HD 37151: A NEW "SLOWLY PULSATING B STAR"*

P. NORTH and S. PALTANI
Institut d'Astronomie de l'Université de Lausanne,
CH-1290 Chavannes-des-Bois, Switzerland

Abstract. We report the discovery of non-radial pulsations with at least 4 periods in the B7V star HD 37151. This result is based on 465 photometric measurements spanning 12 years. In addition, 30 high-resolution spectra were taken in the Mg II λ4481 region: they show a small projected rotational velocity and slight variations of the line profiles. Although this star was once classified B8Vp(Si), all available data show it is a normal B7V star. It is the second coolest SPB star found to date.

1. Photometry

HD 37151, classified B8Vp(Si) by Abt & Levato (1977) and a member of the Orion OB1 association, was discovered to be multiperiodic in the course of a photometric survey of Ap stars in clusters (North 1984, 1987). 465 photometric maesurements made in the Geneva system during the last 12 years with the Swiss telescope at ESO La Silla, Chile, confirm the multiperiodicity and show at least 4 frequencies. These are listed in Table 1 together with the amplitudes for the 3 Geneva passbands [U], [B] and V. The long-term stability of the periods is attested by the presence of the alias frequencies $\nu_i \pm 1$ yr^{-1} in the periodograms. The [U] amplitude is twice as great as the V one, like in the other SPB stars (Waelkens 1991), and the length of the periods points to non-radial oscillations.

2. Spectroscopy

30 high-resolution spectra taken in October 30 – November 5, 1989 at ESO La Silla with the CAT telescope show a clear variability of the Mg II λ4481 and He I λ4471 lines. The frequency ν_1 is seen in the second moment (m_2, see e.g. Balona 1986) of these lines, while ν_2 is present in their first and third moments. The time series is too short to show all photometric frequencies.

One spectrum taken in the Si II λ4128 – 4130 region shows that HD 37151 is **not** an Si star, confirming the lack of photometric peculiarity in the Geneva and Δa systems (Joncas & Borra 1981) and in the UV (Shore & Brown 1987).

The spectra show that $v \sin i = 28$ kms^{-1}, which nicely confirms the suspicion that all SPB stars rotate slowly (Waelkens 1987, 1991).

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TABLE I

Coefficients of the function least-squares fitted to the lightcurve: $m(t) = A_o + A_1 cos(\omega_1 t + \phi_1) + A_2 cos(\omega_2 t + \phi_2) + A_3 cos(\omega_3 t + \phi_3) + A_4 cos(\omega_4 t + \phi_4)$ where t = HJD-HJD$_o$ and HJD$_o$ = 2446948.734. The r.m.s. residual scatter around the fitted curve (absolute photometry) is given too.

Period [d] Frequency [d^{-1}]	bandpass	A_o	A_i	$\phi_i/2\pi$	σ_{res}
$P_1 = 0.804397$	[U]	7.2860	0.01826	0.103	
$\nu_1 = 1.24317$	[B]	6.3176	0.01040	0.107	
	V	7.3798	0.00899	0.115	
$P_2 = 0.847333$	[U]		0.02124	0.103	
$\nu_2 = 1.18017$	[B]		0.01210	0.099	
	V		0.01034	0.097	
$P_3 = 0.904769$	[U]		0.01523	0.758	
$\nu_3 = 1.10525$	[B]		0.00870	0.759	
	V		0.00740	0.744	
$P_4 = 0.959113$	[U]		0.01607	0.238	0.0100
$\nu_4 = 1.04263$	[B]		0.00951	0.234	0.0068
	V		0.00789	0.241	0.0061

3. HD 37151 among the other SPB stars

A comparison of the physical parameters of HD 37151 (obtained from the X and Y Geneva parameters through the calibration of North & Nicolet 1990) with those of the other SPB stars show that it is the second coolest one, with $T_{eff} = 12865K$ and $M = 3.13M_\odot$, just after HD 123515 which has $T_{eff} = 11944K$ and $M = 2.88M_\odot$. It is therefore a useful object for defining the empirical red edge of the instability strip of the SPB's.

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