COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2326

Konkoly Observatory
Budapest
4 May 1983
HU ISSN 0374 - 0676

H ALPHA OBSERVATIONS OF EPSILON AURIGAE

The binary system ε Aur (= HR 1605) is now passing through the phase of its total eclipse. This system has an orbital period of 27.1 years; the primary star is an FOIa supergiant and the secondary component is an object of unknown nature.

ε Aur has been well studied photoelectrically (Gyldenkerne 1970). The light curve shows only the primary minimum, with a totality phase of roughly constant magnitude that lasts about one year. The secondary component gives no observable contribution, at least in the visible bands, to the luminosity of the system at any time. In spite of this, during the totality phase, the difference in magnitude is restricted within less than one magnitude, so that it is supposed to be caused by a disk-shaped or by a semitransparent object.

At the Trieste Observatory ε Aur has been observed with a photoelectric photometer equipped with two interferometric filters of 30 Å halfwidth. One of them is centered on the Hα 6653 Å line of neutral hydrogen, the other being centered on a nearby continuum region, say 6620 Å. The comparison star, λ Aurigae, is a solar type dwarf (GOV). Table I shows the magnitude of the line minus the magnitude of the red continuum, together with the differences between ε and the comparison. Every value is an average of several particular measurements, made with a time resolution of, typically, 1 minute.

The first fact that these measurements seem to reveal is an evident decrease in the relative flux emitted by the line.

Table I

Date	$\Delta m\,(H\alpha - 6620\text{Å})$	$\Delta m_{6620}\,(\varepsilon-\lambda)$
Nov. 19, 1982	- 0.05 ± 0.01	- 1.02 ± 0.01
Jan. 11, 1983	- 0.06 ± 0.02	- 0.98 ± 0.01
Jan. 17, 1983	- 0.04 ± 0.01	- 0.98 ± 0.01
Jan. 23, 1983	- 0.05 ± 0.01	- 0.92 ± 0.01
Mar. 17, 1983	+ 0.13 ± 0.02	- -
Mar. 18, 1983	+ 0.09 ± 0.01	- 0.94 ± 0.01

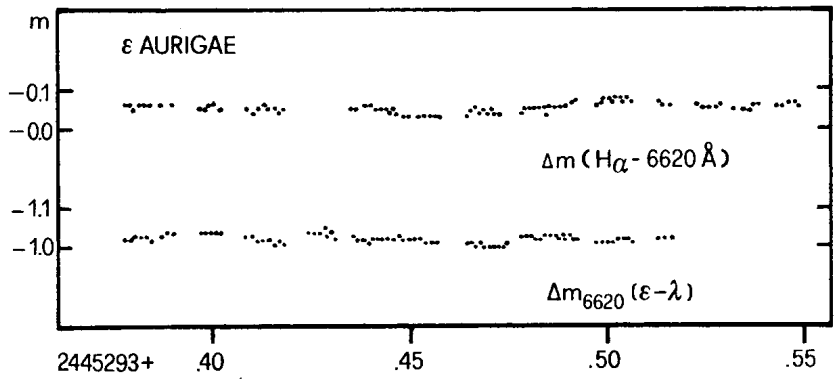

Figure 1. Photoelectric measurements of ε Aurigae during one night, Nov. 19, 1982. The methods used are described in the text.

It may be important to note that this drop happened only well after the beginning of totality, which probably occurred at the end of last year (Stencel 1983). Figure 1 shows one complete run of observations; the behaviour was similar on all the other observing nights, so we can exclude the occurrence of systematic short-time-scale variations in the red flux.

In addition, some high-resolution spectra have been obtained with the 152 cm coudé telescope of the Observatory

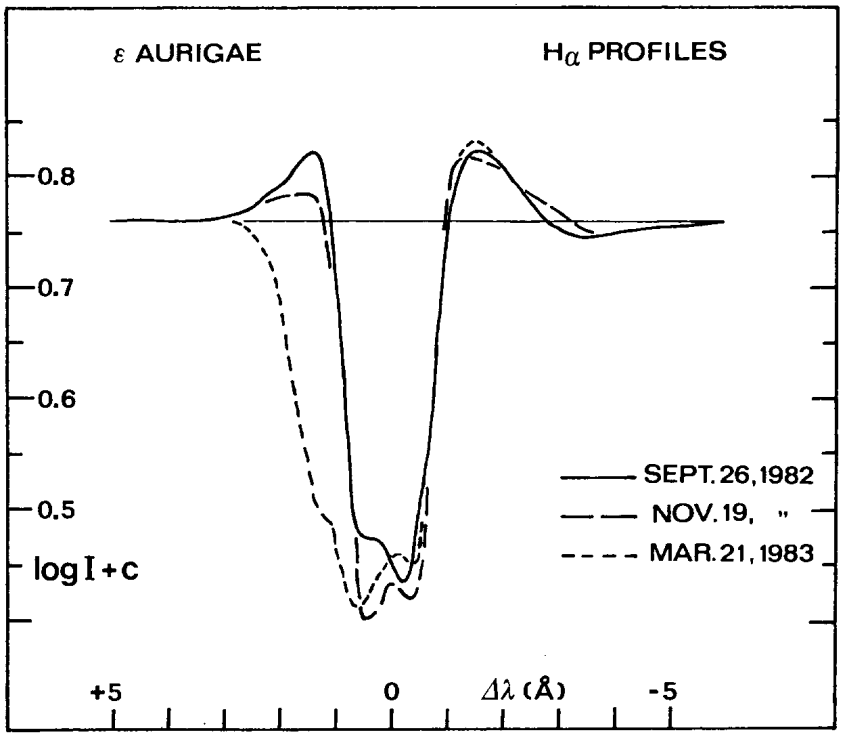

Figure 2. Comparison between H alpha profiles at mid ingress, end ingress and totality phases, plotted in logarithmic scale of intensity.

Haute Provence. One of the most noticeable variations in the spectral features is the change in the profile of the Hα line. In Figure 2 we have plotted the profiles at various epochs. In particular, we can see that the blueward emission wing seemed to remain unperturbed, while the redward one was gradually reduced until it disappeared during last March. In its place, a corresponding broadening of the absorption towards the red can be noted. This observational evidence explains and confirms the analogous decrease observed photoelectrically in the Hα band (30 Å wide).

A similar phenomenon was detected during the corresponding phase of the 1956 eclipse (Wright and Kushwaha 1957), superimposed on strong variations in the blueward emission (occurring,at that time,on the occasion of the first and second contacts). Since significant variations in the Hα profile were seen also out of eclipse (Castelli 1977), one is led to view the observed Hα behaviour in terms of a composite phenomenon. An eclipse effect, generated by combined rotations of the supergiant and of the eclipsing body can produce the Hα inverse P Cygni-like profile,that we observed in March, before mid totality. Irregular variations, probably due to inhomogeneities, both of the primary shell and of the eclipsing object, may then be superimposed.

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