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# SEARCH FOR RAPID OSCILLATIONS AMONG SEVEN NORTHERN CP STARS

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Up to now, there are only about 45 rapidly oscillating Ap (roAp) stars known. They are located within an area of pulsational instability in the Hertzsprung-Russell diagram, at the main sequence, ranging in effective temperature from about 6600 K to 8500 K.

Photometric investigations for these stars show a period range of five to twenty five minutes, which is consistent with acoustic (p-mode) pulsations of low degree and high radial overtone (Kurtz et al. 2011).

The driving mechanism of their oscillation modes is still a matter of debate. But the most probable explanation seems to be the "classical" $\kappa$-mechanism operating in the hydrogen ionisation zone. Many physical processes could play a role in this context: for example the coupling with the magnetic field, the ability of the latter to freeze convection and allow the stratification of chemical elements (Balmforth et al. 2001).

Paunzen et al. (2012) published a list of roAp candidates based on their location in the Hertzsprung-Russell diagram which served us as a primary source. In addition, we selected targets from the catalogue of Ap, HgMn and Am stars by Renson & Manfroid (2009). Since most of the known roAp stars are classified as SrCrEu, we searched for such objects in the aforementioned reference. The fundamental parameters of our targets listed in Table 1 were calibrated as described in Paunzen et al. (2012). Luminosities are only derived if Hipparcos parallaxes were available.

The observations were done at the 0.75m APT at Fairborn Observatory (Arizona) either in Strömgren $v$ or Johnson $B$ depending on the brightness of the target. The integration time was set to 20 seconds with apertures of 30 and 45 arcseconds, respectively. No comparison stars were used because a good sampling of the possible periods are needed. A polynomial function was fitted to the sky subtracted data to account for the extinction and atmospheric variations. In Table 2 the observation log is given. Because all data have an arbitrary zero point, the measurements for each individual star were scaled and then merged.

The final light curves were examined in more detail using the Period04 program (Lenz & Breger 2005), which performs a discrete Fourier transformation. Significant peaks with periods of more than one hour were subtracted. In Figure 1, the Fourier spectra of all light curves are shown. There is no peak, which exceeds 1.3 mmag. For BD +35 3616, we notice a quite prominent peak at about 5 mHz which corresponds to about 200 seconds. Such a high frequency was never detected in any roAp star, so far. However, we are not able find to a possible explanation for this peak.

**Table 1: Fundamental data of our target stars.**

| Star ID | $V$ | Spec | $T_{\rm eff}$ [K] | $\log(L/L_\odot)$ |
|---|---|---|---|---|
| BD +25 4371 | 9.45 | F0 Sr Cr Eu | 8040(160) | – |
| BD +35 3616 | 9.47 | F0 Sr Eu | 6830(410) | – |
| HD 62140 | 6.47 | A8 Sr Eu | 7800(140) | 1.30(7) |
| HD 94427 | 7.36 | A5 Sr Eu Cr | 7500(250) | 1.29(10) |
| HD 96707 | 6.08 | A8 Sr | 7820(230) | 1.55(6) |
| HD 98088 | 6.11 | A8 Sr Cr Eu | 8030(120) | 1.66(12) |
| HD 115606 | 8.55 | A2 Sr | 7880(250) | 1.20(21) |

**Table 2: Observation log.**

| Star ID (BD ...) | HJD(start) 2456200+ | HJD(end) 2456200+ | $N$ | Star ID (HD ...) | HJD(start) 2456200+ | HJD(end) 2456200+ | $N$ |
|---|---|---|---|---|---|---|---|
| +25 4371 | 61.5687 | 61.6422 | 254 | 62140 | 64.0183 | 64.0465 | 103 |
| | 62.5603 | 62.6340 | 256 | | 66.0085 | 66.0244 | 62 |
| | 64.5695 | 64.5695 | 224 | | 86.9491 | 86.9840 | 69 |
| +35 3616 | 21.6505 | 21.6682 | 48 | 94427 | 73.9817 | 74.0476 | 224 |
| | 23.5663 | 23.6548 | 242 | | 74.9755 | 75.0449 | 235 |
| | 25.6500 | 25.6570 | 260 | 96707 | 69.9945 | 70.0507 | 189 |
| | 27.5633 | 27.6461 | 232 | | 71.9850 | 72.0516 | 224 |
| | 28.5686 | 28.6459 | 216 | | 90.9760 | 90.9946 | 66 |
| | 29.5620 | 29.6451 | 232 | 98088 | 82.0011 | 82.0535 | 138 |
| | 30.5615 | 30.6446 | 234 | | 82.9552 | 83.0515 | 309 |
| | 31.5763 | 31.6405 | 175 | 115606 | 86.9870 | 87.0141 | 93 |
| | 32.5628 | 32.6338 | 138 | | | | |
| | 33.5605 | 33.6331 | 205 | | | | |
| | 34.5589 | 34.6325 | 204 | | | | |

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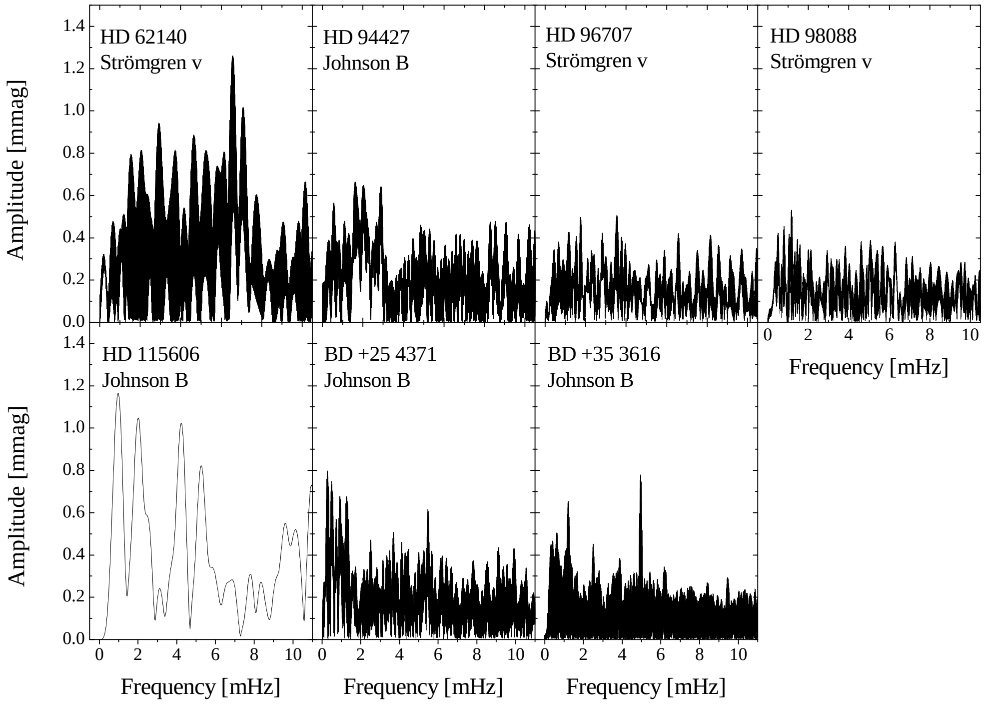


**Figure 1.** Fourier spectra of the target star light curves.

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