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Ultra rapid variability in γ Cas and λ Eri

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Abstract. We present here preliminary results of observations on two Be stars γ Cas and λ Eri made during 27-30 December 1992 and 14-15 February 1993.

Key words : Be stars—variability

1. Introduction

Some Be stars are known to show rapid emission line variability on the time scales of a few minutes (Smith *et al.* 1989). Physics of such rapid variability is not very well understood. We have started an observational campaign on some bright Be stars : γ Cas, λ Eri, 27 CMa and κ Dra at Japal-Rangapur Observatory (JRO) near Hyderabad using Fabry-Perot Spectrometer (FPS) with which it is possible to obtain line profiles in time scales of less than 1 mt and hence is suitable to monitor the rapid variability.

2. Observations and results

The Hα profiles of γ Cas were obtained in December 1992 while those of λ Eri in December 1992 and February 1993 using a piezo-scanned Fabry-Perot Spectrometer (for details, Banerjee *et al.* 1987) at the Nasmyth focus of 1.2 m telescope at JRO. The FPS has a free spectral range (FSR) of 21.3 Å or 972 km s^{-1} in terms of relative velocity, with a resolution of 0.7 Å or 35 km s^{-1} at 6563 Å. The detector was a thermoelectrically-cooled PMT (ITT FW 130) having a typical S20 response. A field aperture of 15 arcsec was used with a seeing resolution of 2.5 arcsec. The FPS was scanned over 2.3 FSR with a time resolution of 1.2 arcsec. All the obtained line profiles are smoothed by 3 point moving average.

Figure 1 shows instrumental profile obtained using NeI line 6598 Å. Figures 2a to 2d show the Hα profile in γ Cas on 27 December 1992. It shows how the well-defined profile in figure 2a has disappeared in figure 2b reappearing in figures 2c and 2d at the same position as in figure 2a but with a change in the shape within a time of about 18 min. On 28 December 1992 γ Cas neither showed any emission profile nor any continuum variation. Figure 2e to 2h show variations observed in continuum on 29 December 1992. In quite contrast to the observations of 27 December 1992, spiky and broad Hα profiles were observed on 29th December (figure 2e). Also continuum intensity varied from 20 counts/sec to 200 counts/sec within a time scale of 60 secs (figures 2e to 2f). Such an increase in intensity in

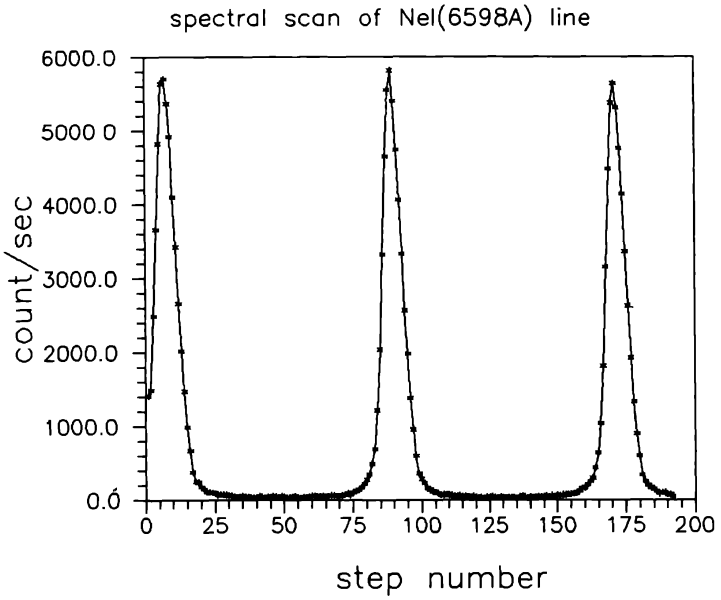

Figure 1. Instrumental profile.

continuum is probably due to broadening of the emission profile beyond the FSR of the etalon used.

The Hα profiles of λ Eri observed during December 1992 are shown in figures 3a to 3d. Here we observe transient phenomena instead of broad profiles. We define the transient phenomena as a spike feature with fringe width at zero intensity typically between 40 to 70 km/sec. The strangeness of transient phenomena is, if they appear in one scan, in the very next scan they either disappear or considerably doppler-shifted with a time scale of 48 sec (time taken for each scan ~ 48 sec). Figures 3e and 3f show Hα profiles of λ Eri observed during February 1993. Figure 3e is average of 14 scans taken on 14 February 1993 while that of figure 3f is average of 12 scans taken on 15 February 1993. The dark count is 1-2 count/sec. Surprisingly we did not observe any transient phenomena in February 1993 instead we observed broad Hα profiles which were totally absent in December 1992.

3. Discussion

Pulses of such short time scale (48 secs) as observed in λ Eri cannot be explained by stellar non-radial pulsations. Smith (1989) has observed similar phenomena but in absorption. Such a transient behaviour can be explained by ejection of a heated blob of matter from the stellar surface. Instabilities in the photosphere can cause such ejections but it is indeed very difficult to explain the physics of such instabilities which can cause such ultra-rapid variations. It can also be explained with a binary model wherein the secondary component say a white dwarf or neutron star, accretes mass from the primary by tidal action at the periastron. Therefore a continuous monitoring of λ Eri is required in order to establish the frequency of occurrence of such pulses which may put constraint on the above models. γ Cas which is a known X-ray binary did not show any transient features, instead it only showed continuum variations and change in the shape of the profile. A modelling of the profiles of these two stars is being

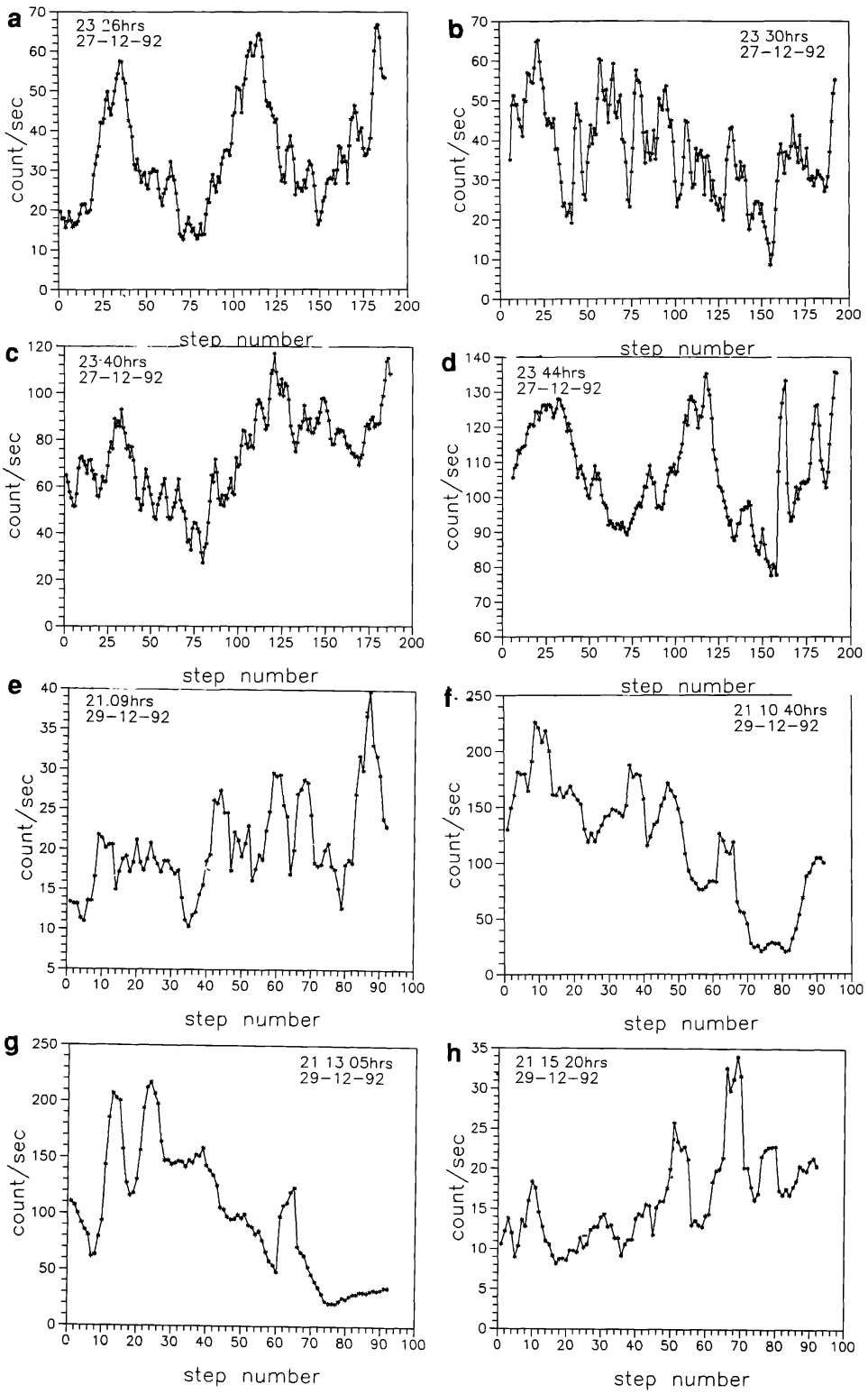

Figure 2. Hα profiles of γ Cas.

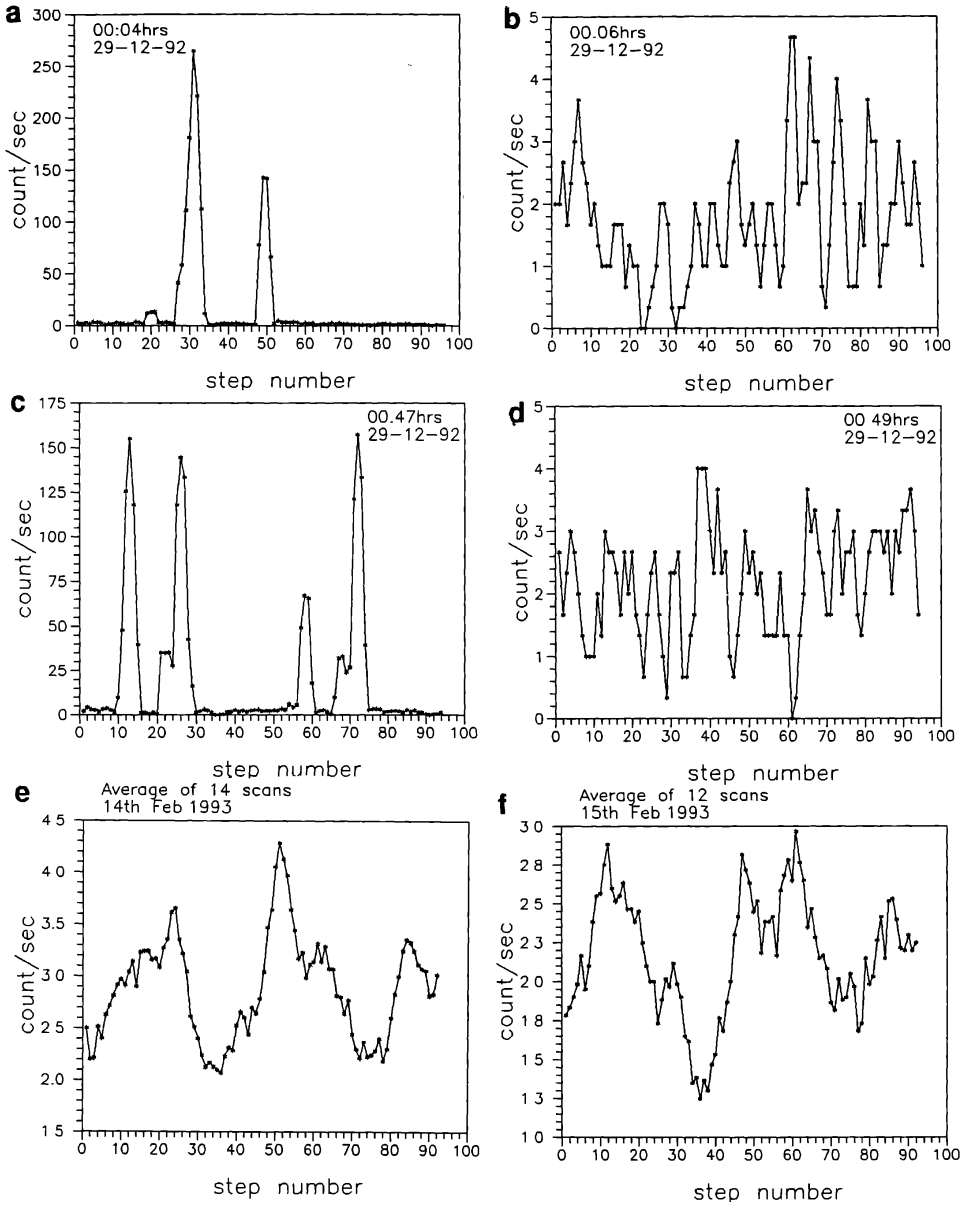

Figure 3. Hα profiles of λ Eri.

attempted and will be published elsewhere. Also we have program of further observations of these stars.

References

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