

Discovery of pulsations in HD 98851

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Abstract. Using the UPSO 1-m Sampurnanand reflector telescope equipped with a fast photometer, we observed the chemically peculiar (CP) star HD 98851 for a total of around 30 hours on 5 different nights between January to April 2000. From the Fourier analysis of our data we have found that HD 98851 pulsates with periods of 75.76 min and 151.52 min and amplitudes ≈ 25 mmag and 12 mmag respectively. The star appears to be a δ Scuti variable.

1. Introduction

Delta Scuti stars are multi-periodic variable stars belonging to the instability strip in the H-R diagram where it crosses the main sequence among the A and F stars. About 30% of the stars in the instability strip are δ Scuti stars, which pulsate with amplitude ranging from a few mmag to almost a magnitude with periods less than 0.3 days. δ Scuti stars pulsate with a number of simultaneous radial and/or non-radial modes of low overtones. This makes them well suited for asteroseismological studies. The pulsations are driven by the κ - mechanism operating in the He II-ionisation zone (Cox, et al., 1979). HD 98851 is a cool Am star (Abt, 1984) of magnitude 7.4. It has Strömgen indices corresponding to high metallicity found in Am and Ap stars viz. $b-y = 0.199$, $m_1 = 0.122$ and $c_1 = 0.766$ and Johnson colour indices $B-V=0.33$, $U-B=0.12$ (Hauck & Mermilliod, 1998).

2. Observations

High speed photometric observations of the star HD 98851 were obtained using UPSO high-speed photometer attached to the 104-cm Sampurnanand reflector telescope at Uttar Pradesh State Observatory (UPSO), Naini Tal. All the observations were made through a Johnson B filter as continuous 10-sec integrations. An aperture of 30" diameter was used to minimize the effects due to seeing and tracking errors. The observations were interrupted for occasional sky background measurements to account for the change in sky background during the night.

No observations were made for the comparison star since these observations were conducted as part of a survey for roAp stars, which have the periods in the range 4-16 min.

Journal of observations of HD 98851

UT Date	HJD	Time (hours)	Total points	Freq (mHz)	Amp mmag
17-02-2000	2451592	7.07	2545	0.21	20.549
				0.11	11.449
19-02-2000	2451594	7.85	2826	0.21	21.926
				0.10	12.948
21-02-2000	2451596	8.05	2895	0.22	27.593
				0.11	7.595
19-03-2000	2451575	3.34	1203	0.22	14.823
				0.11	6.659
23-03-2000	2451627	4.37	1573	0.22	22.287
				0.10	19.292

3. Data reduction and analysis

The data were corrected for the coincidence counting losses due to dead time (~ 23 ns), sky background and mean atmospheric extinction. The corrected data were subjected to the Fourier transform to check for any dominant periodicity using a fast algorithm based on Deeming's (1975) Discrete Fourier Transform (DFT). Each frequency in the star was identified with the higher peak in the amplitude spectrum. A sinusoid with the parameter of this frequency was subtracted from the data ("prewhitened") and then the amplitude spectrum was again computed to search for further low amplitude frequencies.

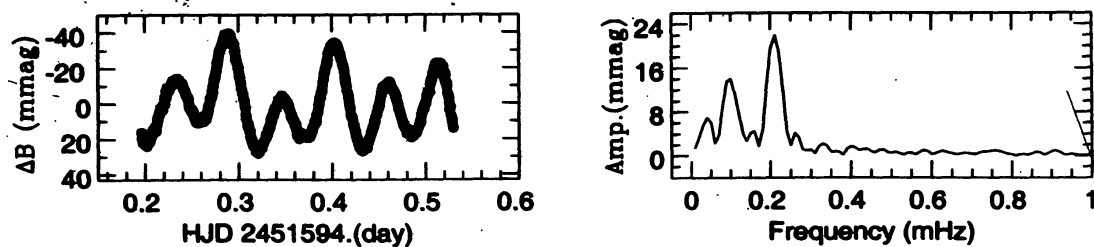


Figure 1. Light curve and amplitude spectrum of HD 98851 on night JD 2451594

4. Conclusion

The data analysis shows that HD 98851 is pulsating with two frequencies corresponding to the periods 75.76 ± 5.0 min and 151.52 ± 15 min. There is an ambiguity regarding the identification of the frequency corresponding to the fundamental frequency. More data are needed for further study.

References

- Cox A.N., King D.S., Hodson S.W., 1979, ApJ, 231, 798.
Deeming T.J., 1975, Ap & SS, 36, 137.
Abt H.A., 1984, ApJ, 284, 247.
Hauck B., Mermilliod M., 1998, A&AS, 129, 431.