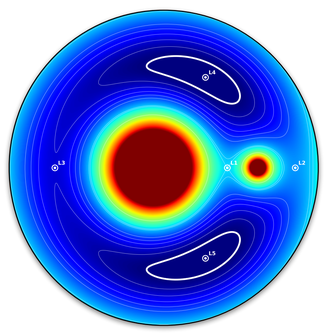
Glory or Death

TOI-178 c,d: either the first co-orbital planets or just false positives

Jorge Lillo-Box

Co-orbital extrasolar planets

Co-orbital objects (also called trojans) are bodies in 1:1 resonance with planets. They can be as large as the planet itself and co-orbit in several dynamically stable configurations. These objects are by-products of the planet formation and early evolution processes, becoming fossils of the first stages of the life of planetary systems. Thus, **they contain primordial dynamical, physical, and chemical information of the system.**



The current knowledge about the dynamical stability in these systems **allows Earth-size planets to co-orbit with more massive giants**, although their formation/capture has yet to be theoretically demonstrated. The only condition for stability is that the planet+trojan mass should be smaller than 4% of the host star mass.

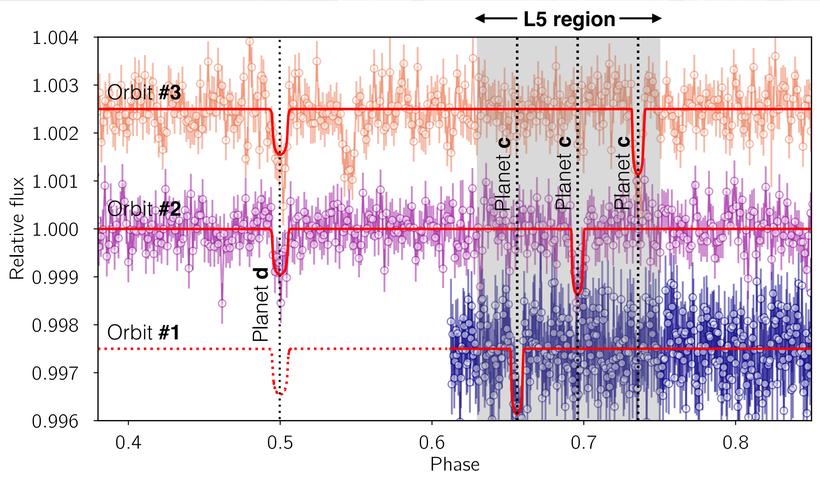
The TROY **project** is an international collaboration that aims at **detecting and studying the first trojan bodies** co-orbiting with extrasolar planets. We are exploring different techniques to detect these bodies and to study their properties and existence in different environments. Here we present one of the results of the project, the **co-orbital candidate TOI-178**.

Do not discard
similar-period planet
candidates:
They can be the first
co-orbital planet pairs

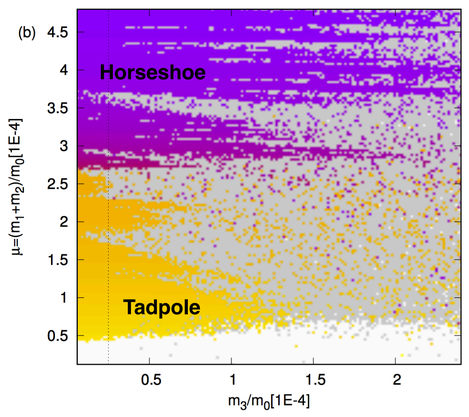
Leleu, Lillo-Box, et al., 2019, A&A, 624, 46

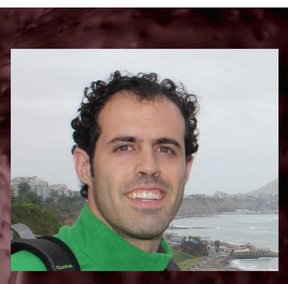
The case of TOI-178

We study the signature of co-orbital exoplanets in transit surveys when **two planet candidates in the system orbit the star with similar periods**. Such a pair of candidates could be discarded as false positives because they are not Hill-stable. However, horseshoe or long-libration-period tadpole co-orbital configurations can explain such period similarity.



TOI-178 is a three-planet candidate system discovered by TESS. The two external planets have periods of 9.9 and 10.1 days. We demonstrate that the co-orbital scenario is the only possible stable configuration if the planets are real. Their orbital architecture depends on their masses, which are still unknown. Follow-up observations are ongoing.





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Other publications from the TROY project:
- Leleu et al., 2019, A&A, 624, 46
- Lillo-Box et al., 2018, A&A 618, A42
- Lillo-Box et al., 2018, A&A, 609, 96
- Leleu et al., 2017, A&A, 599, 7

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