Transiting Sub-stellar companions of Intermediate-mass stars

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We use the CoRoT-survey to search for transiting close-in planets of intermediate-mass stars (M = 1.3-2.1 Msun). We already have identified transiting Jupiter-like planet candidates with short orbital periods and observed these candidates with high-resolution echelle-spectrographs at various telescopes.

Motivation

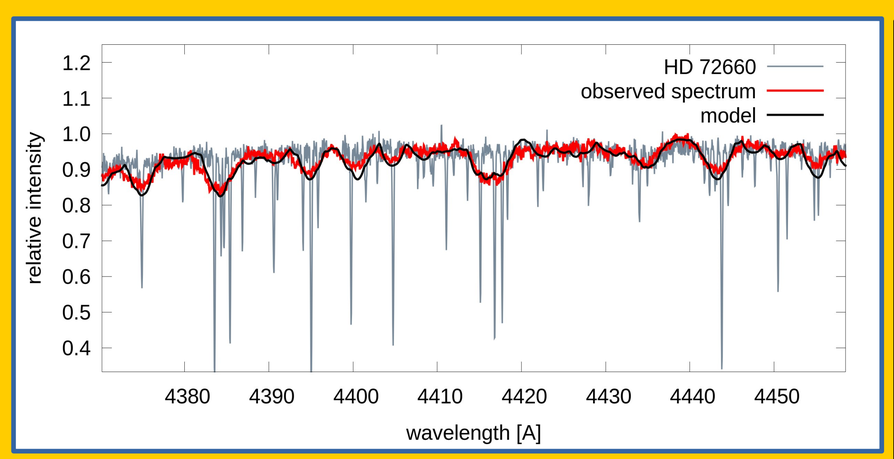
Direct imaging surveys and RV-surveys have shown that stars more massive than the sun have a large number of massive planets. Even brown dwarfs have been found and many of these stars have planets with masses near the border between planets and brown dwarfs.

However, we do not know whether they also have close-in planets. Spitzer observations show that the life time of the proto-planetary disks of such stars is half as long as the life-time of disks of solar-like stars. Stars more massive than the Sun could only have close-in planets, if planets can migrate inwards within a short time.

In our study we concentrated on short-period planets for which a mass determination is possible. The detection of close-in planets of intermediate-mass stars therefore would put strong constraints on the timescales of the formation and migration. Furthermore while determining the physical parameters of such close-in objects we can study the evaporation rate of planets.

Method

Since many of the intermediate-mass stars rotate rapidly (>50km/s) the CCF-method often gives no correlation. Especially for spectra with low S/N. Therefore the spectra are analysed using a least squares fit to an model spectrum.



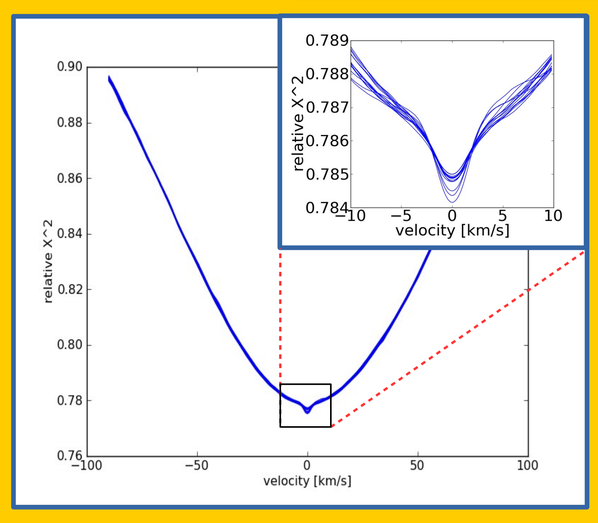
left panel: A model spectrum (black line) is fitted to the UVES spectrum of a fast rotating (vsini= 130km/s) candidate (red line). A slow rotating spectrum of HD72660 (vsini=8km/s, see Diaz et al. 2011) is shown for comparison.

lower panel: velocity corrected profiles of the least squares fit for a fast rotating star.

An algorithm was developed that matches the model spectrum to all orders of the observed echelle spectrum simultaneously.

The echelle blaze-function is taken into account for weighting the fit.

If S/N permits, all velocity corrected spectra are combined.



The combined spectrum is than used as new „model“ for the fit to increase accuracy.

Observations

After analysing the CoRoT light curves using the algorithms in Exotrans (Grziwa et al. 2012)

19 promising candidates have been observed!

For spectral typing we use low resolution spectrographs like AAOmega@AAT, TWIN@3.5m at Calar Alto and the Nasmyth spectrograph@TLS. Therefore for all candidates in our study the spectral type is known.

For radial velocity determinations well stabilised high-resolution echelle spectrographs are absolutely essential. To rule out binaries we use the Sandiford@2.1m telescope at McDonald Observatory.

The well stabilised spectrographs CAFE@2.2m at Calar Alto, UVES@VLT as well as FIES@NOT are used to analyse high priority targets in detail.

Results

19 promising candidates are selected from the CoRoT database. Three turned out to be solar type stars from low resolution spectroscopy (for details see Sebastian et al. 2012; Guenther et al. 2012).

For **16 candidates** echelle spectra have been obtained.

More than 150 echelle spectra were analysed!

- brightness range from V = 11 - 15mag
- spectral types range from B5V to F8V
- periods range from 0.5 to 16 days

current status:
- **one** planet candidate
- **one** brown dwarf candidate
- **nine** binaries identified (among them one proto He-WD candidate)
- one turned out to be an BEB
- still analysing: four candidates

References:

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