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Planet candidates from the SARG visual binary survey

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Abstract. We present preliminary results of the radial velocity survey on going at TNG targeting binaries with similar components.

Keywords. binaries: general, planetary systems

1. Introduction

Determination of the fraction of stars hosting planetary systems of various characteristics is a major tool to test models of planet formation. A large fraction of stars are in binary systems; determination of incidence of planetary system in binary stars is then very interesting.
The SARG radial velocity (RV) survey is devoted to find planets around individual components of wide binary systems with a typical separation of 200 AU and formed by similar main sequence stars (ΔV<1mag). The sample was chosen by Hipparcos catalog (d<100pc). This survey started in September 2000 (Desidera *et al.* 2007) using the Galileo High Resolution Spectrograph (SARG) (Gratton *et al.* 2001) at Telescopio Nazionale Galileo (TNG) and follow up of planets candidates is on-going.

2. Radial velocity analysis

In the last year, some improvements have been implemented in the analysis procedure, e.g. the new version of the AUSTRAL code by Endl (Endl *et al.* 2000). For a better treatment of the shape of the Instrument Profile (IP) the model is set up on a sub-pixel grid. The analytical form of the instrumental profile must be chosen with care. The IP is modeled using a combination of Gaussians. The asymmetries are reproduced using a Gaussian centered at the origin and up to 12 Gaussian satellites placed in the wings. These smaller features are added or subtracted from the main one in order to recreate the asymmetries of the profile. Since the IP varies along the spectrum, this is subdivided into smaller spectral chunks, each of them modeled independently. The modeling process is a multi-parameter χ^2-optimization algorithm.

The modeling of stellar spectra to measure the Doppler shift is similar to the first step, but in this case the stellar spectrum is also present. Even in this case the IP is reconstructed until the model of best fit for each chunk is achieved. The Doppler shift between the iodine and the model provided by the template among the parameters determined for each chunk. The final RV is the weighted mean, and its error is the standard deviation of the mean of the values of each chunk. Tests performed showed that the best number of Gaussians used to fit the IPs is closely related to the S/N of the spectrum beeing analyzed. The final RV precision is about 2-3 m/s for bright stars and 3-10 m/s for the program star (V = 8-10).

3. Abundance analysis and stellar activity

Beside the RV determination, an high precision differential abundance analysis was done on the binary components of the survey, with error of Δ[Fe/H] about 0.02dex (Desidera *et al.* 2004; Desidera *et al.* 2006). For warm stars, with thin convective zone, limits are similar to the quantitiy of meteoritic material accreted by the Sun during its MS lifetime.
Contamination and stellar activity effects have been studied on a sample of the survey through the analysis of line profiles (Martinez Fiorenzano *et al.* 2005).

4. Candidates

The statistical analysis shows us no planets with period shorter then the survey duration and RV semi-amplitude larger than 30 m/s have been found.
We presented a couple of low-amplitude planet candidates: one with probably a Jupiter mass planet in 5yr orbit and a system with two planets with RV amplitude $<$15 m/s.

5. Work in progress

Preliminary statistical analysis shows a trend of lower frequency of planets for tighter binaries and the upper limits simulations indicates for lower frequency of planets in the survey sample then single stars (Bonavita & Desidera 2007).
We are improving a statistical analysis by using bootstrap technique and an orbital parameters grid, taking into account simultaneously the RMS, χ^2 and the Generalised Lomb-Scargle periodogram (Zechmeister & Kürster 2009).

References

Bonavita, M. & Desidera, S. 2007, *A&A*, 468, 721
Desidera, S., Gratton, R. G., Scuderi, S., *et al.* 2004, *A&A*, 420, 683
Desidera, S., Gratton, R. G., Scuderi, S., *et al.* 2006, *A&A*, 454, 581
Desidera, S., Gratton, R. G., Endl, M., *et al.* 2007, *arXiv*, 0705.3141
Endl, M., Kürster, M., & Els, S. 2000, *A&A*, 362, 585
Gratton, R. G., Bonanno, G., Bruno, P., *et al.* 2001, *Experimental Astron.*, 12, 107
Martinez Fiorenzano, A. F., Gratton, R. G., Desidera, S., *et al.* 2005, *A&A*, 442, 775
Zechmeister, M. & Kürster, M. 2009, *A&A*, 496, 577

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