MASS EJECTIONS FROM THE G-TYPE HYPERGIANT HR 8752

J.Smoliński[1], J.L. Climenhaga[2] and J.M. Fletcher[3]

[1]*N. Copernicus Astronomical Center, Toruń, Poland*
[2]*Department of Physics and Astronomy, University of Victoria, Victoria, BC, Canada*
[3]*Dominion Astrophysical Observatory, Victoria, BC, Canada*

One of the most luminous stars in our Galaxy (Humphreys 1988) HR 8752 = HD 217476 (G0 Ia), is similar in some respects to Luminous Blue Variables. Studies by several authors (Sargent 1965; Smoliński 1971; Smoliński et al. 1977; Stickland and Harmer 1978; Lambert and Luck 1978; Lambert et al. 1981; Smoliński et al. 1986; Sheffer and Lambert 1987) have contributed to the understanding of activities in the atmosphere of this star, but its nature is still not well understood.

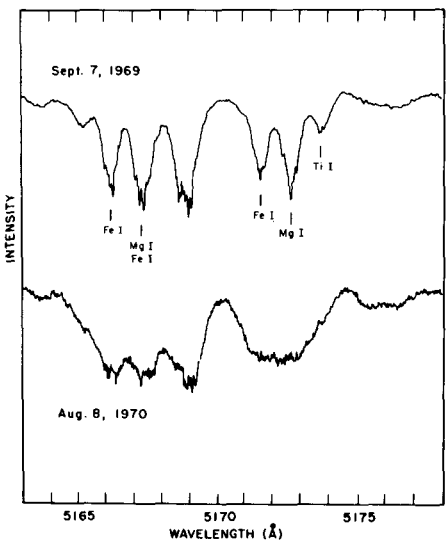

Fig. 1. Comparison of two spectra of HR8752 showing an increase in line widths during 1970.

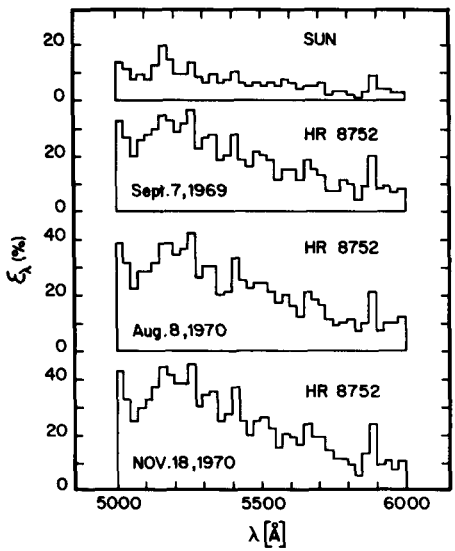

Fig. 2. Line absorption values ϵ_λ for HR 8752 during 1969 and 1970 compared with ϵ_λ for the Sun.

K. Davidson et al. (eds.), Physics of Luminous Blue Variables, 131–134.

Since 1969, we have made spectroscopic observations of this star with the same equipment at the Dominion Astrophysical Observatory, Victoria, BC, Canada. During this period various changes occured in the spectra: Changes in the broadening of absorption lines, splitting of some absorption lines into several components and the appearance of emission components in certain lines.

From our observations we are able to distinguish clearly at least 3 periods of time or episodes when spectral features are different.

(i) *The 1970 episode*: During this episode, which lasted at least 8 months, the absorption lines were at their broadest. The widths of the absorption lines increased by a large amount (by about a factor of 2) from 1969 to 1970. This increase can be seen clearly in Fig.1 which shows two spectra of HR 8752 obtained on September 7, 1969 and August 8, 1970. Line absorption values, ϵ_λ, in 1970 were found to be about 25% higher than in 1969 (Fig.2). Such a large increase should change the colour of the star considerably. In 1970, when the lines were very strong and broad it is possible to distinguish 3 blue-shifted absorption components of neutral metallic lines and of some ionized lines, with radial velocities with respect to the star system of about 35, 54 and 84 km/s.

(ii) *The 1979 episode*: During this period inverse P Cygni profiles were observed in the metallic lines, especially in the Fe I lines (Smoliński et al. 1979). The blue emission components were visible for at least 7 months with variable intensities (Fig.3) and with very little change in radial velocities.

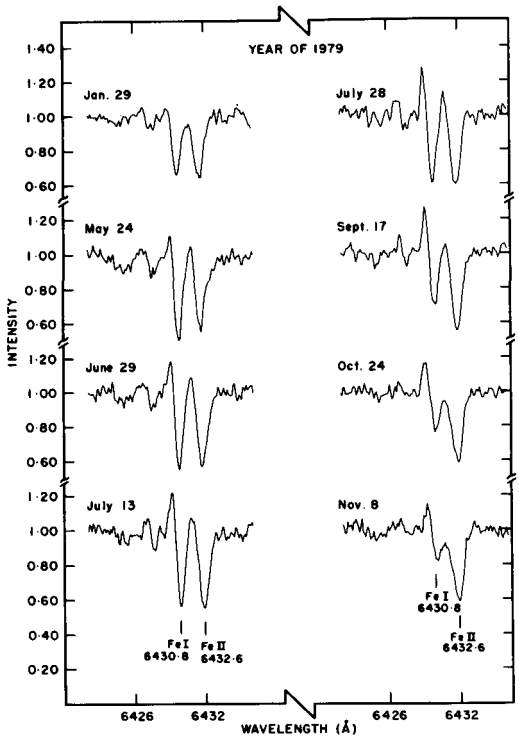

Fig. 3. A series of spectra of HR 8752 showing a blue shifted emission component of variable intensity in the Fe I line during 1979.

https://doi.org/10.1017/S0252921100004383 Published online by Cambridge University Press

(iii) *The 1982 episode*: During this episode a blue-shifted absorption component with velocity of about -100 km/s was strong and clearly distinguished in neutral metallic lines, particularly in the Fe I lines (Fig. 4) and in the Ti II lines (Smoliński et al. 1982).

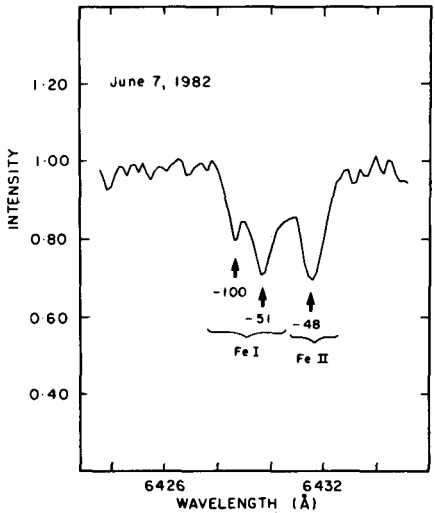

Fig. 4. In this June, 1982, spectrum of HR 8752, a blue shifted absorption component in the Fe I line is present and has a velocity of -100 km/s.

We interpret the changes during these episodes to be the result of mass ejections and the existence of an expanding circumstellar envelope.

Our results are in agreement with the model proposed by us (Smoliński, Climenhaga and Fletcher, 1986) suggesting that HR 8752 is a binary system with a period of 620 days contained in a common expanding envelope and surrounded by an H II region.

REFERENCES:

Humphreys, R.M.: 1988, in press.
Lambert, D.L., Hinkle, K.H., Hall, D.N.B.: 1981, *Astrophys. J.*, **248**, 638.
Lambert, D.L. and Luck, R.E.: 1978, *Mon. Not. R. Astr. Soc.*, **184**, 405
Sargent, W.L.W.: 1965, *Observatory*, **85**, 33.
Sheffer, Y. and Lambert, D.L.: 1987, *Pub. A.S.P.*, **99**, 1277
Smoliński, J.: 1971, in *Colloquium on Supergiant Stars*, ed. M. Hack, 68
Smoliński, J., Climenhaga, J.L., Funakawa, H. and Fletcher, J.M.: 1979, *I.A.U. Circ*, No. 3382.
Smoliński, J., Climenhaga, J.L., Funakawa, H. and Fletcher, J.M.: 1982, *Inf. Bull. Var. Stars*, No. 2229.
Smoliński, J., Climenhaga, J.L., Fletcher, J.M.: 1986, *Symposium on Luminous Stars and Associations in Galaxies, ed. De Loore, C.W.H., Willis, A.J., Laskarides*, P., 89.
Smoliński, J., Feldman, P.A., Higgs, L.A.: 1977, *Astron. Astrophys.*, **60**, 277.
Stickland, D.J., Harmer, D.L.: 1978, *Astron. Astrophys.*, **70**, L53.

DISCUSSION

Gallagher: (1) What is the period for this system? (2) Is it a super-symbiotic star?

Smolinski: (1) We have determined the orbital period to be 620 days. (2) This is an interesting suggestion. However, the orbital separation in Mira-type symbiotic stars is hundreds of AU, while our estimate of the separation for HR 8752 is only several AU. It does have some similarity to ζ Aurigae stars, but it is possibly different from both types.

Walborn: Did you suggest that the apparent change in spectral type is due to the appearance of extra blue-shifted components in the neutral lines, rather than a temperature change?

Smolinski: Yes, we suggest such a possibility. The presence of blue components in the Fe I lines as we observed in our 1970 high-dispersion spectra would affect the estimate of spectral class in low-dispersion spectra even without any temperature change. However, we do not rule out either possiblity.

Zickgraf: Where in your model are the inverse P Cygni profiles of the Fe I lines coming from?

Smolinski: We believe that the blue emission components of the inverse P Cygni profiles of the Fe I lines are produced in a shell surrounding the system and expanding with a velocity of about 35 km/s. During 1979 the emission components were visible for at least 7 months with continuously changing intensities.

McGregor: Lambert, Hinkle, and Hall found CO emission in HR 8752 (1981; *Astrophys. J.* **248**, 638). The CO lines at high resolution showed P Cygni profiles and later inverse P Cygni profiles. They interpreted this as a shell which was ejected and which then fell back onto the star.

Smolinski: Their infrared CO observations are interesting. However, our observations do not indicate the shell falling back onto the star.

https://doi.org/10.1017/S0252921100004383 Published online by Cambridge University Press