STRUCTURE OF THE GASEOUS DISK IN RX CAS

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RX Cas appers to be a long-period Algol-like binary with very fast mass exchange (Struve 1944). In the period 1975-1977, this star was observed photometrically by Arsenijevič, Grygar, Harmanec, Horn, Koubský, Kříž and Pavlovski at Hvar Observatory (Yugoslavia) and by Zverko at Skalnaté Pleso Observatory (Czechoslovakia). The resulting UBV light curves seem to be rather peculiar, for the following reasons:

1) Combining our observations with the older ones, we obtain the following formula for the times of minima:

$$\text{Min} = \text{J.D. } \underset{\pm .053}{2416250.953} + \underset{\pm .00025}{32.31195}\, E + \underset{\pm .026}{1.030}.10^{-5}\, E^2.$$

The period increase is surprisingly high.

2) The scatter of observed points is considerable (about 0.2 mag.) and cannot be caused by observational errors. It corresponds to short period light variations on the time scale of several days.

3) After J.D. 24422660, the brightness of the whole system decreased in all colours. This decrease is about 0.2 mag. in V colour and 0.5 mag. in U colour. Only after J.D. 2442900 the brightness increased again. Such a behaviour confirms the reality of old observations by Gaposchkin (1944) and Martynov (1950) who found a long-term light variation with a period of approximately 500 days.

4) The part of the light curve around the phase 0.75 is definitely much lower than the corresponding part around the phase 0.25. This effect is most pronounced in the ultraviolet; the depression around the phase 0.75 is much deeper than the secondary minimum. This behaviour is opposite to the behaviour of dwarf novae. Instead of a bright shoulder connected with a bright spot, we observe some darkening.

We propose the following working model of RX Cas: The late-type component overflows the corresponding Roche lobe. The outflowing

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material is transferred to the detached mass-gaining component through an accretion disk. Contrary to the dwarf novae, the accretion disk almost fills its Roche lobe. Therefore, the transferred material cannot accelerate and form a hot spot. This cold material is mixed with the material of the disk in the region visible around the phase 0.75, covers the hot central parts of the disk and causes the depression of the light curve near this phase. A considerable part of the light arises from the disk and from the transition region between the disk and the mass-gaining component (especially in the ultraviolet). The long-period light variations are connected either with the variable mass transfer predicted by Bath (1972) or with some instability of the disk itself which may be similar to the instability proposed by Osaki (1974) and Paczynski (1978) for explanation of the outbursts of dwarf novae.

A detailed paper dealing with the photometry of RX Cas will be published in Bull. Astron. Inst. Czechosl.

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DISCUSSION FOLLOWING KŘÍŽ

Pringle: Is the disc you are talking about two-dimensional, or does it fill the whole three-dimensional Roche lobe?

Kříž: It is essentially flat, i.e. two-dimensional. I have presented only a phenomenological model. I computed a beautiful theoretical model, but it does not fit my observations.

K. Walter: The fluctuations in the light curves shown here seem to be of a similar type to those I found for the Algol system TV Cas. I observed that orbital system, with a period of 1.8 days, during six years and found clear fluctuations with a basic period of 600 days. This period could be interpreted as the precessional period of the rotational axis of the primary component, if it is assumed that the this axis is somewhat inclined to the orbital plane. My paper will appear in the Astronomy and Astrophysics Supplement. For RX Cas, with its orbital period of 32 days, a very long precessional period is to be expected.

Plavec: In long-period systems such as RX Cas, circumstellar disks and envelopes play a dominant role, namely in the optical region, and their instabilities may easily cause the fluctuations.