THE BQ[] EVOLVED MASSIVE ECLIPSING BINARY RY SCUTI

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Photometric and spectroscopic observations of RY Scuti are presented. These data indicate an advanced stage of this β Lyrae-type massive system, whose further evolution could lead to a SN-II event with the formation of a system like Cyg X-1.

Photometric observations

Accurate photometry of RY Sct has been somewhat neglected, although it is very much needed for the discussion of this interesting system.

Gaposchkin (1943) using about one thousand observations gave the first photographic light curve, with the following elements : $2427979.34 + 11^d.124939$ and deduced approximate parameters for the system. He indicated a binary system of about 80 $M_\odot$,this result based only on photographic observations of a β Lyr light curve and on the radial velocity curve inferred by Popper (1943) from two single lines, HeI 4026 Å and SiIV 4088 Å.

A successive determination by O'Connell using 774 plates (1949) yielded : $2427823 + 11^d.12444$,as reported in Koch et al.(1963).

We have observed RY Sct in about 40 nights during summer 1976 at Catania Astrophysical Observatory, in order to obtain the photometric orbital elements from a photoelectric UBV light curve. Although the work is in progress, because we are still collecting other data, we preliminarly present the light curve of RY Sct obtained so far. The blue amplitudes of primary and secondary minima are about 0.6 and 0.5 mag. Our points better follow the O'Connell's elements, while those of Gaposchkin leave a phase shift of -0.06 P, as independently found with photographic photometry by Wenzel and Gesner (1977).

During July-August 1977 about 20 more nights of UBV observations have been secured by us at Catania.

Spectroscopic observations

Hydrogen emission lines were found since 1921 in RY Sct. In 1928 Merrill observed emission lines of H,HeI and forbidden lines of FeIII at that time unidentified. In 1940 Struve and Swings found a rich absorption spectrum in the blue-violet region, indicating an O or BO spectral type. The following elements were present : H,HeI,NII,NIII,OII,OIII,CII,CIII and probably SII,SiII,SiIII,SiIV and MgII; moreover the H and K lines of CaII and D_1,D_2. The interstellar features λλ 4415-45 , 6203 and 6284 were strong. The emission spectrum was characterized by H_α,H_β,H_γ ,

https://doi.org/10.1017/S025292110006958X Published online by Cambridge University Press

HeI 4471 and 5876 Å, HeII 4686 Å, NIII and forbidden lines of [FeIII], [NII], [OIII]. Later on, only a limited interest has been deserved to this object.

Spectra of RY Sct have been obtained at Asiago Astrophysical Observatory from 1969 to 1977, with dispersion between 60 and 240 Å/mm. The absorption lines of H and HeI exibit variations in radial velocity: they are displaced, with respect to the corresponding emissions, toward the blue at phases around 0.10 (from primary minimum) and toward the red at phases around 0.80. At this last phase SiIV 4088 and 4654 Å are visible in absorption. The interstellar features H and K of CaII, 5780, 5892 and 6284 Å are strong, indicating a remarkable reddening, made also evident from the shape of the continuum. The infrared excess is fairly strong, being H-K= 0.39 and K-L=0.75 .

It is interesting to note the strength of HeI 4713 and 4471 Å, this latter stronger than H_γ , which might indicate either an overabundance of helium or an hydrogen deficiency. The emission lines are recorded at H_α,H_β,H_γ and H_δ, and λλ 4471,5876,6678,7065,10830 of HeI; HeII is weakly present at 4686 Å with a diffuse structure, and also CIII 5696 Å is visible. Among the forbidden lines [FeIII] is remarkable at λλ 4607,4658,4667,4701,4733,5010,5270, while [SIII] 9069-9532 Å are outstanding. We also record [ArIII] 7136 Å, [NII] 5755 Å and 6548-84 Å (quite strong). The [OIII] line 4959 Å is uncertain, while the one at 5007 Å is sometimes distinguishable from [FeIII] 5010 with the same low intensity. We note the lack of emission of OI 8446 Å on our spectra: this line has been recorded as strong by Andrillat and Swings (1976). This behaviour might mean that the field velocity required for the excitation of this line changes abruptly.

Thus we think that the nebula, which is excited also at radio frequencies by at least one component of the binary, is being ejected from the system. This consideration,together with the anomalous strength of helium absorption lines, may be and indication that the system is in an advanced phase of evolution. Since its mass is presumably very large, according to Popper and Gaposchkin (1943) and to Cowley and Hutchings (1976), we suggest that in a short time the system will evolve reaching a stage where one component of large mass will collapse.

Details on the available photometric and spectroscopic material, together with a further discussion, will be shortly published.

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