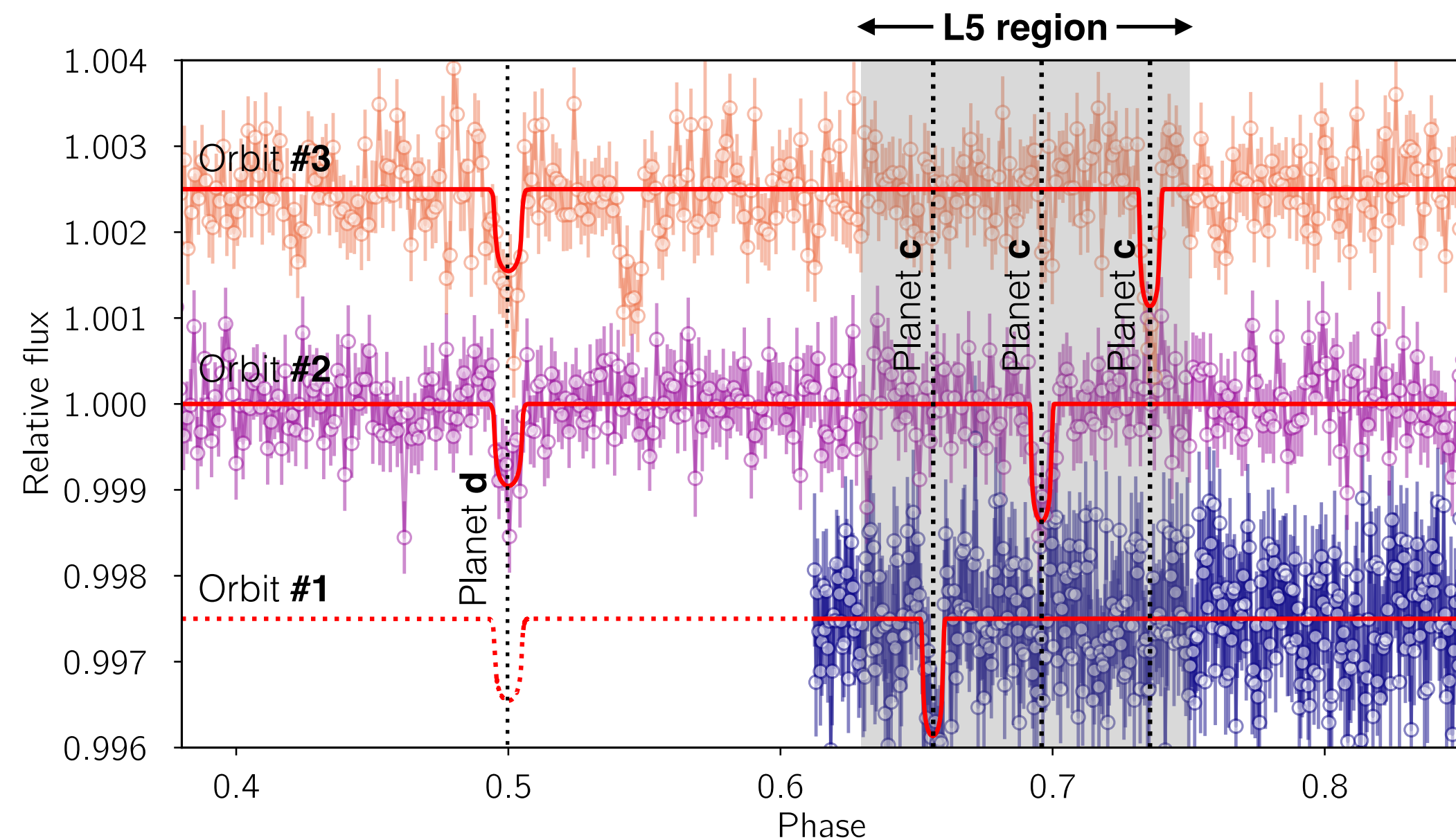


# Glory or Death

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



EXCELENCIA  
MARÍA  
DE MAEZTU



Light curve from the TESS space mission phase-folded with the period of planet d in TOI-178. The transits of planet “c” occur exactly at the Lagrangian point of planet “d”, becoming then the first coorbital planet pair candidate

Credit: Jorge Lillo-Box

## Take-home message:

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

**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.**

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. Follow-up observations are ongoing. If confirmed, this will be **the first coorbital planet pair.**