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NONVARIABILITY AMONG λ Boo STARS I.: ESO 1993 AND 1994 DATA

In 1993 we started an extensive survey for pulsation in λ Bootis stars. The λ Bootis stars are a group of metal poor, population I, A-type stars (Weiss et al., 1994) with broad and often shallow hydrogen lines, which are probably caused by a gas shell. Two theories exist concerning the evolutionary status of this group. In the first case diffusion would be the determining mechanism and the stars are at the end of the ZAMS phase. In the other hypothesis accretion and/or mass-loss would be responsible for the low metallicity and the stars would be just arriving at the ZAMS (Turcotte & Charbonneau, 1993).

Therefore their location in the Hertzsprung–Russell diagram, and hence their evolutionary status, is still controversial (Iliev & Barzova, 1995). Keeping these contradicting theories in mind, it is important to discover pulsation among λ Bootis stars, because pulsation allows to derive stellar structure parameter by applying the tools of asteroseismology. We have chosen for our survey candidates from Renson et al. (1990) and Gray & Corbally (1993). These stars were observed with the classical technique, using at least one comparison star and two filters (Strömgren v and b). All observations were corrected for the sky background, deadtime and extinction. Up to now we found 11 new pulsating λ Bootis stars (e.g. Paunzen, 1995). In a series of IBVS notes we want to present data of all photometrically constant λ Bootis candidates.

In this paper we discuss data observed at the 50 cm ESO telescope (observer: E. Paunzen) from June 25th to July 8th 1993 and July 19th to July 31st 1994. Table 1 lists all observed λ Bootis and comparison stars with the night and duration of the observations. The amplitude spectra and spectral window (Figures 1 to 5) were calculated with a standard Fourier technique (Breger, 1990). Due to the limitation of the IBVS format we present in these figures the amplitude spectra and spectral windows for the differential photometry of the λ Bootis and *one* comparison star up to the Nyquist frequency. The other comparison star (if observed) was constant as well. In case of observations in more than one night, we merged the data of all nights. The upper level of nonvariability is typically 4 mmag in Strömgren b.

It is evident from Table 1 and the figures that the nights have been of different quality. Due to the noise and the limitation of the data set we cannot exclude variability on a low amplitude level because we can only give an upper limit for it. However, until proven otherwise, we assume these stars to be constant. The periods of variable λ Bootis stars detected so far range typically from 50 to 140 minutes. From the PLC-relation of Stellingwerf (1979) we would expect a fundamental period of a radial mode for early A-type stars at the MS of about 45 to 120 minutes (30 to 10 c/d).

Table 1. Program and comparison stars, ⋆ this comparison star is used for the figure

Star	Durchm.	JD	hours	m_V	Spec.		Upper level [b]
HD 319	CD −23°13	2449166	2	5.93	λ Boo		0.004
HD 203	CD −3°4			6.18	F2IV	⋆	
HD 141851	CD −023°4058	2449168	4	5.10	λ Boo		0.004
		2449175	5				
HD 140775	CD −03°3829			5.52	A5IV	⋆	
HD 140837	CD −01°3092			5.39	B8III		
HD 143148	CD −31°12442	2449560	4	7.39	λ Boo(?)		0.004
HD 142542	CD −31°12407			6.29	F5V	⋆	
HD 142851	CD −31°12426			7.13	A0V		
HD 145782	CP −57°7716	2449166	4	5.71	λ Boo(?)		0.006
HD 144480	CP −57°7613			5.57	B9.5V	⋆	
HD 154153	CD −43°11396	2449175	3	6.18	λ Boo(?)		0.004
HD 153234	CD −44°11339			6.51	F3V		
HD 154025	CD −45°11188			6.28	A2V	⋆	
HD 179791	BD +05°4081	2449166	3	6.51	λ Boo(?)		0.006
HD 178596	BD +05°4040			5.22	F0III	⋆	
HD 180482	BD +04°4045			5.59	A3IV		
HD 188164	CP −69°3073	2449173	3	6.35	λ Boo(?)		0.004
		2449174	6				
HD 188097	CP −69°3072			5.75	Am	⋆	
HD 193256	CD −29°16980	2449560	5	7.70	λ Boo		0.002
		2449563	3				
		2449564	5				
HD 193281	CD −29°16981	2449563	3	6.61	λ Boo		0.004
		2449564	5				
HD 194170	CD −29°17046			8.27	A4V	⋆	
HD 204041	CD −00°4215	2449568	3	6.45	λ Boo		0.002
HD 203405	CD +00°4714			6.78	F2		
HD 204121	CD +00°4726			6.13	F5V	⋆	

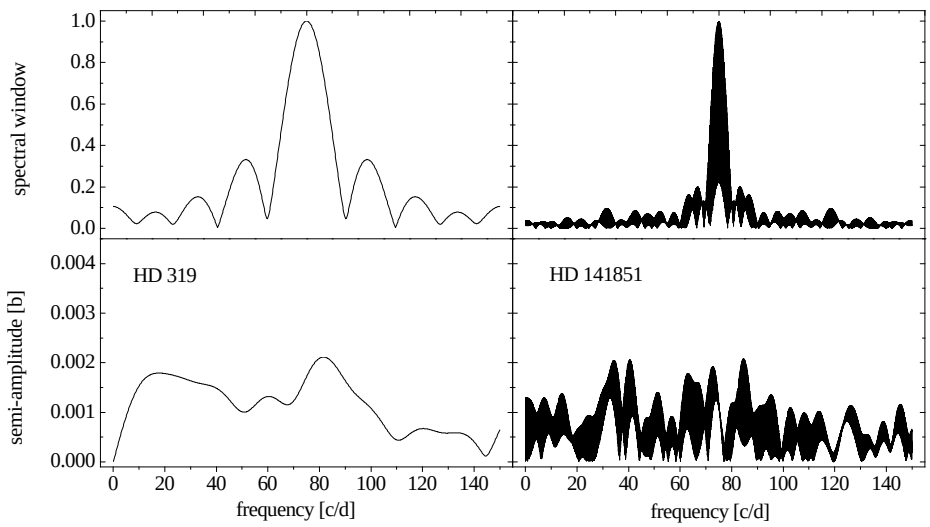

Figure 1. Amplitude spectrum and spectral window for the differential data of HD 319 and HD 141851 in Strömgren b.

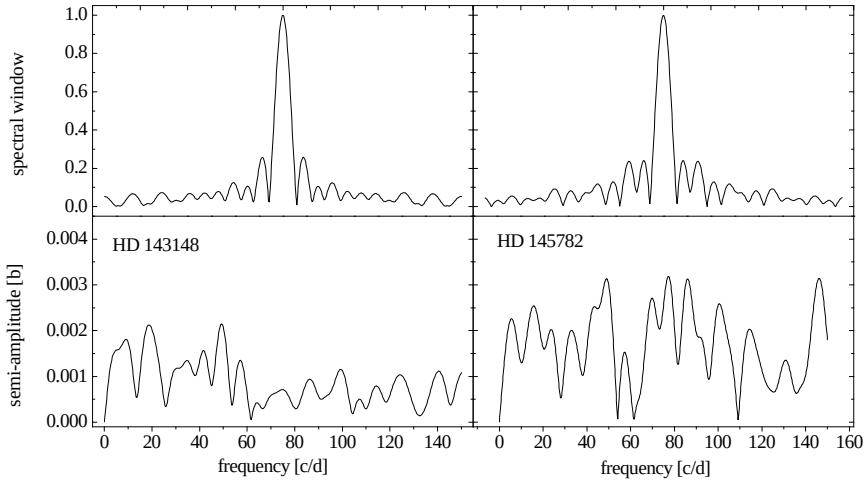

Figure 2. Amplitude spectrum and spectral window for the differential data of HD 143148 and HD 145782 in Strömgren b

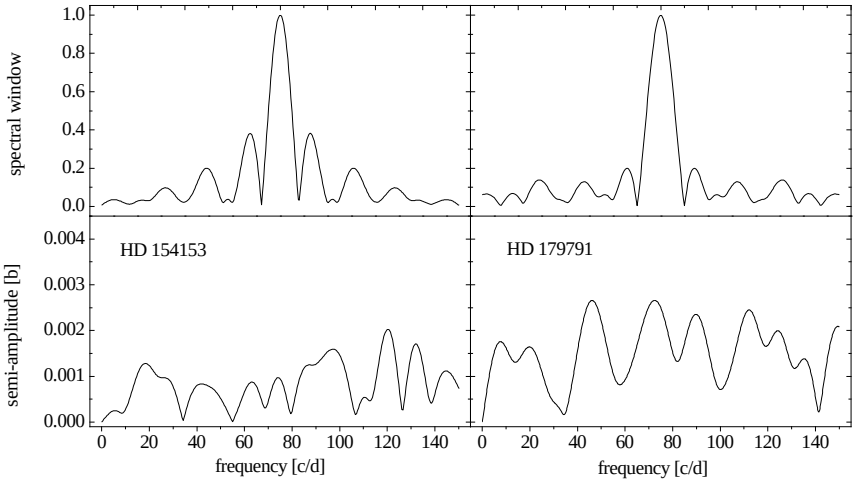

Figure 3. Amplitude spectrum and spectral window for the differential data of HD 154153 and HD 179791 in Strömgren b.

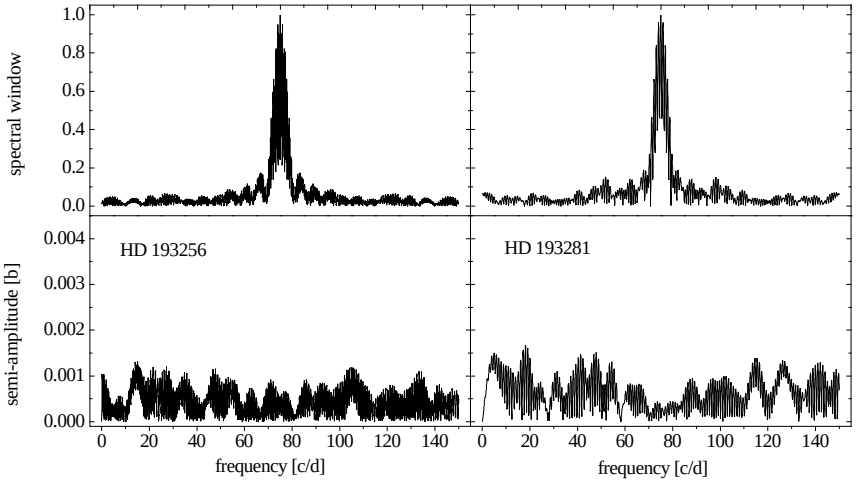

Figure 4. Amplitude spectrum and spectral window for the differential data of HD 193256 and HD 193281 in Strömgren b.

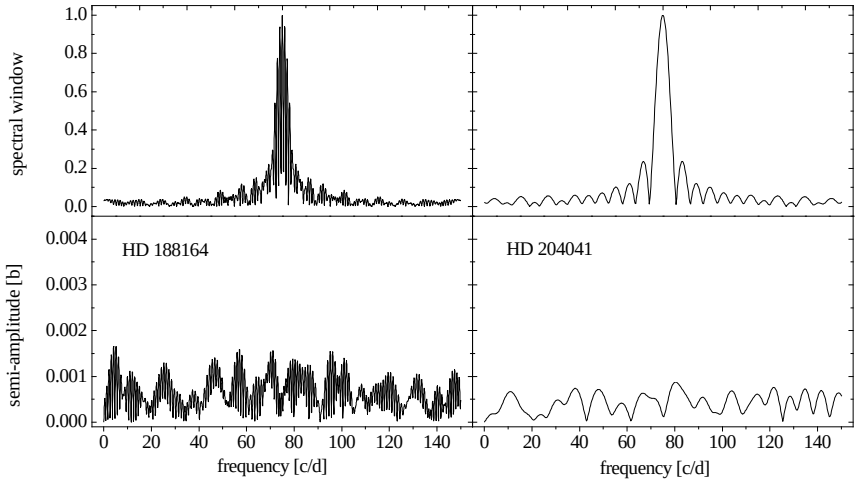

Figure 5. Amplitude spectrum and spectral window for the differential data of HD 188164 and HD 204041 in Strömgren b.

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ERRATUM

In Table 1 of the IBVS No. 4302 several cross-identifications have been erroneously given. The correct version of the Table is given below.

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		2449175	5				
HD 141378	BD −03° 3829			5.52	A5IV	⋆	
HD 140873	BD −01° 3092			5.39	B8III		
HD 143148	CD −31° 12442	2449560	4	7.39	λ Boo(?)		0.004
HD 142542	CD −31° 12407			6.29	F5V	⋆	
HD 142851	CD −31° 12426			7.13	A0V		
HD 145782	CP −57° 7716	2449166	4	5.71	λ Boo(?)		0.006
HD 144480	CP −57° 7613			5.57	B9.5V	⋆	
HD 154153	CD −43° 11396	2449175	3	6.18	λ Boo(?)		0.004
HD 153234	CD −44° 11339			6.51	F3V		
HD 154025	CD −45° 11188			6.28	A2V	⋆	
HD 179791	BD +05° 4081	2449166	3	6.51	λ Boo(?)		0.006
HD 178596	BD +05° 4040			5.22	F0III	⋆	
HD 180482	BD +04° 4045			5.59	A3IV		
HD 188164	CP −69° 3073	2449173	3	6.35	λ Boo(?)		0.004
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