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v sin *i* observations of potential exoplanet parent stars

A. Stankov (1), R. Schulz (2), C. Erd (2), T. Ho (3), J. Stüwe (4), H.Smit (2)
(1) European Space and Astronomy Center, ESA-ESAC, Madrid, Spain (Anamarija.Stankov@esa.int), (2) Science and Robotic Exploration Directorate, ESA-ESTEC, Noordwijk, The Netherlands, (3) DLR, Institute for Space Systems, Bremen, Germany, (4) Leiden Observatory, Leiden, The Netherlands

Abstract

We present spectroscopic measurements for a sample of 19 stars with spectral types F, G, and K, suitable to host exoplanets. The relative strengths of the Ca II H and K emission lines were measured and from these the projected rotational velocities, *v* sin *i*, will be determined.

Theory states that the *v* sin *i* value is smaller if the observed star hosts exoplanets [1]. This is valid for stars later than spectreal type F 5 [2]. The *v* sin *i* information can be used to prioritize a target star catalog for a project that is aiming at discovering new exoplanets.

Here we describe this project in more detail and show first results for selected target stars.

1. Introduction

This project was performed in three phases. In phase 1 we tested the feasibility of this method with stars with well-established *v* sin *i* values. In phase 2 we extended these observations to stars which are known to host planets but for which the *v* sin *i* is not known or poorly determined. In phase 3 we observed stars without known planets which are likely to be selected to be observed by future space missions which are searching for habitable planets.

1.1 Observations

In 2006 and 2007 we executed 7 observing runs at the Teide Observatory on Tenerife using the Optical Ground Station (OGS) spectrograph. With this spectrograph a spectral resolution of ~0.1Å can be achieved for the Ca II H and K lines.

For phase 1 we observed stars which are known to host exoplanets and for which the *v* sin *i* is well determined. In Figure 1 we show the location of potential phase 1 stars and different symbols represent different *v* sin *i* ranges (see legend). We selected five of these stars with a spread of different projected rotational velocities (red circles and green HD numbers). In total, 70 spectra were taken of these five stars.

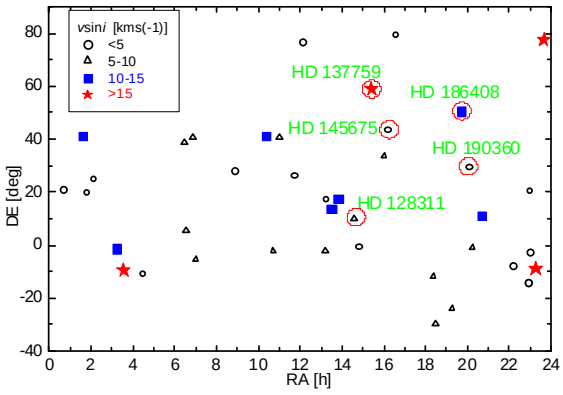

Figure 1: Potential stars to be observed in Phase 1.

For phase 2 we observed stars which have confirmed planets and where their projected rotational velocity is not or not well known. In total, we observed six stars and took 64 individual spectra. The list of these stars is given in Table 1.

For phase 3 stars were selected around which no planets have yet been detected and where their projected rotational velocity is not known (as of 2007). We observed eight stars and took 123 individual spectra (see Table 1).

In total 19 stars were observed and 257 individual spectra were taken. The table of observed stars is given here below:

Table 1: List of observed stars including number of single observations and phase association.

Star	# obs. 2006	# obs. 2007	Phase
HD 128311	7	7	Phase 1
HD 137759	4	8	-"-
HD 145675	7	9	-"-
HD 186408	9	8	-"-
HD 190360	6	5	-"-
HD 20367	8	4	Phase 2
HD 34445	3	1	-"-
HD 37124	6	7	-"-
HD 37605	3	1	-"-
HD 190228	10	6	-"-
HD 209458	11	4	-"-
HD 12846	9	13	Phase 3
HD 165401	4	12	-"-
HD 168442	5	12	-"-
HD 184385	6	14	-"-
HD 208038	8	3	-"-
HD 219538	7	6	-"-
HD 220221	6	5	-"-
HD 222143	7	6	-"-
HD 128311	7	12	-"-
total	**126**	**131**	

In Phase 1 each star was observed 1-3 times per night. On average, we observed ~ 8 target stars per night in this phase. In subsequent phases we adapted the observation plan such that we revisited these stars less often and took more spectra of phase 2 and phase 3 stars.

Standard stars were observed regularly and calibration lamp exposures were taken for wavelength calibration purposes.

2. Data reduction and analysis

Standard reductions steps were performed removing bias, normalizing for dark current and applying flat fielding. These steps were performed for the science frames, as well as the calibration lamp images and also for the standard stars.

From the reduced science frames the spectra were extracted using IRAF[1]. Then wavelength calibration was performed with the calibration lamp images. Next, dispersion correction was applied and finally the flux was calibrated.

For standard stars sensitivity functions were fitted and these functions were fitted to the data. Ca II H and K fluxes were calculated.

3. Summary and Conclusions

So far we have performed data reduction and extracted the spectra for all stars. The analysis of this data is still on-going. Early result show that this method can indeed be applied to target star lists to prioritize the order stars to be observed to maximize the efficiency of the observing program. The results of the analysis will be presented at a later time.

References

[1] Vaughan, A. H., Preston, G. W., Baliunas, S. L. et al. 1981, *ApJ*, **250**, 276

[2] Wilson, O. C. 1978, *ApJ*, **226**, 379

[1] IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.