MASS OUTFLOW IN AG CARINAE AND A COMPARISON WITH P CYGNI+

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ABSTRACT

AG Car is a variable supergiant surrounded by a small ring nebula. Its ultraviolet and optical spectrum, and UV to IR energy distribution are similar to those of P Cyg with $v_\infty = -290$ km s^{-1}. Also the strength of the 2200 A band is the same and suggests $E(B-V) = 0.55$ for both stars. The possible variability of the infrared flux is discussed.

AG Car (HD 94910) is a variable P Cyg-like star which is the central star of a small ring nebula (listed as 289-0°1 in Perek and Kohoutek 1967). Spectroscopically the nebula is of low excitation with strong H_α and [NII] lines (Johnson 1976). From the splitting of the nebular lines

+ This work is based in part on observations made at the European Southern Observatory at La Silla. H.M.J.'s part of this work has been done under contract NAS 5-24481 with NASA. We are glad to acknowledge the assistance of the IUE Observatory Staff at GSFC in the acquisition and reduction of these data. Dr. A. Giangrande is gratefully aknowledged for his help in the IUE data analysis.

C. Chiosi and R. Stalio (eds.), Effects of Mass Loss on Stellar Evolution, 67–69.
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https://doi.org/10.1017/S0252921100094616 Published online by Cambridge University Press

Thackeray(1977) determined an expansion velocity of the nebula near 50 Km/s. If the star is at the same distance of the OB associations of the Carina nebula (2.3-2.7 Kpc,Thé et al.1980) the nebula should have been ejected by AG Car some 4000 years ago.

The optical spectrum is strongly variable from one very similar to that of P Cyg with He I and N II lines to a cooler spectrum without these lines (Caputo & Viotti 1970). The spectrum observed at ESO on May'78 is P Cyg-like (fig 1) with an absorption component violet displaced by 50 Km/s, i.e. close to the expansion velocity of the nebula. In the earlier Balmer lines the velocity is larger up to -140 Km/s for H_α. In addition H_α to H_δ present a second absorption at -205 Km/s (fig 2). Like in P Cyg, H_α is characterized by very broad emission wings with FWHM=24 Å and Weq=28 Å (in P Cyg FWHM=22 Å and Weq=18 Å: see Bernat & Lambert 78). They attributed this feature to electron scattering in the extended expanding atmosphere of the star. This may well be also the case of AG Car.

The UV spectrum was observed with the IUE at NASA on Dec'78. The low resolution spectrum shows strong absorption lines of O I, Si II, Si IV, Al III, Mg II, Fe II etc(Johnson 1980). The UV energy distribution presents a strong 2200 Å absorption band which disappears if the fluxes are corrected for an interstellar extinction of E(B-V)= 0.55 and assuming a normal extinction law. In P Cyg the 2200 Å band has the same strength of AG Car (Cassatella 1980) which is suggestive of the same reddening for the two P Cyg stars. The high resolution LW IUE spectrum of AG Car taken on Dec '78 is quite similar to that of P Cyg (e.g. Cassatella et al.1979) with shortward shifted absorption components of Mg II and Fe II extending to -290 and -255 Km/s respectively. Weak emission components are visible only for the Mg II doublet (fig 3).

AG Car was observed from 1.25 to 4.8 μ with the IR photometer adapted at the 1m ESO telescope on May'78 and Feb. and April'79 with a 13 arcsec diaphragm. There is a difference of 0.1÷.2 magnitudes between the observations made in different epochs but it is difficult to say at the moment how real they are. The mean IR fluxes are reported in fig 4, not corrected for reddening and compared with the previous HK observations of Swings and Allen (1972) and 3.5 to 11.7 μ observations of Cohen & Barlow (1980). The former magnitudes are 1^m fainter than the present ones, while the 4.8 μ magnitude of Cohen and Barlow is close to our $3^m.96$ value. Since the visual luminosity of AG Car is variable with an amplitude of more than one magnitude (Mayall 1969, also AAVSO circulars) we expect the star to be variable also in the IR as suggested by the observations. Continuous monitoring in the IR is required to clarify this point. In fig 4 we also show the energy distribution of P Cyg. Assuming a distance of 1.8 Kpc in agreement with its large E(B-V) (Barlow & Cohen 1977) we find that when corrected for the different distances the energy distributions of the two

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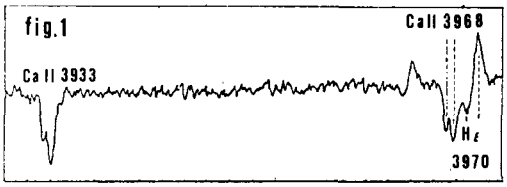

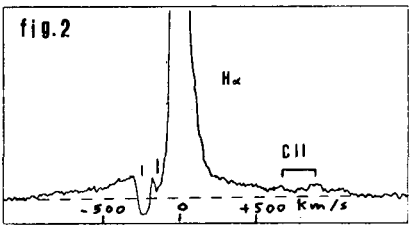

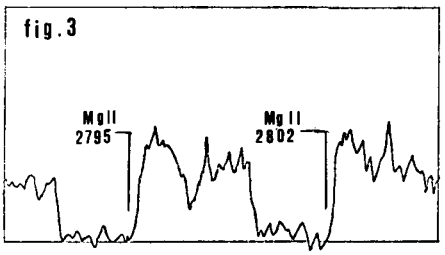

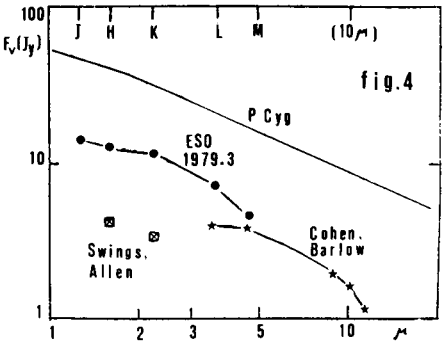

stars nearly overlap from 1.25 to 3.6μ while the spectrum is steeper for AG Car longward of 3.6μ.

All the above results suggest that the atmospheric structure of AG Car is similar, at least in some phases, to that of P Cyg. We conclude that their mass loss rate should be of the same order of magnitude.

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