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HD 183324, A PULSATING λ Boo STAR?

λ Bootis stars are a class of chemically peculiar A-type (CP2) stars. They have a typical Pop I kinematics, but their metallicity is up to a factor of 100 too low for this type of population.

HD 183324 (m_V=5.8, HR 7400, BD−1°4010) was selected as a candidate for a southern hemisphere survey for variability among λ Boo stars. The spectral classification by Gray and Corbally (1993) for this object is A0 Vb λ Boo. Our observations were obtained in May 1994 at SAAO with the 0.5m telescope and a single channel photometer. A Strömgren v filter, and a 10 s integration time was chosen. Two comparison stars were used:

HD 180482 (C1, m_V=5.6, HR 7303, BD−4°4045, A3IV), and

HD 178596 (C2, m_V=5.2, HR 7266, F0III).

More information on the observations is listed in Table 1.

Table 1: Observing log.

night	hours	number of observations		
May '94		HD183324	HD180482	HD178596
1/2	2.99	410	47	53
2/3	3.66	1073	57	56
3/4	3.76	1205	41	-
4/5	3.54	1169	25	-
5/6	1.55	478	28	-
7/8	4.13	1360	45	-
9/10	4.32	1098	94	57
total	23.95	6802	307	166

Figure 1 shows the residuals to the mean instrumental magnitudes for the night of May 9/10. The light curve of both comparison stars is basically constant, only smooth sky transparency variations are visible. The parabolic trend in the light curve of C2 comes from a slightly incorrect extinction coefficient, which is inadequate for the late spectral type of C2 (F0) – compared to C1 (A3). The measurements of HD 183324, however, give clear evidence for amplitude modulated variability.

After subtraction of long term trends caused by sky transparency variations we computed an amplitude spectrum for all merged data of the program star (Figure 2). The maximum semi-amplitude for HD 183324 with 2.08 mmag(v) appears at the frequency f=47.37 1/d (30.39min). The bulk of frequencies around this highest peak is broader than a single period would produce according to the spectral window (inset in Figure 2). This property may be taken as evidence for at least one other frequency in this λ Boo star. Furthermore, all light curves show a significant amplitude modulation in each night (Figure 3).

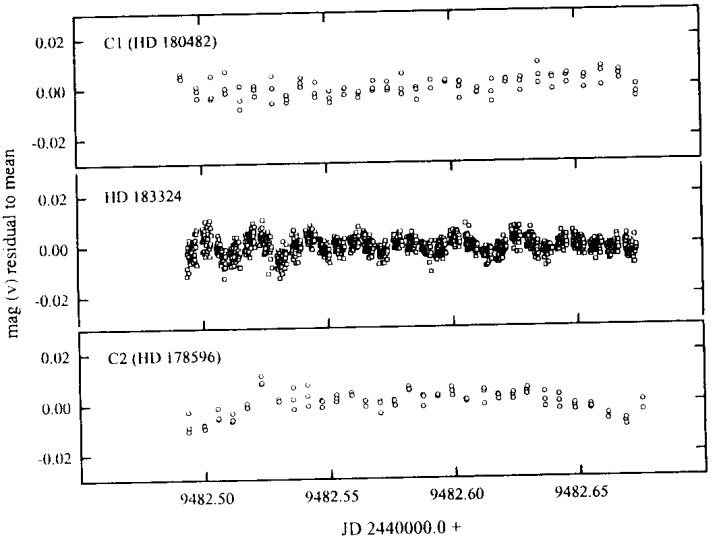

Figure 1: Instrumental Strömgren v data for HD 183324 and both comparison stars

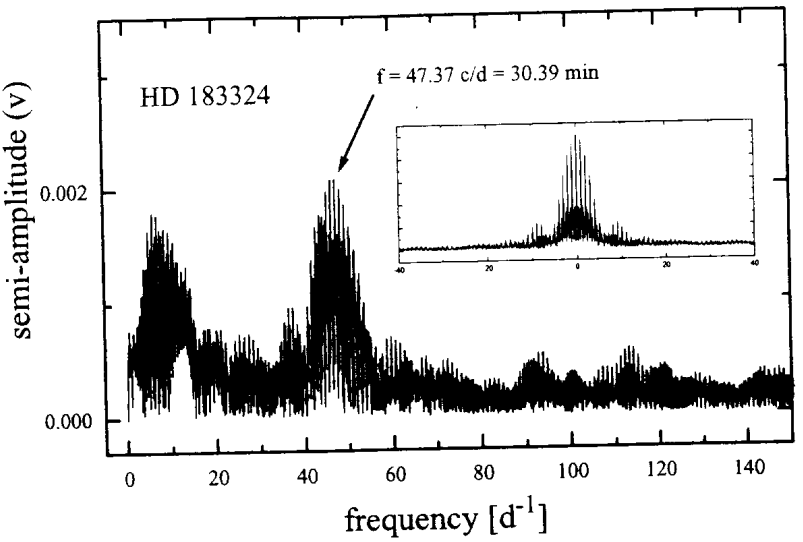

Figure 2: Amplitude spectrum (v) for HD 183324

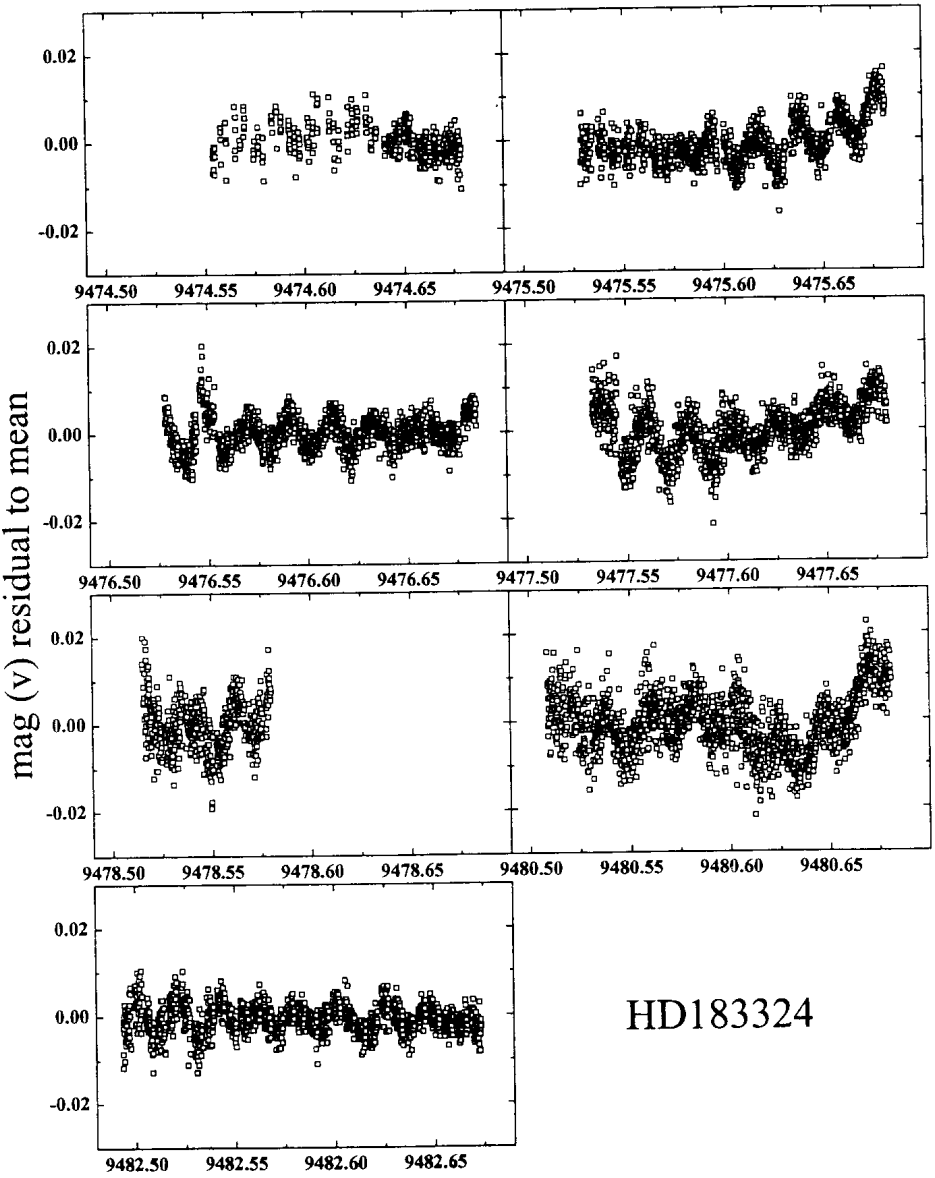

Figure 3. Light curves of HD 183324

Because of the period of about 30 minutes, the shortest period ever found in this group of peculiar stars, HD 183324 is an outstanding λ Boo star. Variations in this frequency domain come already close to the well known rapid oscillations in some cool Ap (roAp) stars.

Our discovery increases the number of known variables in the group of λ Boo stars to 10. It is the fourth variable we found in our survey which started at ESO in 1993. The suspected presence of multi-mode pulsation similar to δ Sct stars definitely requires the organisation of photometric multi-site observing campaigns in order to derive reliable pulsation frequency spectra (Weiss et al. 1994).

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