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Study of magnetic fields of different luminosity hot stars

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Abstract. Circular spectropolarimetric observations of four different luminosity hot stars were obtained in an attempt to detect magnetic fields via longitudinal Zeeman effect in the spectral line HeI 6678.149 Å: γ Pegasi (Sp B2 IV), γ Orionis (Sp B2 III), ω Orionis (Sp B3 IIIe), ζ Persei (Sp B1 Ib). No statistically significant values of the mean magnetic field were detected. The pulsation period of γ Pegasi was refined as $P = 0^{\rm d}.151750393 \pm 6.4 \times 10^{-8}$.

Key words: stars: magnetic fields – stars: pulsations

Circular spectropolarimetric observations of four different luminosity hot stars were obtained in an attempt to detect magnetic fields via longitudinal Zeeman effect in the spectral line HeI 6678.149 Å. Stars were selected to sample over the range of spectral types from B1 to B3 and of luminosity types from I to IV: γ Pegasi (HR 39; HD 886; B2 IV), γ Orionis (HR 1790; HD 35468; B2 III), ω Orionis (HR 1934; HD 37490; B3 III), ζ Persei (HR 1203; HD 24398; B1 Ib).

In Figure 1 one can see an example of the profile of the line HeI 6678.149 Å normalized to the continuum in the spectrum of γ Pegasi. The restriction level of the used part of the contour is shown by the straight line.

γ Pegasi is one of the β Cephei (or β Canis Majoris) type stars. This star displays the visual light curve with the amplitude $\Delta V \approx 0.017$, radial velocity curve with the amplitude $2K \approx 7.0$ ($km\ sec^{-1}$) and with the pulsation period $P = 0^{\rm d}.15175020 \pm 4 \times 10^{-8}$, which is comparable to the periods of other β Cephei-type variable stars (Ducatel et al. 1981). In order to add a new sample of velocity measurements for γ Pegasi, 178 exposures were made during 5 nights. The duration of the set of radial velocity measurements per night was more than the pulsation period of the star. For period calculation our data were complemented by data of McNamara (1955), Sandberg et. al. (1960), Ducatel et al. (1981). A single pulsation period was found using Martin Sperl's program "Period98" :

$$HJD_{max} = 2451060.4614 + n0^{\rm d}.151750393 \pm 6.4 \times 10^{-8}. \quad (1)$$

The radial velocity values as a functions of phases of the pulsation period of γ Pegasi are given in Figure 2. The mean radial velocities per night are subtracted from each radial velocity value. The mean values per night of the longitudinal magnetic field and radial velocity are presented in Table 1.

References

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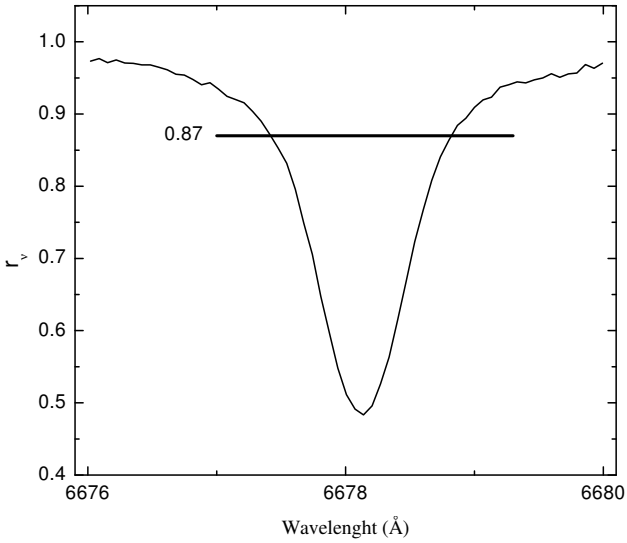

Figure 1: The profile of the line HeI 6678.149 Å in the spectrum of γ Pegasi, which was observed on 1998 September 3, normalized to the continuum.

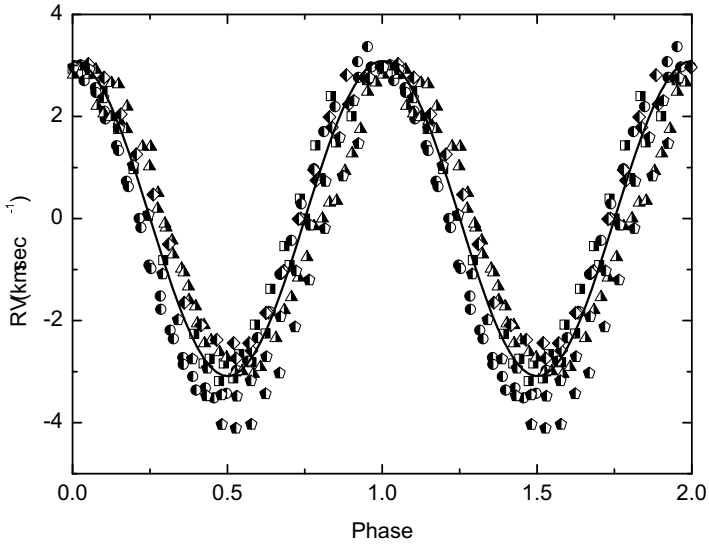

Figure 2: The radial velocity curve of γ Pegasi.

Table 1: Results of measurements of magnetic fields and radial velocities

JDH (+2400000.000)	Set (hours)	$B_e \pm \sigma$ (Gauss)	V_r (km sec^{-1})
γ Pegasi (Sp B2 IV)			
50681.516	1.05	-7.70 ± 5.55	-
50684.495	3.02	-2.56 ± 3.59	-
50802.318	1.08	-6.48 ± 9.07	-
51060.481	5.17	-4.97 ± 6.28	2.27
51061.480	5.40	10.51 ± 4.83	3.71
51088.430	4.53	0.75 ± 5.96	-
51172.251	4.93	-	3.11
51488.272	4.97	-2.66 ± 4.08	1.86
52217.366	5.45	-	3.52
γ Orionis (Sp B2 III)			
51171.223	0.67	-	19.59 ± 0.18
51172.256	2.78	-	18.76 ± 0.001
51486.424	1.80	10.37 ± 18.33	17.96 ± 0.11
51487.522	5.33	-28.32 ± 14.15	17.29 ± 0.03
51488.512	6.02	-11.55 ± 7.39	17.93 ± 0.06
52280.261	1.83	80.28 ± 32.08	-
ω Orionis (Sp B3 IIIe)			
51489.610	1.42	-14.89 ± 183.32	-
51502.514	5.67	31.77 ± 117.00	-
ζ Persei (Sp B1 Ib)			
50692.481	1.83	8.61 ± 15.04	-
51522.347	2.58	-72.44 ± 37.14	17.67 ± 0.23
52280.184	1.58	83.15 ± 90.30	-
52624.192	1.67	81.76 ± 29.73	21.51 ± 0.07
52625.219	1.42	114.79 ± 51.10	21.36 ± 0.09