Transiting Planets
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Observing exoplanets from Brazil: the first try

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Abstract. This project consists in mapping a 4-square-degree region searching for exoplanets using the transit method. This "mini-survey" will be the first use of the 16″ robotic telescope developed by Universidade Federal de Santa Catarina (UFSC-Brazil) and Laboratório Nacional de Astrofísica (LNA/MCT-Brazil). The chosen region is over the Columba constellation and our first observations have shown that we have enough signal-to-noise ratio to search for transits on about 20,000 stars with $\sim 13 < I < 16$ mag, a magnitude range between the OGLE and HAT projects. In this star sample we expect to find about a dozen planets with transits duration of 1-3 hours and magnitude depth from 0.001 to 0.010 mag. As for other projects, all information will became public as a VO service.

Introduction

Our project proposes mapping a 4-square-degree region searching for exoplanets transiting stars in the mag I range $\sim 13-16$ using the 16″ robotic telescope developed by Universidade Federal de Santa Catarina (UFSC-Brazil) and Laboratório Nacional de Astrofísica (LNA/MCT-Brazil).

Observations

Our 16″ telescope was used in the last years to develop a totally independent robotic system for surveys and has now become stable † (Silva & Kanaan 2007). It is located at the Pico dos Dias Observatory (OPD), the main optical observational facility in Brazil (coordinates: $+45^{o}\ 34'\ 57''\ -22^{o}\ 32'\ 04''$, 1860 m above sea level). OPD is operated and maintained by Laboratório Nacional de Astrofísica (LNA), a unit of the Brazilian Ministry of Science (MCT). Our telescope is a f/10 Schmidt-Cassegrain Meade LX 200 and, for early tests, we are using a SBIG 1.56 Mpixel ST8 camera. For the survey we will use a brand new Apogee Alta U16 (16 Mpixel) camera. To perform the observations we chose the U Bessel passband, in order to avoid limb darkening effects (von Braun *et al.* 2005) and sky brightness contamination.

Target field

To define the best sky position to perform the observations, we focused on a region of Galactic position with latitude near +30 or −30 that has the maximum appearance

† http://chimera.sourceforge.net/

time in our best weather time (from June to August, Sartori & Castilho 2004). The chosen region is over the Columba constellation, with coordinates $\alpha = 05^h\, 30^m\, 00^s$ and $\delta = -40^h\, 00^m\, 00^s$, corresponding to the Galactic position $\mathrm{l} = -32^\circ\ 00'\ 00''$ and $\mathrm{b} = 245^\circ\ 00'\ 00''$. With this position we intend to keep a star density close to that in the Galactic plane, but avoiding early type stars. This is useful to maximize the number of stars expected to host a planet in the data (Brown & Charbonneau 2000) making the photometry more efficient.

Early results

Our first observations have shown that we have enough signal-to-noise ratio (S/N) to track transits on about 10,000 stars per season. Our calculations were made accounting white and red noise effects (Pont 2006), transits duration of 1−3 hours and magnitude depth from 0.001 to 0.010 mag. In this star sample we expect to find up to a dozen of planets in stars with $\sim 13{-}16$ mag I, a magnitude range between the HAT (Bakos *et al.* 2004) and OGLE (Udalski *et al.* 2002) projects.

Due to the great data volume generated by this process, the data reduction procedure needs to be automatized. We are writing a reduction pipeline based on standard photometric steps performed on high-precision CCD photometry (e.g., Everett & Howell 2001). The light curves will be submitted to a variability detection system that will spot the possible exoplanet candidates and other stellar variable sources. We are also performing simulations to compare the results using Analysis of Variance (Schwarzenberg-Czerny 1989), Lomb-Scargle (Black & Scargle 1982) and TFA (Kovács *et al.* 2005) and select the model that fits better to our needs.

Further Analysis

Once we have a list of candidates, we will use the spectrographs available at LNA telescopes. Low- and mid-resolution spectrographs are important to classify the variable sources found during the campaign and to rule out false exoplanet candidates for further more detailed follow-up observations. For this work, including radial velocity measurements, we intend to secure time at the SOAR and Gemini telescopes, using the time available for the Brazilian community. As for other projects, all information will became public as a VO service.

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