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RECENT ACTIVITY OF U CEPHEI

The eclipsing binary U Cephei is one of the most typical representatives of the semi-detached binaries similar to Algol. Since the time of Struve it has been known that the radial velocity curve of the primary (B7 V) component is badly distorted, probably by gas streams flowing between the two components. However, all efforts made at Victoria (A.H. Batten, Publ.Dom.Astrophys.Obs.14,191, 1974 (in press)) to detect emission lines typical for gaseous rings either failed or revealed only marginal emission features at H α , except on one occasion when weak emission was observed at higher Balmer lines (A.H. Batten, Publ.Astr.Soc.Pacific. 81, 904, 1969).

Recently, however, very strong emission lines were observed in the system. During the primary minimum of August 8, 1974, Plavec, Polidan, and Burger, working with the Lick 120-inch telescope, discovered strong emissions which behaved in accord with the qualitative model of a ring proposed in 1942 by A.H. Joy. At the second contact, the red lobe of the emission at H α is very strong, while the blue lobe is marginal. At mid-eclipse, the red lobe is weaker and the blue lobe is equally strong. The blue lobe then dominates at the third contact. Concurrent seven-colour photometric observations by Lee McDonald determined the time of minimum at Aug. 8.4345 (heliocentric). They show strong distortions of the light curve at the second and third contacts, no doubt indicating that the emission lines contribute to the light observed through the filters. In certain colours the effect is so strong that for example in Strömgen's γ -colour the totality is greatly reduced in duration and the light curves may be mistaken for those of a partially-eclipsing system.

Observations at Victoria during September and October confirm the picture presented above. B.W. Baldwin independently discovered the emission during the eclipse of September 7. Plates obtained during this eclipse showed emission in every hydrogen line from H β to at least H 18, and in some lines of ionized metals. Their behaviour during the different phases of the eclipse is as just described. Baldwin also independently discovered the distortion of the light curve at

the next observable eclipse on September 12 as reported in I.A.U. Circular No. 2701. We have confirmed the existence of emission and the distortion of the light curve at the eclipses of September 12, 17, 22, 27 and October 7. During most of the period emission has been visible at H α during full light. The out-of-eclipse spectral type has changed to something like A0 and the B - V colour has changed correspondingly. A plate obtained during the eclipse of October 17 shows that the emission strength has now markedly decreased, but the weather was not good enough to permit simultaneous photometry that night and we do not know the present shape of the light curve. Heliocentric times of minima determined from photoelectric observations at Victoria by Baldwin and Scarfe are:

J.D. 2,442,302.8402
307.8280
312.8095
317.7950
327.7697

Previous observations made mostly by Batten indicated that for several years at least, the gas stream probably flowed directly from the G8 IV star to the B7 star and most of the material they carried was deposited on the B7 star. This picture seems to be changed now, and a real ring or disk surrounds the B7 star. Further observations and studies must decide whether this is a consequence of a greatly increased rate mass transfer, or increased velocity of ejection from the G8 star, or of an outburst in the outer layers of the B star. Thus such observations may quite well be of fundamental importance.

Systematic spectroscopic and photometric observations of U Cephei are very desirable. Fortunately, the star will be favorably placed for observations for several months to come, because of its very high northern declination. It should be realized that even simple timing of minima is unusually important, despite the recent decrease in emission strength, because the phenomenon may very well be accompanied by a sudden jump in period.

It is quite possible, too, that these events are fairly frequent in U Cephei or in other similar Algol systems. We recommend frequent checks at the times of primary minima.

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