMÜLLER, Philipp (DLR, Institut für Planetenforschung)

Session Classification: Contributed Talks (part 2)

Contribution ID: **28** Type: **not specified**

Low-mass exoplanets: From internal structure to long-term evolution

Tuesday 18 April 2023 11:20 (15 minutes)

During the past decade, exoplanet detections have revealed a vast diversity of planets, particularly in the low-mass regime below 20-30 Earth masses. Mass and radius observations are the main constraints to infer the present-day internal structure of these planets whose knowledge provides a starting point to characterize them and answer many fundamental questions in exoplanetary science: How did these planets form and evolve? How unique are the Earth and the Solar System? Which of these planets have the potential to host life?

Planets are not static objects. Interiors and atmospheres as inferred today from remote observations are the result of a complex evolution in response to a variety of factors such as long-term cooling, volcanic outgassing, atmospheric escape, as well as orbital and stellar evolution.

In this talk, we will discuss the work on exoplanet interiors currently carried out at DLR, focusing on two main aspects. 1) We will show how machine-learning methods can be used to rapidly gain insight into the interior structure of exoplanets and how accurate radius and mass measurements from PLATO can help to better constrain the size of the interior reservoirs. 2) We will present simulations of the coupled long-term evolution of the interior and atmosphere of large populations of terrestrial bodies and discuss the key factors that influence their long-term habitability.

Primary author: BAUMEISTER, Philipp (DLR, Institut für Planetenforschung)

Presenter: BAUMEISTER, Philipp (DLR, Institut für Planetenforschung)

Session Classification: Contributed Talks (part 3)

Contribution ID: **31** Type: **not specified**

DLR's modelling efforts relevant to PLATO Interpretation specific science working groups

Tuesday 18 April 2023 10:50 (15 minutes)

We will present the modelling efforts at the DLR that will contribute to several PLATO interpretation specific science working groups. More specifically, we will showcase our 1D modelling effort for rocky exoplanet atmospheres that will contribute to the "atmospheres of terrestrial planets" and "PLATO habitable zone planets"WGs; our hot Jupiter modelling that will be useful for the "composition and formation of gas and ice giants"working group; our 3D modelling of hot Jupiter that will contribute to the "3D exoplanet climate modelling"WG; and finally our cloud modelling strategy for the "cloud and gas chemistry of planetary atmospheres".

Primary author: IRO, Nicolas

Presenter: IRO, Nicolas

Session Classification: Contributed Talks (part 3)