Giant Transiting Planets Observations with LAIWO

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Abstract. We present preliminary single field results on a search for transiting extrasolar planets with the LAIWO wide field optical CCD camera, attached to the 1-m telescope at the Wise Observatory. With a 3 min integration time, the system achieved a few mmag precision for the brightest stars in a field of view of one square degree. We detect several periodic variables and a few transit-like events. The promising candidates will be followed-up in the near future.

The Giant Transiting Planets Observations (GITPO) program is a collaboration between the Max-Planck Institut für Astronomie (MPIA), the University of Tel Aviv and the Sternwarte of Göttingen, aiming to detect transiting exoplanets (Afonso et al. 2006). The results in this work are based on single field observations with the Large Area Imager (LAIWO), built at the MPIA for the 1-m telescope at the Wise Observatory, Israel. LAIWO is a wide field optical camera composed by an array of four front-side illuminated 4K×4K Lockheed CCDs with pixel size of 15 μ m and scale of 0.87 pixel/arcsec when binned 2×2 pixels (Baumeister et al. 2006). Located in Ophiuchus the reported here LAIWO V field was observed $\sim$ 4000 times over a total of $\sim$ 60 days interval between February 05 and August 06, 2009 and March 02 and June 24, 2010. The images were obtained in the Johnson R-band filter with exposure time set to 180 sec. We processed the images using a custom developed automatic IDL pipeline. We considered non saturated stars only, with pixel values $\leq$ 35,000 ADU to avoid nonlinearity in the CCD. Light curves of $\sim$ 16,000 field stars were extracted using aperture photometry with fixed diameter on all images. We identified a set of high quality non-variable reference stars, present on each image, which were used to compute an “average reference star” (ARS), following the method of Scholz & Eislöffel (2004) to obtain relative magnitudes the light curve of the ARS was subtracted from all time series to correct for atmospheric extinction. We removed systematics with the SysRem algorithm of Tamuz, Mazeh & Zucker (2005). Root-mean-square (rms) in logarithmic scale versus R magnitude for all objects is presented in Figure 1. Before the transit search we performed a pre-selection procedure to the collected light curves. We limited our search to stars with photometric accuracy $\leq$ 20 mmag (rms from the entire time series) and standard deviation $\leq$ 0.02 mag. In the next step all remaining stars were searched for transit signal in the period range $P = 1.10$ day to $P = 10.10$ day, using the Box Least Square (BLS) algorithm (Kovacs et al. 2002). BLS detections with signal detection efficiency (SDE) above 3.0 and signal-to-noise ratio (S/N) greater than 16.0 were selected as significant. To identify the variable stars we applied the Lomb-Scargle algorithm (Lomb 1976) to the rest of the stars. After visual inspection we identified $\sim$

Figure 1: *Photometric results for the stars in the LAIWO V field. RMS in logarithmic scale over 20 observations is plotted as a function of the R magnitude, with no detrending applied.*

10 periodic variables (with amplitudes 0.2-0.6 mag) and a few transit-like candidates. Figure 2 presents two newly discovered periodic variables and one transit candidate. This and the other candidates will be further analyzed in more detail in the near future.

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Detection and Dynamics of Transiting Exoplanets

Figure 2: *Phase-folded light curves of two newly discovered periodic variables (upper and middle panel) and a transit candidate (bottom panel). Although the third example may not be produced by a planet, it demonstrates the ability of LAIWO and our used reduction software to detect transits.*