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DISCOVERY OF RAPID OSCILLATIONS IN HD 218994

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Asteroseismology has the potential to provide new insights into the physics of stellar interiors. Among the most promising objects that can be studied through this technique are the rapidly oscillating Ap (roAp) stars. These pulsate in high-overtone, low-degree, nonradial p-modes, with periods in the range 6–21 min. Our previous study (Hubrig et al., 2000) discussed the relationship between the roAp stars and the non-oscillating Ap (noAp) stars and concluded that the noAp stars are, in general, slightly more evolved than the roAp stars. The Ap Sr star HD 218994 was checked photometrically for the presence of rapid oscillations in the Cape Survey, but no oscillations have been detected by Martinez & Kurtz. This star was previously included in the sample of non-pulsating binary Ap stars studied by Hubrig et al. (2000). We have been granted one hour of UVES high time resolution observations of this star at ESO VLT on Cierro Paranal on November 15, 2006 and were able to obtain 15 spectra with exposure times of 3 min and a sampling of 3.7 min, taking into account the CCD readout time. To search for pulsational line variability, we calculated the average spectrum of the observed 15 spectra and subtracted it from the original spectra. In Fig. 1 we present the behaviour of the spectral profile of the Nd III line at λ 6327 and its standard deviations. Similar variations were also found for the Pr III lines at λ 6053 and λ 6090.

It was already shown in numerous studies that rare elements have higher amplitudes in roAp stars compared to lines of Fe-peak elements (e.g. Kurtz, Elkin & Mathys 2005). We also note that the mean RV for different elements is different, indicating the presence of chemical inhomogeneities on the stellar surface. Our analysis of RV variations of the Nd III line indicates two pulsation periods: one period of 5.1 min with an amplitude of 516 m/s and another one of 13.9 min and an amplitude of 497 m/s. It is very likely that one of these peaks is an alias. The amplitude spectrum of the radial velocity variations is presented in Fig. 2.

We note that a longer time series with better temporal resolution is needed for a careful identification of the principal frequency and a search for the presence of other pulsation frequencies. To confirm the detected spectroscopic variation period, we searched for a periodicity in the photometric data using Hipparcos and ASAS photometric databases. Indeed, also the photometric data show a sinusoidal variation with a period identical to the spectroscopic period, P=5.1 min, and an amplitude of 0.005 mag. In Fig. 3 we present both the RV variations of the Nd III line and the ASAS light curve.

The star HD 218994 becomes now the 36th star known to be a roAp star.

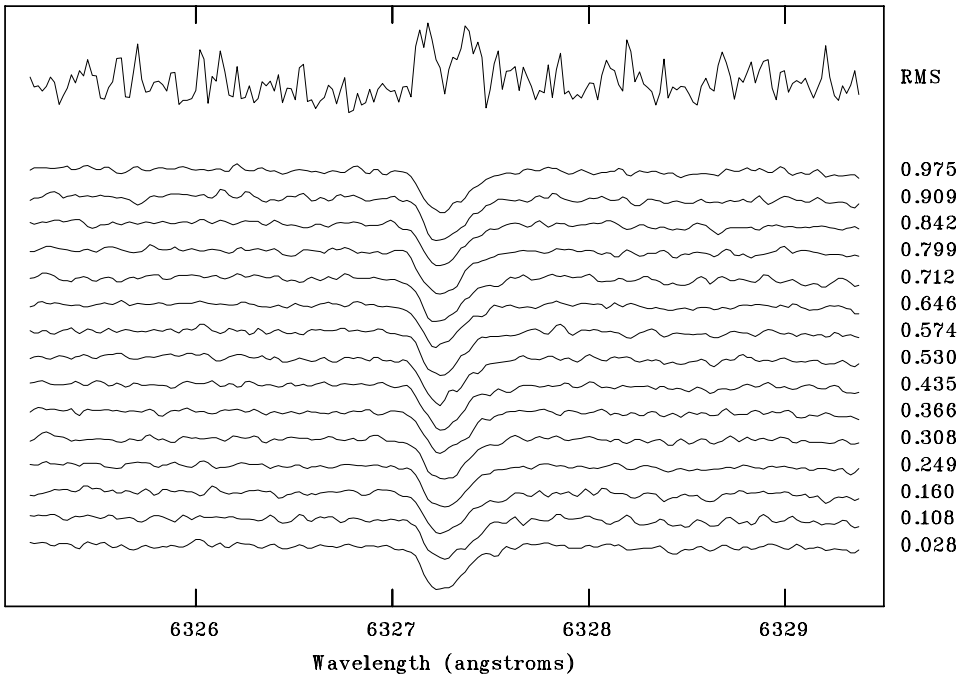

Figure 1. The behaviour of the profile of the Nd III line at λ 6327. In the top part we present the standard deviation and in the bottom the observed variations of this line.

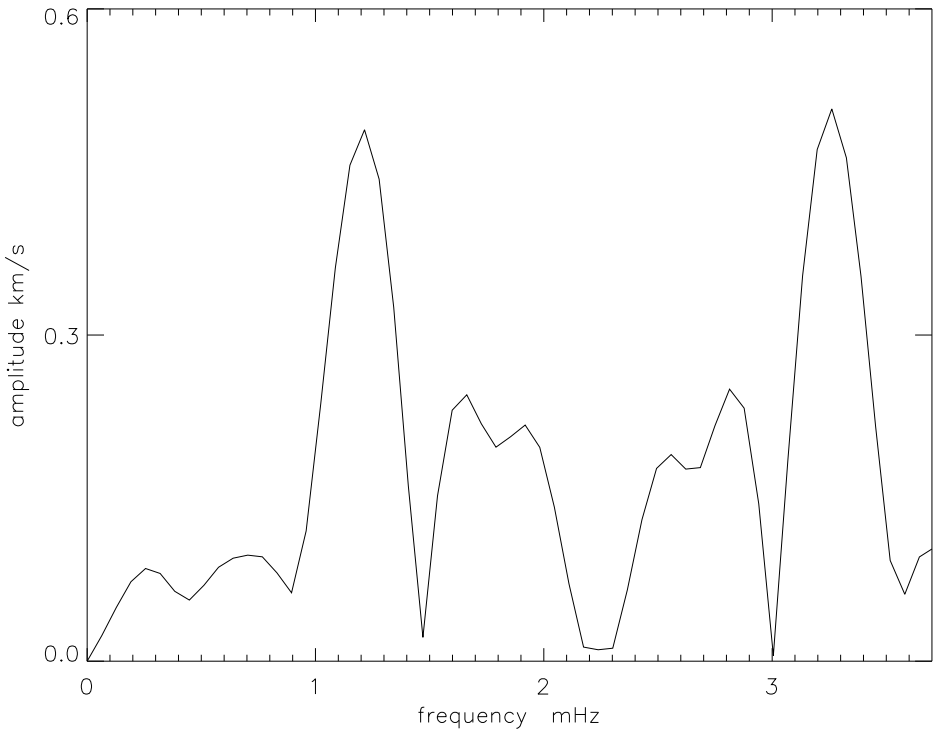

Figure 2. The amplitude spectrum of the radial velocity variations of the Nd III line at λ 6327.

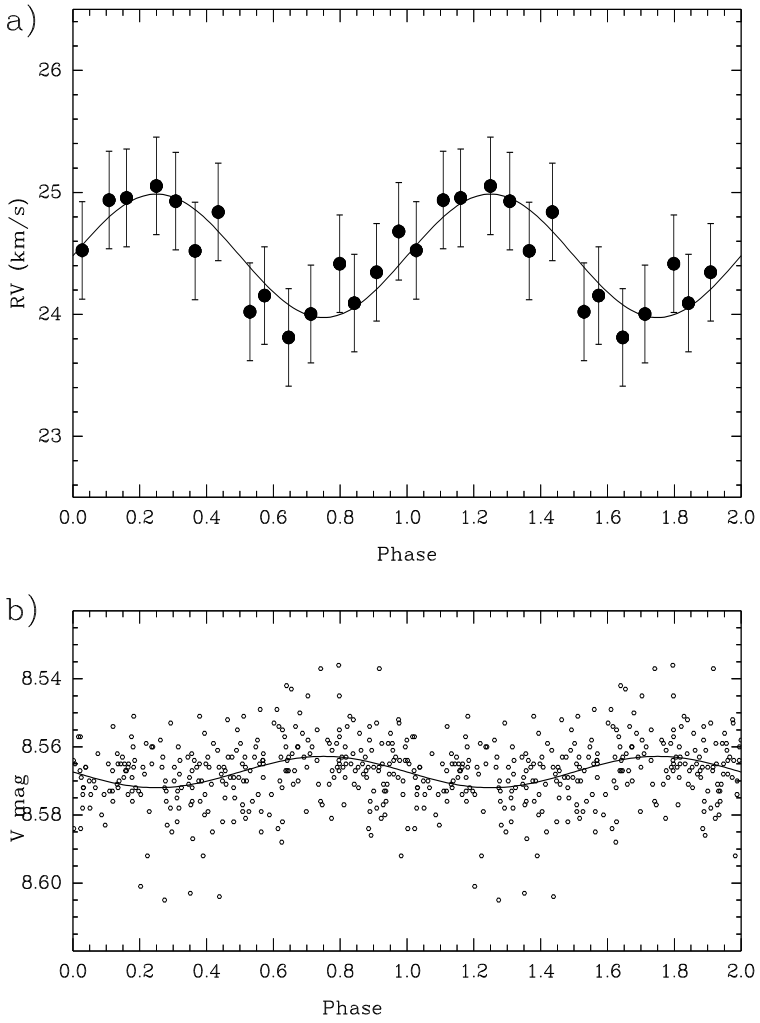

Figure 3. RV curve of the Nd III line at λ 6327 (upper panel) and photometric data from the ASAS database phased with the period P=5.1 min (lower panel).

References:

Hubrig, S., Kharchenko, N. Mathys, G., North, P., 2000, *A&A*, **355**, 1031
Kurtz, D.W., Elkin, V.G., Mathys, G., 2006, *MNRAS*, **370**, 1274
Martinez, P., Kurtz, D.W., 1994, *MNRAS*, **271**, 129