THE SPECTROSCOPIC BINARY γ 2 VELORUM

Virpi S.Niemelä *
51 y 11,Villa Elisa,Buenos Aires,Argentina

and

Jorge Sahade **
Instituto de Astronomía y Física del Espacio,
Buenos Aires,Argentina

γ2 Velorum is the brightest binary system with a Wolf-Rayet component;it has been classified as a O9I+WC8 pair (Conti and Smith 1972). The orbital elements of this system were determined earlier by Ganesh and Bappu (1967) from spectrograms of 125 Å/mm dispersion,on the basis of the radial velocities from CIII-IV λ4652 Å emission for the WC component,andon the radial velocities from H absorption only,for the O star.

In this paper we report on the preliminary results from a new spectrographic investigation of the γ2 Velorum system,based primarily on a large number of 42 Å/mm spectrograms secured by one of us (J.S.)at the Córdoba Observatory,Argentina,in the interval 1948-1962.A few additional coudé spectra were obtained by V.S.N. at the Cerro Tololo Inter-American Observatory,Chile,between 1971-1977.In addition we have used 76 old objective prism spectrograms obtained by C.D.Perrine between January and July,1919,at the Córdoba Observatory,Argentina,in order to improve the value of the orbital period.

All suitable absorption and emission lines on our spectrograms were measured for radial velocity by V.S.N.with the Grant engine at the Cerro Tololo Inter-American Observatory.

---

* Visiting Astronomer,Cerro Tololo Inter-American Observatory,supported by the National Science Foundation under contract No. NSF-C866.

** Member of the Carrera del Investigador,Consejo Nacional de Investigaciones Científicas y Técnicas,Argentina.

P. S. Conti and C. W. H. de Loore (eds.), Mass Loss and Evolution of O-Type Stars, 287–289.

We have then derived a new orbital solution for the γ^2 Vel system. The radial velocities of the O star were derived from the measurement of a number of absorption lines, about 13 per plate. The radial velocities from the emission features show a large scatter, and those from CIV and CIII were preliminarily used only to derive the semiamplitude of the velocity curve of the WC8 component. Thus we obtained the following preliminary orbital parameters, namely,

$$P = 78.5002 \pm 0.0001 \text{ days}$$
$$\gamma = +12 \pm 1 \text{ km/s}$$
$$K_{O9} = 68 \pm 2 \text{ km/s}$$
$$K_{WC} = 130 \pm 10 \text{ km/s}$$
$$e = 0.40 \pm 0.01$$
$$w = 256^\circ \pm 3^\circ$$
$$M_{O9}\sin^3 i = 32 \pm 6 \; M_\odot$$
$$M_{WC}\sin^3 i = 17 \pm 2 \; M_\odot$$

The radial velocities from the absorption lines and of the C emissions are plotted in Figure 1, where the dashed line represents the above listed orbital solution. It is clear that an orbital solution based on the velocities from the C emissions only, would suggest a smaller eccentricity and further analysis will be carried out so as to understand such a behaviour.

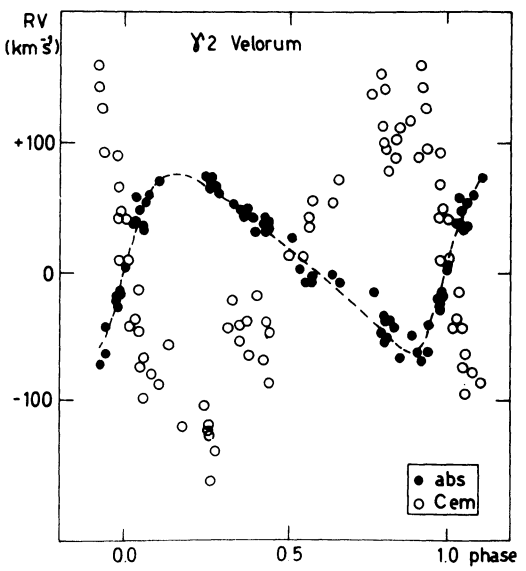

Figure 1. Velocity curve of γ^2 Velorum.

https://doi.org/10.1017/S0074180900013620 Published online by Cambridge University Press

The minimum masses that correspond to our orbital parameters have a very different ratio than the one derived earlier by Ganesh and Bappu (1967).If we adopt the value of i suggested by Moffat's (1977) photometric investigation,namely 70°,the masses of the components turn out to be M_{O9} = 38 $M_\odot$ and M_{WC} = 20 $M_\odot$,respectively.It is worth pointing out the large value that we have derived for the mass of the WC star,as compared with the usually accepted value for Wolf-Rayet objects,namely 10 $M_\odot$,clearly an unappropriate extrapolation from the results in the case of the WN+O system V 444 Cygni.

In regard to the violet-shifted absorptions that flank the emission lines,they follow the orbital motion of the WC component.The mean radial velocities of these absorptions are correlated with the excitation potential of the upper level of the corresponding line,as shown in Figure 2.A correlation with increasingly negative radial velocity with decreasing excitation potential is generally interpreted as an outwards accelerated velocity field in the stellar atmosphere.That this should be true in the WC8 component of γ 2 Vel agrees with what we know about the velocity gradients in other Wolf-Rayet atmospheres (e.g.Kuhi 1972; Seggewiss 1975;Niemelä 1975).

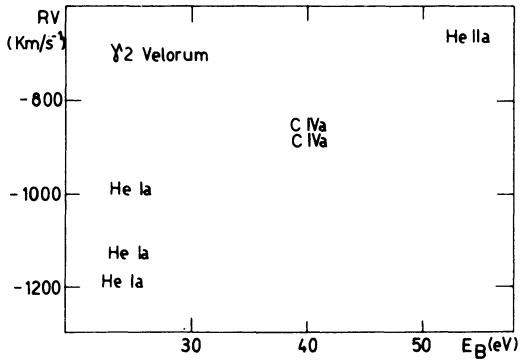

Figure 2. Radial velocities of the violet shifted absorptions in function of the excitation potential of the upper level of the corresponding line.

References:

Conti,P.S. and Smith,L.F. 1972,Ap.J.,172,623.

Ganesh,K.S. and Bappu,M.K.V. 1967,Kodaikanal Obs.Bull.,No.183.

Kuhi,L.V. 1972,Ap.J.,180,783.

Moffat,A.F.J. 1977,Astr.Ap.,57,151.

Niemelä,V.S. 1975,in Physics of Movements in Stellar Atmospheres,Coll. No.250 of C.N.R.S.of France,eds.R.Cayrel and M.Steinberg,p.467.

Seggewiss,W. 1975,in Variable Stars and Stellar Evolution,eds.V.Sherwood and L.Plaut,(Dordrecht:Reidel),p.285.

https://doi.org/10.1017/S0074180900013620 Published online by Cambridge University Press