The influence of metallicity at the boarders of the classical instability strip

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Observations

The Exo-channel light curves of 32688 stars which were observed during the inital and the first two anticenter long runs of Corot (IRa1, LRa1 and LRa2) were extracted from the CoRoT archive and corrected for artificial discontinuities (steps). Figure 1 shows the light curve of the star CoID0102751744 with a 512s sampling. The original light curve is plotted in green and the destepped one is plotted in black. Vertical dashed lines mark the positions of identified discontinuities in the light curve. The lower panel shows the corresponding amplitude spectra before (green) and after (black) detrending. Solid red lines in the amplitude spectra correspond to modes with a S/N > 4, blue lines mark frequencies related to the CoRoT orbital frequency, its multiples and 1 d^{-1} sidelobes. Vertical dashed lines mark the orbit or multiples of the orbit frequency, dotted lines correspond to the respective 1 d^{-1} sidelobes of these frequencies. Furthermore constant stars always show in addition instrumental signal at 1,2 and 4 d^{-1}.

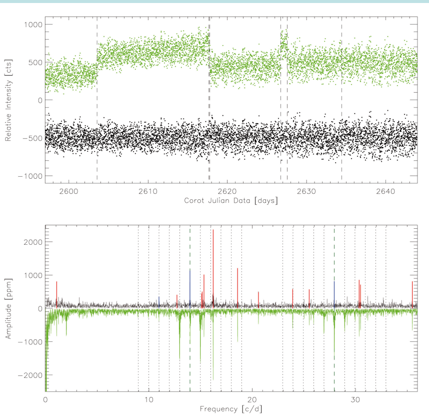

Figure 1: CoRoT light curve destepping

As a part of the ground based follow up 11982 stars from these three runs were observed with the AAOmega multi object spectrograph mounted on the AAT (Anglo Australian Telescope) which is located at the Siding Spring Observatory in Coonabarabran in Australia. For these stars fundamental parameters were estimated using a full automated Bayesian technique (Kaiser et al. 2012). Figure 2 shows for example the color coded probability distribution for T_{eff} (7582 ± 122K), log*g (4.38 ± 0.12)*, M/H (0.8 ± 0.03) and vsini (150 km/s) for the star CoID0102751744. The lower right insert shows the observed spectrum in black and the best fitting synthesis in red.

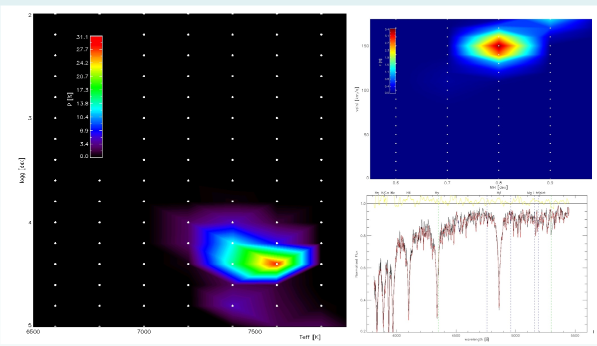

Figure 2: Color coded probability distribution for T_{eff}/log*g* (left), vsin*i*/MH (right top) and the observed spectrum with the best fitting synthetic spectrum

Frequency Analysis

The frequency analysis for all stars, where fundamental parameters could be estimated from AAO spectroscopy, was done using CAPER (Walker et al. 2005 and Saio et al. 2006). Employing models from the Yale Rotating Stellar Evolution Code (YREC), the location of the fundamental pulsation mode could be estimated for all stars. Using the fundamental mode as separation between the g and p-mode domain it was possible to categorize the stars by hand. From a total of 1214 stars hotter than 6100K and cooler than 10000K, 382 δSct, 290 γDor and 102 Hybrid stars could be identified. About 40% of all stars showed to be constant down to the detection limit of CoRoT or showed only rotational and/or binary behavior.

Results

In the top left panel of Figure 3 the HRD with the color coded metallicity for all identified δSct stars is shown. In the top right panel the same is shown for all identified γDor stars and the lower panel shows the results for the Hybrid stars. The red and blue lines indicate the cool respectively the hot boarders of the instability strips. It shows that the Hybrids are not only confined to the overlapping region of the δSct-γDor instability strips, but are present all over the δSct strip. Many γDor stars being cooler than the theoretical red edge of the γDor strip show low metallicity, whereas γDor stars on the blue edge show higher metallicity. Cool δSct stars in the overlapping area of both strips show in general low metallicity. This suggests that the depth of the convective envelope that chances with metallicity plays an important role in the selection of the pulsation mechanism as predicted by theory.

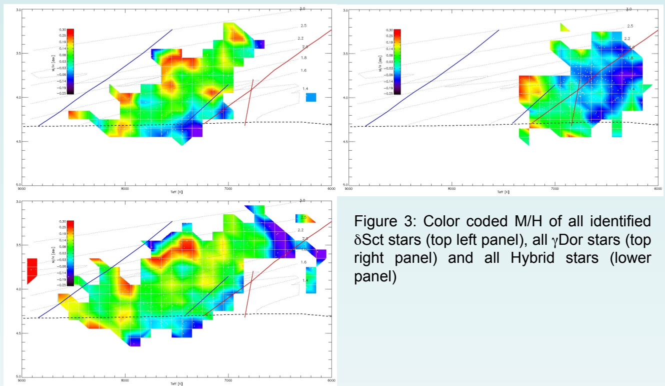

Figure 3: Color coded M/H of all identified δSct stars (top left panel), all γDor stars (top right panel) and all Hybrid stars (lower panel)

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