

Search for exoplanets using Transit Timing Variations (TTVs) in the Southern Hemisphere.

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ABSTRACT

The method of Transit Timing Variations (TTVs) can detect additional low-mass planets in transiting exoplanetary systems, which are in principle undetectable by other methods like Radial Velocities. Since 2008 we are conducting an homogeneous monitoring of known transiting planets in the Southern Hemisphere with observing cadence from 20 to 50 seconds. By carefully measuring the central time of the transit events we are able to detect long- and short-term variations of the primary transits, and therefore infer the presence of additional bodies in those systems.

We have observed more than 60 transits of 18 extrasolar planets visible from the Southern Hemisphere (Fig. 1). Additional observations are planned for this year to complement the number of transits already monitored. We have data from GMOS at Gemini South, SOI at SOAR and Y4KCam at the 1.0m SMART Telescope.

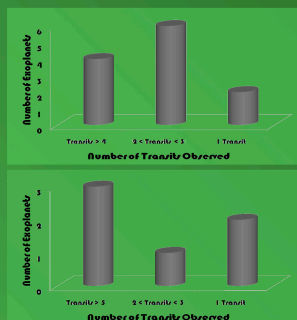


Figure 1. Number of exoplanets, WASP (top) and OGLE (bottom) versus the number of transits observed by our project. More transits will be observed during this year to complement our data.

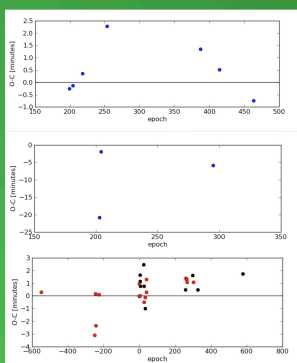


Figure 3. Observed minus Calculated Diagrams of the central times of the transits of three of the exoplanets monitored. Typical errorbars are between 20 and 40 seconds. Some systems in our sample are showing very interesting preliminary results.

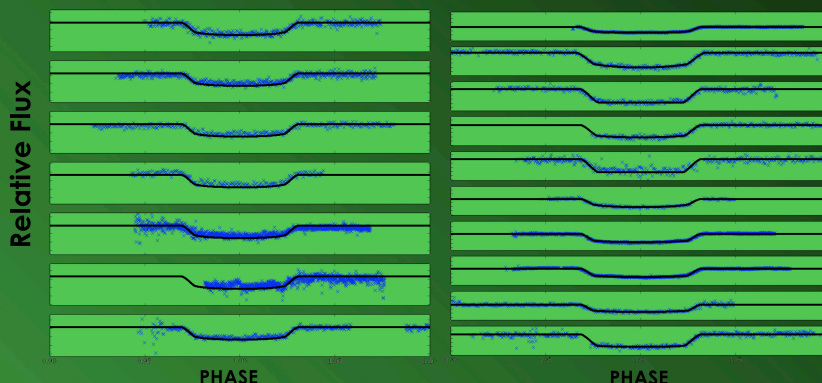
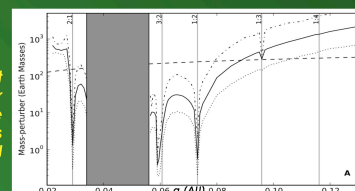


Figure 2. Preliminary light curves of transits of WASP-4b and -5b exoplanets. With our monitoring we can detect variations in the mid-time of the transits and in other parameters like the orbital inclination, duration and depth of the transit. All of those variations can be induced by the presence of an unseen companion in the system.

From light-curve fitting we build 'Observed minus Calculated' Diagrams of the mid-times of the transits (Fig. 3) to search for variations induced by an orbital companion. Some of the systems are showing very interesting preliminary results. With this information and the use of dynamical simulations we can constrain the mass of the possible perturber as a function of the semi-major axis (Fig. 4).

Figure 4. Upper mass limits for an orbital perturber for the exoplanet OGLE-TR-111 (Hoyer et al. 2011). The solid line represents a perturber which produces TTVs of amplitudes of 1.5 minutes. The dashed line represent the limits due Radial Velocities. We have discarded planets with masses greater than 1.3, 0.4 and 0.5 Earth Masses in the 3:2, 1:2 and 2:1 resonances of their system.



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<--- 1 m Telescope at CTIO

