COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4149

Konkoly Observatory
Budapest
23 January 1995

HU ISSN 0374 – 0676

SHORT TIME-SCALE VARIATION OF ε Aur Hα BLUE WING EMISSION

ϵ Aur is a peculiar spectroscopic binary system with a long period of 27.1 years. Its primary is an F0Ib star around which there is a slowly moving ring-like (or disk-like) HII radiation cloud accompanying with the rotation of the F star, and this makes Hα wing produce two emission lines with rotating structure. The secondary is a disk-like multi-ring gaseous cloud (Ferluga, 1990). In 1982-84 eclipse, Ferluga and Mangiacapra (1991) observed the shell spectra of the secondary and obtained its multi-ring model.

Our observations on ϵ Aur Hα line outside eclipse were carried out by using the thick CCD system on Coudé spectograph of the 1-meter telescope at Yunnan Observatory. The dispersion of the spectrograph (f=1900) is 4.16Å/mm, and spectral resolution $\lambda/\Delta\lambda$=455000. Read-out noise of the CCD system is 12.3 electrons/sec, the resolution of image cell 0.048Å/pixel, wavelength range for a single exposure about 37Å, and the signal-to-noise ratio 150-250. A line of sight velocity standard star, α Lep, and a spectrophotometric standard star, ζ Leo were observed to confirm the Hα blue wing emission profile. The measurement errors of the equivalent width values in the Hα lines are $\pm$30mÅ for the absorption and $\pm$6mÅ for the blue wing emission.

In Figure 1a and b, the Hα observational profiles are given. No. 1 to No. 15 are out-of-eclipse Hα lines of ϵ Aur and No. 16 is that of the sight line velocity standard star, α Lep. Two significant variations appear at the blue emission peaks on No. 4 and 6 lines; the emission intensity decreases at the line center, and the equivalent widths for these two lines are +193mÅ and +199mÅ (see Table 1), respectively; comparing with Nos.3, 5 and 7, the equivalent width decreases by about 100mÅ in less than 40 minutes. In the time interval of 2.5 hr, the intensity variation from No. 7 to 10 is very small, within $\pm$10mÅ; and on both No. 11 and 14 lines only a small fluctuation appears in 2 hr period. The variations of the equivalent widths for the blue wing emission and absorption in the interval of 7 hr on Oct. 30 are drawn in Figure 2. It is shown from the above description that short time-scale variations from 20 minutes to several hours exist in the blue wing emission; while the red wing and absorption profiles are similar to previously observed profiles, almost no variation can be found (see Figure 1a and b). The average equivalent width of the absorption lines is $-$545mÅ, only a seventh or eighth of that eclipse; the standard deviation σ_x=11, and the maximum variation is within $\pm$18mÅ, smaller than the error of the measurement.

From the Hα observations in 1955-57 (Wright, 1957) and 1982-84 (Tan, 1985) eclipses, in ingress the secondary first would absorb the Hα red wing emission; and from our model (Cha et al., 1994) the blue wing emission source should be region C, therefore, in the region possibly exists an HII cloud with a short time-scale variation. If our observational Hα continuum is taken as a reference, in the emission over the continuum in 20 minutes

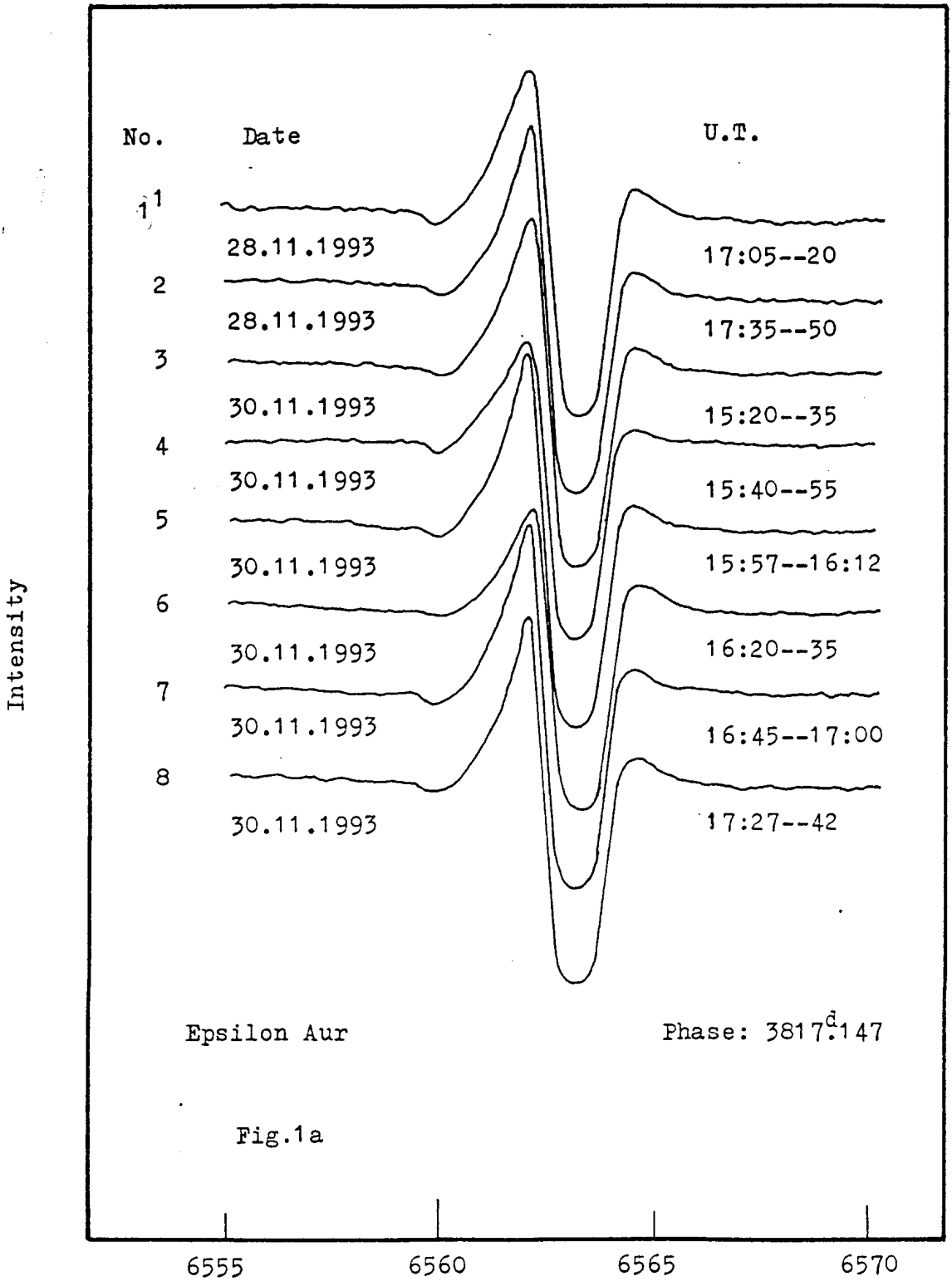

Figure 1a

Figure 1. Short-time variation of ϵ Aur Hα blue wing emission

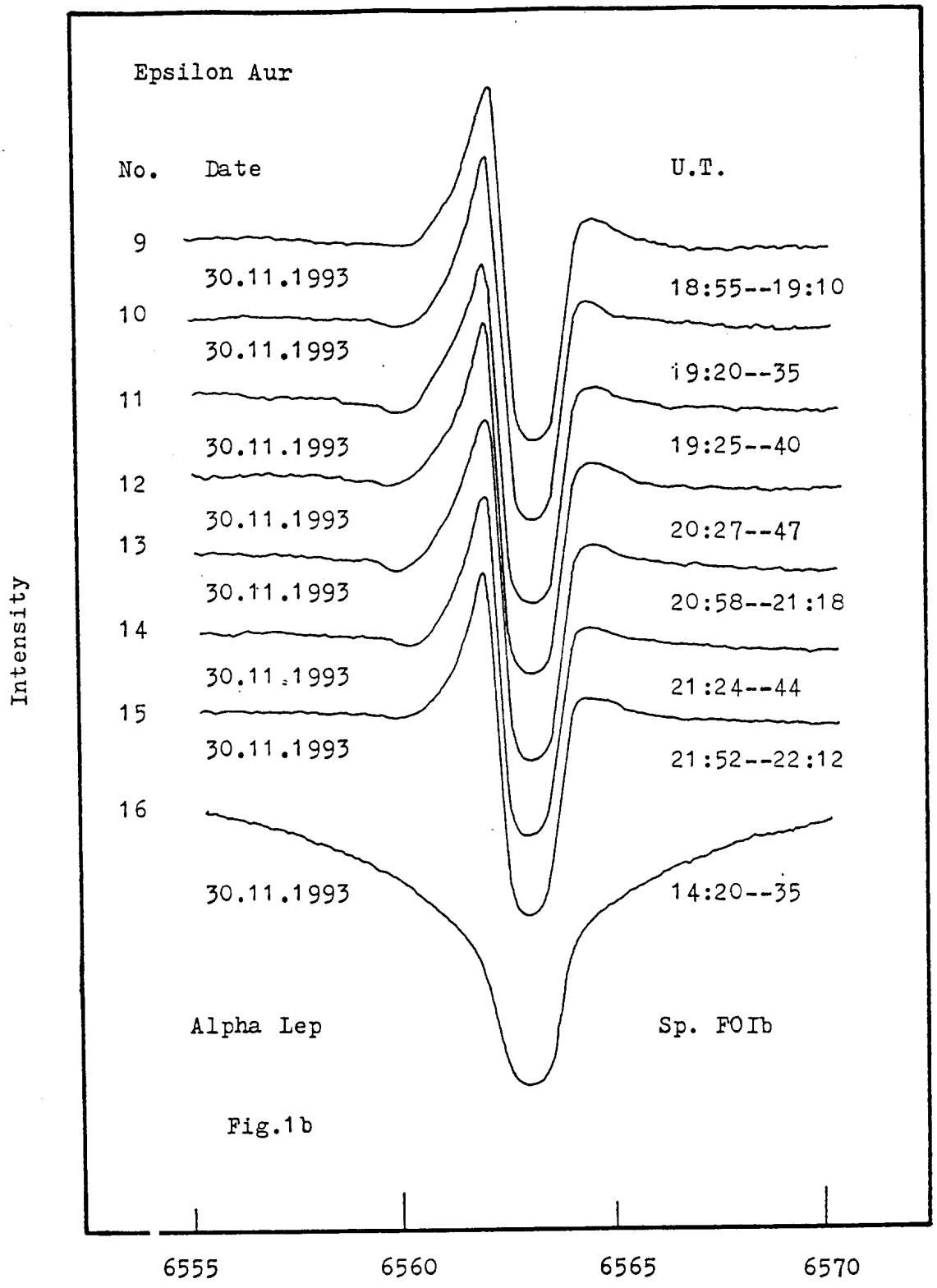

Figure 1b

Figure 1. Short-time variation of ϵ Aur Hα blue wing emission

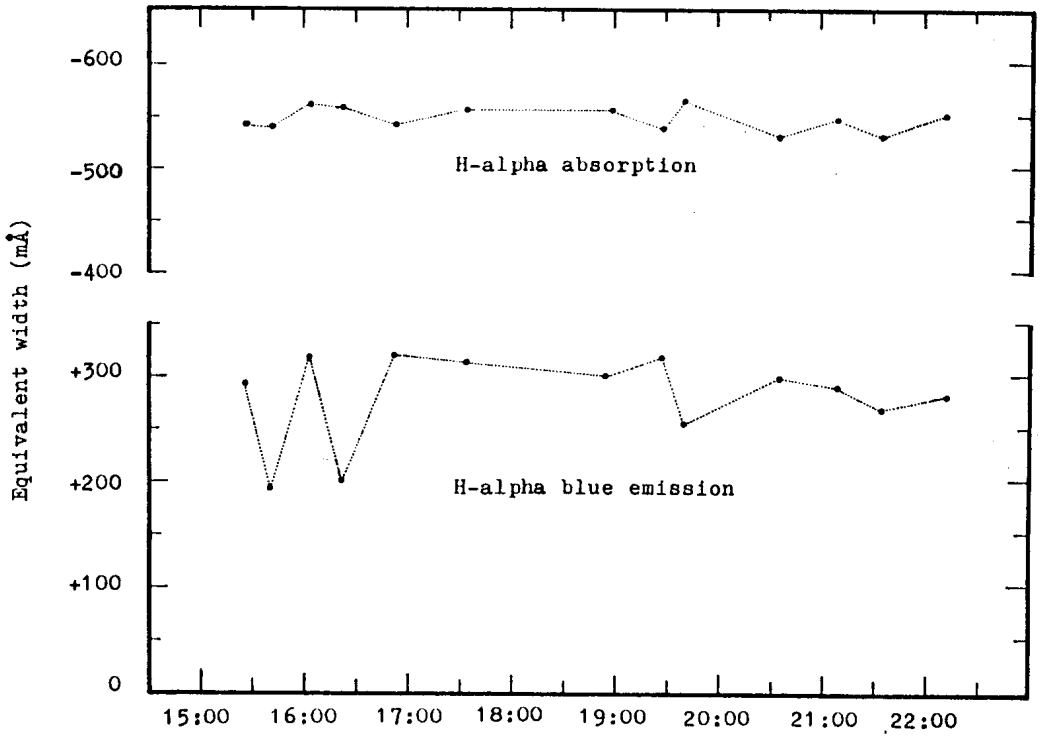

Figure 2. Variation of equivalent widths.

interval appear two fast variations, and the intensity ratio is 2:3 (in No. 4 and 6 to No. 3 and 5), with the intensity decrease by one third. The strong blue wing emission center is close to the Hα absorption profile, and active emission may probably locate in the region slowly appearing from the back of the F0 supergiant. A continuous monitoring on ϵ Aur is of importance to obtain more information about the matter in Hα rotating ring for analysing its motion features, physical characteristics annd emission mechanism.

CHA GUANGWEI
LI YONGSHENG
XU JUN
United Laboratory for Optical
Astronomy,
Chinese Academy of Sciences
Yunnan Observatory
P.O. Box 110
Kunming 650011
People's Republic of China

References:

Cha Guangwei, Tan Huisong, Xu Jun, and Li Yongsheng, 1994, *A&A*, **284**, 874
Ferluga, S, 1990, *A&A*, **238**, 270
Ferluga, S., and Mangiacapra, D., 1991, *A&A*, **243**, 230
Tan Huisong, 1985, *Acta Astrophysica Sinica*, **5**, No. 3, 180
Wright, K. O., and Kushwaha, R. S., 1957, *Contribution from the Dominion Astrophysical Observatory*, No. 57, 421