RevMexAA (Serie de Conferencias), **29**, 151–151 (2007)

NEW RESULTS FROM THE MULTI-OBJECT KECK EXOPLANET TRACKER

J. C. van Eyken,[1] J. Ge,[1] X. Wan,[1] B. Zhao,[1] A. Hariharan,[1] S. Mahadevan,[1] C. DeWitt,[1] P. Guo,[1] R. Cohen,[1] S. W. Fleming,[1] D. McDavitt,[1] J. Crepp,[1] C. Warner,[1] S. Kane,[1] F. Leger,[2] and K. Pan[2]

The W. M. Keck Exoplanet Tracker is a precision Doppler radial velocity instrument for extrasolar planet detection based on a new technique, dispersed fixed-delay interferometry (DFDI), which allows for multi-object surveying for the first time. Installed at the 2.5-m Sloan telescope at Apache Point Observatory, the combination of Michelson interferometer and medium resolution spectrograph (Erskine & Ge 2000; Ge 2002) allows design for simultaneous Doppler measurements of 60 targets (Ge et al. 2005).

Using a single-object prototype of the instrument at the Kitt Peak National Observatory 2.1-m telescope, we previously discovered a $0.49\,\mathrm{M_{Jup}}$ planet, HD 102195b (ET-1), orbiting with a 4.11 d period (Ge et al. 2006). During trial observations with the Keck Exoplanet Tracker in May 2006 we were able to successfully obtain 54 usable simultaneous fringing stellar spectra on eight different fields, of a quality sufficient to begin a survey for short period hot-Jupiter type planets. A total of 432 stars were surveyed over a period of 12 nights. These observations form part of a trial survey as a precursor to a planned much larger scale survey, using multiple parallel Keck ET instruments (Ge et al. 2007), with the potential to search up to 500,000 stars for extrasolar planets by 2020.

Figure 1 shows example results obtained for two known planet-bearing stars used as references, including ET-1. Daytime sky data were also taken to measure the apparent solar velocity, providing a zero reference for which typical RMS scatters were around 18–$27\,\mathrm{m\,s^{-1}}$ over the length of the run, and 12–$16\,\mathrm{m\,s^{-1}}$ (matching the photon limit) over periods of a few hours. Around 15 of the search targets were chosen as interesting candidates for further followup and are currently being investigated. Statistically, we expect $\sim$4 hot-Jupiter type planets to be present in the total sample.

[1]Department of Astronomy, University of Florida, 211 Bryant Space Science Center, P.O. Box 112055, Gainesville, FL, 32611, USA (vaneyken@astro.ufl.edu).

[2]Apache Point Observatory, 2001 Apache Point Road, PO Box 59, Sunspot, N.M. 88349, USA.

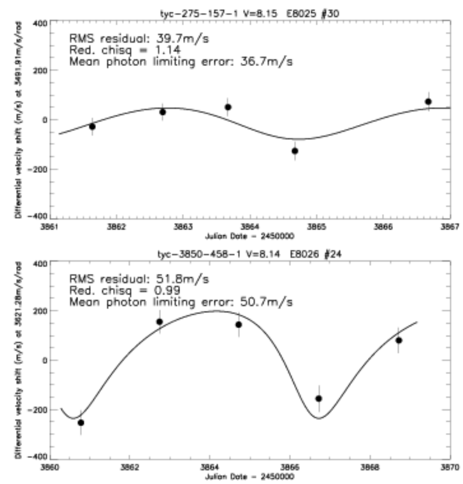

Fig. 1. RV results obtained on known planet bearing stars ET-1 (top) and HD 118203 (bottom), with expected RV curves over-plotted.

Since these data were taken, a number of engineering improvements have been made to reduce the noise floor and photon limit. As of September 2006, 59 spectra are now fully functional, and the RMS (day sky) and photon limits appear to have improved by a factor of around 2.

A similar instrument at the GTC would benefit from the considerably larger light collecting area, since the technique operates near the photon limit. Simple scaling arguments show that an appropriately tuned instrument on the GTC with 10 object capability could theoretically achieve RV precisions as good as $3\,\mathrm{m\,s^{-1}}$ at magnitude $V = 13$ (cf. design goal of $20\,\mathrm{m\,s^{-1}}$ at $V = 13$ for current Keck ET).

REFERENCES

Erskine, D. J., & Ge, J. 2000, in ASP Conf. Ser. 195, Imaging the Universe in Three Dimensions, ed. W. van Breugel & J. Bland-Hawthorn (San Francisco: ASP), 501

Ge, J. 2002, ApJ, 571, L165

Ge, J., et al. 2005, in Protostars and Planets V, ed. B. Reipurth, D. Jewitt, & K. Keil (Tucson: Univ. of Arizona Press), 8410

Ge, J., et al. 2006, ApJ, 648, 683

Ge, J., et al. 2007, RevMexAA (SC), 29, 30