STUDY OF EXOPLANETARY SYSTEMS VIA TIMING VARIATIONS

PHOTOMETRIC FOLLOW-UP OF THREE INTERESTING TRANSITING NEPTUNES

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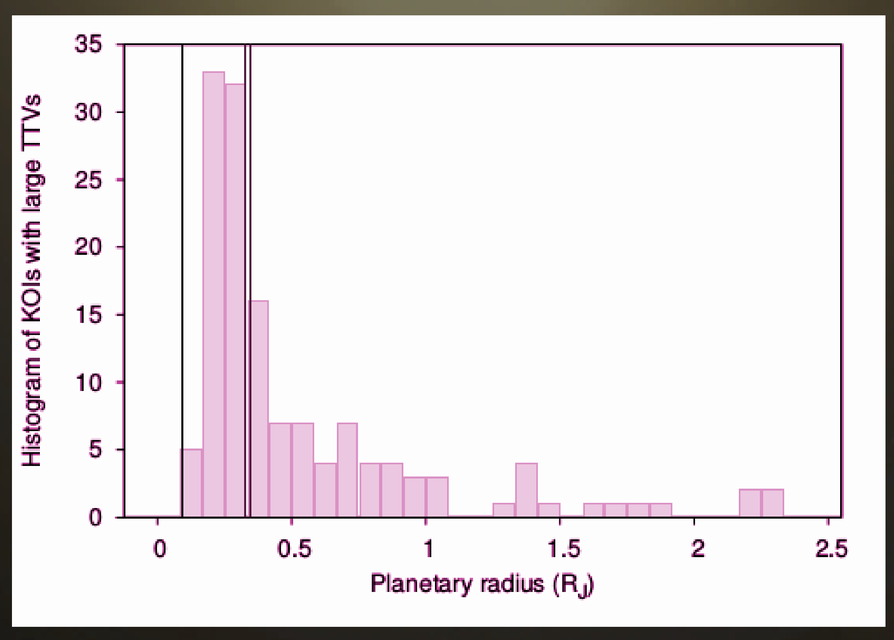
Abstract:

The CoRoT launched in 2007 as the first satellite with a strong dedication to extrasolar planets. Two years later, the Kepler space telescope was acquiring photometric data of unprecedented precision. Although both space-based missions have played a main role enhancing our understanding about the exoplanet population, nowadays we have to continue the study of space-based discoveries adjusting our ground-based capabilities. By instance, Kepler data reveals Earth and Neptunes to be the most ordinary exoplanets, several of them showing transit timing variations (TTVs), a successful tool to constrain masses without the need for ground-based radial velocity measurements. However, most ground-based follow-ups were -and still are- focused on hot Jupiters. In the framework of a large collaboration involving Argentinian institutions we proposed to re-direct our observing capabilities to follow-up three Neptune-sized exoplanets already showing hints of TTVs. To this end, we have build-up a network of seven meter-class telescopes located between the United States and South Africa. In this work we present the network and first observational data. Our planned observations will contribute to clarify unknowns so fundamental as how do planets form and evolve, and maybe the truthfulness about a long-established human thought: the uniqueness of our Solar System.

EXOPLANETS

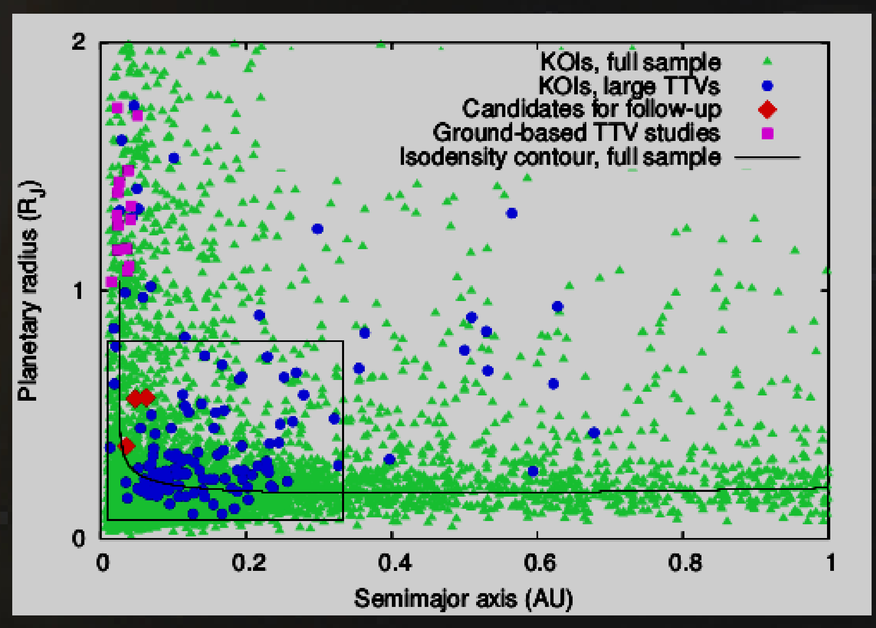
Our project focuses in three transiting Neptunes, **CoRoT-8**, **HAT-P-26**, and **GJ 3470**. The three share a Transit Depth of $\sim 0.5\%$, making the observations a real challenge. Thus, our follow-up comprises medium-sized telescopes such as the 2.15m "Jorge Sahade".

OUR MOTIVATION



Histogram of $\sim$ 130 LTKOIs (TTV amplitude $\geq$ 5 min) as a function of the planetary radius. The black-single vertical line indicates 1$R_\oplus$ while the double line corresponds to 1$R_{Neptune}$. Most of the KOIs lie between 0.3 and 0.6 R_J and are, therefore, Earth to Neptune-sized.

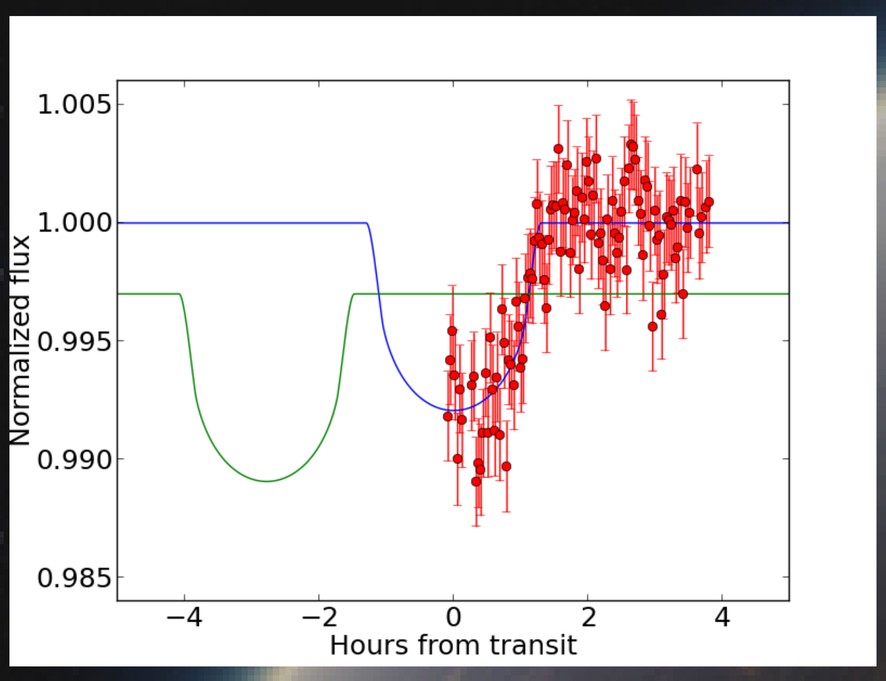
NEPTUNES AFTER KEPLER ERA



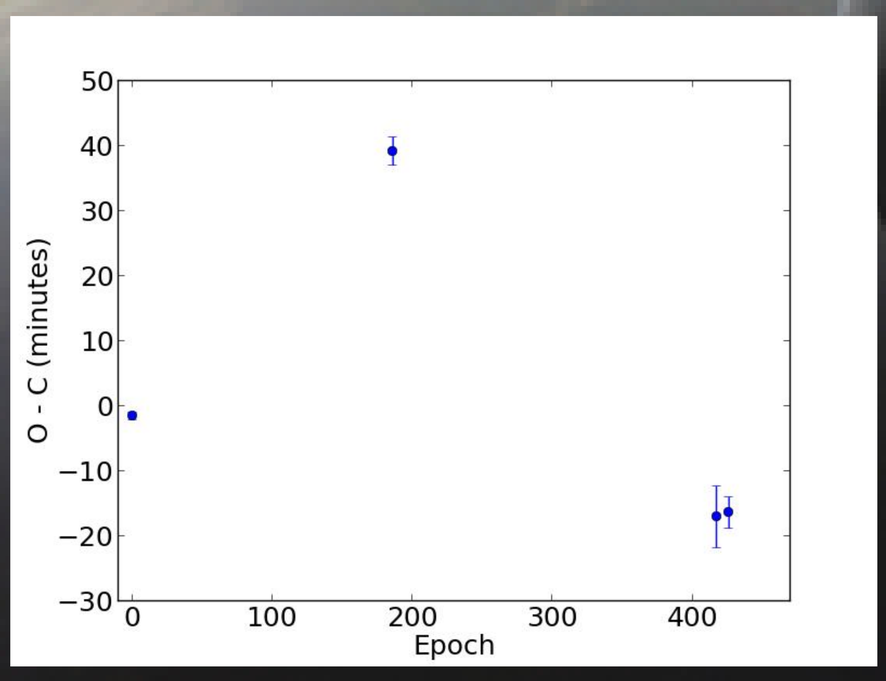
Full sample of $\sim$ 7000 KOIs plotted with green triangles, along with the $\sim$ 130 LTKOIs in blue circles. 80% of LTKOIs fall within the black rectangle. The three exoplanets of our interest are plotted with red diamonds. The pink squares show most of the systems were ground-based TTV studies were carried out. Continuous black line shows maximum density contours.

COROT-8: OBSERVATIONS FROM CASLEO AND FIRST RESULTS

On the night of August 15 we observed one transit of CoRoT-8 using the 2.15m "Jorge Sahade" telescope located in CASLEO, San Juan, Argentina. Using this observation plus two more light curves available in the literature we re-determined the ephemeris and found a considerable change in the orbital period. The Figure on the left shows the partial transit observed from CASLEO. While the blue line indicates the best-fit model, the green line shows where the transit should have ocurred according to the bibliography. If we wouldn't use further ground-based data to update the orbital period, we would have completely missed the transit. The Figure on the right shows the O-C diagram (observed mid-transit times minus the mid-transit times computed from a constant period). A clear TTV of $\sim$1 hour amplitude can be observed. This is considerably larger than the $\sim$10 minutes reported by the CoRoT team.



CoRoT Space Telescope (2010)
Per = 6.21229 $\pm$ 0.00003



CASLEO (2014)
Per= 6.212586 $\pm$ 0.000003