The Monotransit Initiative

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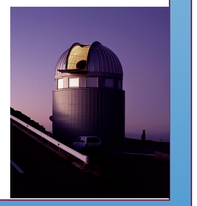
PlanetS

INTRODUCTION

Long-period transiting planets provide the opportunity to better understand the formation and evolution of planetary systems. Their atmospheric properties remain largely unaltered by the impact of the host star, and their orbital arrangement reflects a different, and less extreme, migrational history compared to close-in objects. The sample of long-period exoplanets with known radii is still limited, but a growing number of long-period objects reveal themselves through single transits in TESS data.

AIM

Detect and characterize cool giant transiting planets orbiting bright stars and interpreting their nature using planet formation and evolution models



METHOD

- Vet monotransit events flagged by differents pipelines: TOI, TSTPC, NGTS (Ref 1 & 2)
- Select the best candidates
- Schedule these candidates for spectroscopic vetting with high-resolution spectrograph CORALIE
- Photometric follow up is set up with NGTS in blind survey mode (when single transit is detected) or alias chasing mode (when a set of period aliases can be defined)
- Continue radial velocity monitoring once spectroscopic vetting is successful
- Optimize observation strategy for candidates revealing significant radial velocity variations
- Modeling of the radial velocities to confirm the orbital period of the transiting candidates (Ref 3)
- Joint modeling with additional transit events (Ref 4)

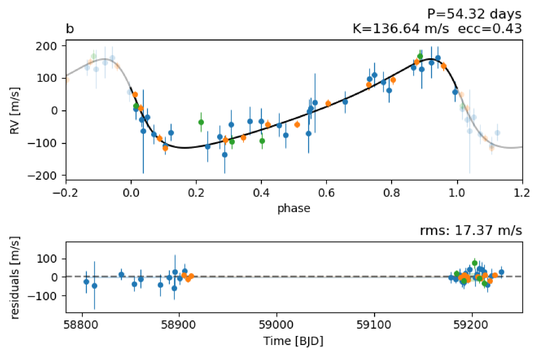
RESULTS

TIC 257527578 b

A mildy-irradiated but highly eccentric gas giant

A single transit event was detected in the TESS Sector 4 data. No second transit was seen in the TESS extended mission, The star was monitored by the Next Generation Transit Survey (Ref 5) in blind survey mode (star is observed every possible night). A second transit was detected by NGTS about two years later after the first one.

With an eccentric orbit (e~0.4), this system is relevant to **test if it is a proto Hot-Jupiter in the midst of migration (i.e.high eccentric migration scenario) or if other mechanisms are required to explain its orbital configuration.**

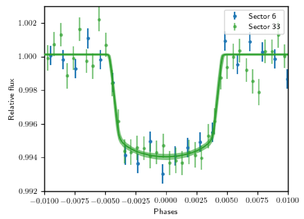


Spectroscopic vetting and radial velocity follow-up was performed with CORALIE. This star was also monitored by other spectrographs: FEROS and HARPS. The phase folded transit lightcurves and radial velocity data and corresponding models are shown in the two figures above.

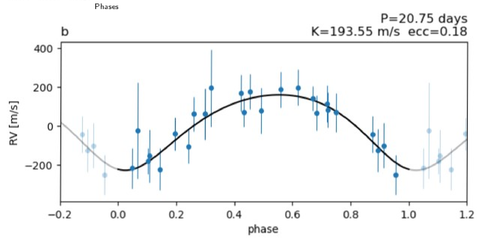
TIC 124029677 b

Eccentric warm Jupiter transiting a late F-type star

Two single transits were detected in TESS Sector 6 and Sector 33. Both transits are separated by two years. Radial velocity follow up was performed with CORALIE. Phase folded lightcurve and radial velocity plots are shown below.



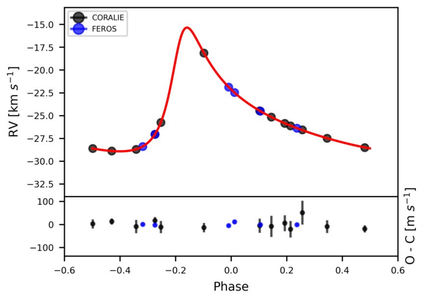
Joint modeling reveals an object with a planetary mass of 3Mjup and on a 20 day orbit with an eccentrcity of 0.18.



Monotransit vetting in key numbers

Single transit events vetted through eyeballing: 400 targets
Candidates spectroscopically vetted: 35 targets

Candidates with an orbital solution: 5 targets
Spectroscopic binaries: 5 targets



Phase folded radial velocity curve of one of two eclipsing low mass binaries

(Moyano, in prep)

CONCLUSIONS

Warm Jupiters have quite long orbital periods compared to Hot-Jupiters but they are still located quite close to their host star. Do these planets form in-situ? Otherwise what are the mechanisms which drive their migration? Such questions are still in debate, thus increasing the sample of warm Jupiters with precise planetary mass and radius is crucial to better understand their formation process.

We detected and charaterized four warm giant planets which orbit reasonably bright host stars making these objects valuable targets for follow-up studies of the planetary atmosphere.

Summary of the characterized exoplanets:

TIC 124029677b: a 20 day period planet with a planetary mass of 3 Jupiter masses and a low eccentricity of about 0.18.

TIC 257527578b: a 54 day period planet with a planetary mass around 2.4 Jupiter masses and a high eccentricity of about 0.4 (Ulmer-Moll, in prep)

ACKNOWLEDGEMENTS

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