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Searching for Planets around Stars in Wide Binaries

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Abstract. We describe the status of the radial velocity planet search on going at the Italian National Telescope TNG using the high resolution spectrograph SARG. The targets are stars in wide binaries. We are looking for the dynamical effects on the presence and characteritics of planetary systems caused by the stellar companion and for the chemical anomalies due to the ingestion of planetary material.

1. Introduction

The presence of planets in binaries and their characteristic represent an important clue for the models of planet formation. Possible dynamical effects include, e.g., the inhibition of planetary formation because of the truncation and perturbation of circumstellar disks, and the alteration of the planetary orbits and migration processes.

We then started a radial velocity survey with the goal to search for extrasolar planets around the components of a sample of wide binaries, using the high

resolution spectrograph SARG at TNG, equipped with a iodine absorption cell (Gratton et al. 2001a).

We are monitoring about 50 pairs with similar components (main sequence stars with $\Delta V < 1$). The typical projected separation between the components is about 100-400 AU.

2. Radial velocities

The radial velocity analysis is performed using the AUSTRAL code (Endl et al. 2000). We reach a precision of about 2-3 m/s on bright stars and of 5-10 m/s for the typical program stars (V=8-9).

The star HD 219542B shows velocity variation with a period of 112 days at a confidence level of 96% (Desidera et al. 2003a). This suggests the presence of a Saturn-mass planet in a Mercury-like orbit. However, at present we can not exclude that the radial velocity variations are due to the activity of the star. We are currently improving our techniques for line bisector measurement, with the aim to properly disentangle keplerian vs activity-induced velocity variation in this and other program stars.

3. Abundance analysis: clues on planetary pollution

The pairs of our sample are suitable for a careful differential abundance analysis, thanks to the similitude between the components (main sequence stars with temperature difference below 400 K). This allow an investigation on the occurrence of chemical abundance differences caused by the ingestion of planetary material. The lack of a suitable reference make such kind of analysis very challenging when considering single field stars.

The abundance analysis of 23 pairs was performed using the technique described by Gratton et al. (2001b) on the stellar templates (the spectra without iodine lines). Typical errors are about 0.02 dex. We found a few pairs with differences up to 0.07 dex (Desidera et al. 2003b). There are no pairs with abundance difference between the components as high as the typical metallicity offset between planet hosts and normal field stars (0.25 dex, Laws et al. 2003). The accretion of planetary material as high to increase the metallicity of the star by more than 0.1 dex appears to be a fairly uncommon occurrence. Considering the mass of the mixing zone, we are able to exclude an accretion of more than 2 Earth masses of iron around most the stars.

References

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