Rev. Mexicana Astron. Astrof., 11, 71-72 (1985)

ON THE BROAD BALMER PROFILES FROM CAR II AND THEIR POSSIBLE ORIGIN AS DUST SCATTERED LINES FROM η CARINAE

J. A. López
Instituto de Astronomía
Universidad Nacional Autónoma de México

and

J. Meaburn
Department of Astronomy, University of Manchester

Received 1985 March 7

RESUMEN

Se sugiere que los componentes de alta velocidad presentes en las líneas de Hα y Hβ de la región Car II en la Nebulosa de Carina se pueden deber a la emisión variable de η Carinae esparcida por polvo en la región de Car II.

ABSTRACT

It is suggested that the high velocity components present in the Hα and Hβ lines over the entire face of the Car II region, in the Carina nebula, could have their origin in the time varying emission from η Carinae scattered by dust in the Car II region.

Key words: NEBULAE – INDIVIDUAL — LINE PROFILES

I. INTRODUCTION

Very high velocity components, over a radial velocity range of $\sim$ 1000 km s^{-1}, present only in the Hα and Hβ lines over the face of the Car II region, near η Carinae, have been discussed by López and Meaburn (1984). Several possible explanations were considered for the origin of these high velocities. These invoked mainly stellar winds. New evidence (Ruiz, Melnick, and Ortiz 1984) has now been presented which shows that the shape of the Hα profiles from η Carinae varies on a time scale of $\sim$ 1 year. This result permits the possibility to be considered that the broad profiles from the Car II region, whose shapes vary over the face of the nebula, could be caused by scattering by dust of the time varying Balmer emission profiles of η Carinae.

II. DISCUSSION

The center of the Car II region (positions B1 and B2 of López and Meaburn 1984) is approximately 3.28 arcmin away from η Carinae, which at a distance of 2.7 kpc represents 2.49 pc or 8 light years. The physical association of η Carinae with the Car II region is demonstrated by the presence of Fe II emission lines in the spectra of positions I1 and I2, Figure 5 of López and Meaburn (1984), reflected from η Carinae (see also Aller 1979). This indicates that a substantial amount of starlight from η Carinae is scattered by dust within Car II.

López and Meaburn (1984) have shown that the velocity of individual high velocity components in Hα vary between the different positions mapped in Car II. This would appear to rule out a light scattering mechanism from a nearby source as responsible for the presence of the high velocity components in Car II. However, if a hypothetical external source to Car II had time-varying emission on a scale of $\sim$ 1 year, and this emission had spectral characteristics similar to those observed in the Hα and Hβ profiles from Car II, it could then indeed be the source of the "high velocity" motions of Car II.

It has just recently been shown by Ruiz *et al.* (1984) that the emission from η Carinae varies on a time scale of the order of 1 year. Moreover, the Hα and Hβ emission profiles of η Carinae are very similar (i.e., see Aller and Dunham 1966 for a description of the Hβ profile of η Carinae).

The Hα profile of η Carinae obtained by Ruiz *et al.* (1984) in March 1983 resembles closely some of the Hα profiles in Car II obtained in May 1983 by López and Meaburn (1984), particularly those corresponding to the positions B1, B2, A1, A2 and F2. The FWHM of the Hα profiles in the Car II region are of the order of 600 km s^{-1} (see also Elliot 1979). This value coincides with the observed FWHM for the Hα profile of η Carinae. Similarly, the components arrowed in Figures 4*a* and 4*b* of López and Meaburn (1984), particularly at $\sim$ 6557 A, resemble closely the conspicuous blue-

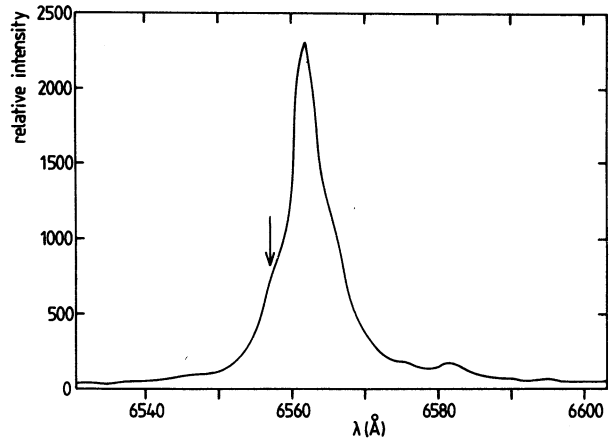

Fig. 1. The Hα profile of η Carinae obtained in May 1983. The conspicuous blueshifted component is arrowed. A similar component is present in the Hα emission over many positions in the Car II region.

shifted component of the Hα profile of η Carinae shown in Figures 1 and 2 of Ruiz *et al.*

It is therefore plausible to assume that the high velocity components of Hα and Hβ in Car II represent scattered components of the Hα and Hβ emission from η Carinae. Thus, the variations of intensity and velocity of these components in the Hα and Hβ profiles over the face of Car II could be only a consequence of variation in time of the corresponding emission from η Carinae.

This alternative explanation overcomes the difficulties encountered in explaining the apparent high velocity motions in the Car II region in the absence of a supernova explosion, as discussed by López and Meaburn (1984).

Figure 1 shows a smoothed spectrum of the Hα profile of η Carinae observed in May 1983 with the image tube spectrograph and Reticon photon counting system mounted at the Cassegrain focus of the 1.9-m SAAO telescope. The resolution is the same as that for the intermediate dispersion spectra of López and Meaburn (1984) for Car II, namely 2 A. The wavelength range in Figure 1 is as in Figures 4*a* and 4*b* of López and Meaburn (1984). The conspicuous blueshifted component is arrowed. A similar component is easily identifiable in Figures 4*a* and 4*b* of López and Meaburn (1984), as is the non-Gaussian red side of the profile.

The profile in Figure 1 (May 1983) should also be compared to those in Figures 1 (March 1982) and 2 (March 1983) of Ruiz *et al.* (1984). The diminishing strength with time of the blueshifted component in the Hα profile from η Carinae is apparent in these profiles.

Spectropolarimetry of the high velocity components in the Hα and Hβ profiles over Car II should give a definite answer to this problem.

The authors acknowledge fruitful conversations with Dr. M.J. Barlow. JAL is grateful to the Universidad Nacional Autónoma de México and the Science and Engineering Research Council of Great Britain for financial support.

REFERENCES

Aller, D.A. 1979, *M.N.R.A.S.*, **189**, 1p.
Aller, L.H. and Dunham, T. 1966, *Ap. J.*, **146**, 126.
Elliot, K.H. 1979, *M.N.R.A.S.*, **186**, 9p.
López, J.A. and Meaburn, J. 1984, *Rev. Mexicana Astron. Astrof.*, **9**, 119.
Ruiz, M.T., Melnick, J., and Ortiz, P. 1984, *Ap. J. (Letters)*, **285**, L19.

J.A. López: Instituto de Astronomía, UNAM, Apartado Postal 877, 22830 Ensenada, B.C., México.
John Meaburn: Department of Astronomy, University of Manchester, Manchester M13 9PL, Great Britain.