PLATO's capability in studying Phase Curves

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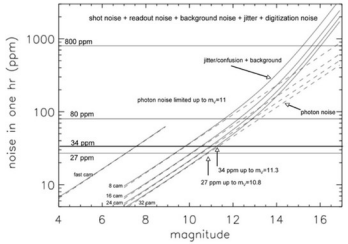
Introduction

The PLAnetary Transits and Oscillations of stars (PLATO) telescope is going to study a large number of extrasolar planetary systems. Given the design of the mission, PLATO will produce long-duration uninterrupted high precision Photometry. The SNR will be quite significant enough to describe the subtle features of an exoplanetary phase curve(PC) such as the atmosphere's brightness profile and/or stellar ellipsoidal variation etc.



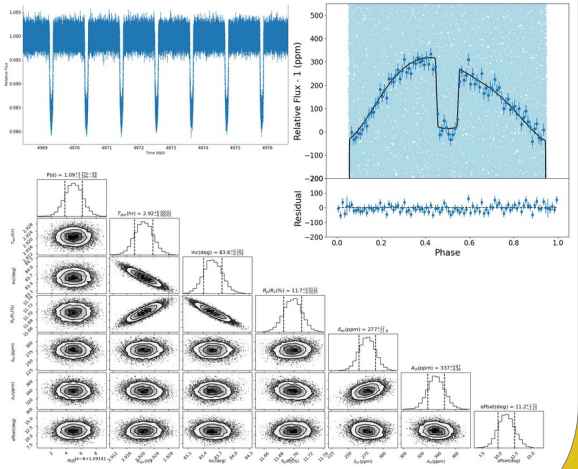
Rauer+ 2014

Context

- How good is PLATO in terms of photometric precision for phase curve observations? (see Fig. above)
- How precise are the estimates on the planetary phase curve parameters w.r.t past optical telescopes like Kepler and TESS?
- In what way can PLATO contribute in exoplanetary atmospheric characterization in the JWST and later ARIEL era?

Case study: WASP-12b

- We simulated the PC of WASP-12b around the 11.7 magnitude star.
- We used the 8 camera photometric noise estimates.
- T_{day} and A_g estimates were taken from TESS and Spitzer phase curves.
- We simulated a light curve as seen by PLATO for over 2 months.
- The light curve is fitted with a Transit and PC model in a Bayesian framework to obtain the precision on the planetary parameters.
- The assumed planetary parameters are successfully recovered within uncertainties.



Results

- In comparion to TESS's 27 days observation, PLATO's 2 month long continuous observation will provide at least 7 fold increment in the precision of the planetary parameters for this 11.7 mag star system.
- PLATO's results are almost comparable to a few year long Kepler observations as tested with the phase curve of Kepler-76b, a 13.3 magnitude star system.
- For brighter systems, the signal is significant enough to even study eclipse mapping which can precisely provide the 2-D brightness profile of the exoplanet.

Conclusion

- PLATO will outperform TESS, CHEOPS and Kepler in the optical analysis of planetary phase curves, thereby precisely constraining the geometric albedo and the planetary brightness temperature.
- For brighter systems, PLATO's observations could monitor temporal evolution of the phase curve profiles, a consequence of the dynamics in the upper atmosphere.
- High-precision phase curve obtained with PLATO also provides a great opportunity to study non-transiting exoplanets thereby allowing their orbital and atmospheric characterization

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