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Hα EMISSION IN F-K HIGH LUMINOSITY STARS

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RESUMEN

Investigamos la presencia y variabilidad de Hα en emisión en supergigantes de alta luminosidad con tipo espectral de F a K. También determinamos el límite de M_V donde Hα empieza a aparecer en emisión.

ABSTRACT

We investigate the presence and variability of Hα emission in very luminous F-K supergiants and determine the lower limit of M_V where Hα begins to appear in emission.

Key words: STARS-EMISSION LINES

I. INTRODUCTION

In this study, we investigate the presence and variability of Hα emission in very luminous F-K supergiants, and attempt to determine the lower limit of M_V where Hα begins to appear in emission. Such a study was made for early type supergiants by Rosendhal (1973). Eight stars with very broad absorption lines were chosen. According to the relation between line widths and luminosity, they are all very luminous stars.

The basic information about these stars is given in Table 1. The data on spectral type and visual absolute magnitude are taken from Smolinski (1971), Osmer (1972*b*) and Keenan (1973). M_V for HD 331777 was calculated using the linear correlation given by Osmer (1972*a*) between M_V and the equivalent width of the O I λ7774. The number of spectra obtained for each star in the Hα region ranged from 3 to 50 taken during the period from 1970 to 1979, and were obtained at the Dominion Astrophysical Observatory with the 48-inch telescope and the coudé spectrograph providing a dispersion of 10 A mm^{-1}.

In columns 4 and 5 of Table 1 there is information concerning activity in Hα and the shape of the Hα

TABLE 1

Hα EMISSION IN F – K SUPERGIANTS

Star	Spectral type	M_V	Hα Emission	Hα Type
89 Her	F2 Ia	−7.1	a	R
HD 231195	F5 Ia	−8.30	s	B
HD 331777	F8 Ia	−8.10	s	B, C
ρ Cas	F8 Ia	−8.40	s	BR
HD 217476	G0 Ia	−9.0	a	BR,R,C
HD 12399	F5 Ia	– – –	s	B
W Cep	K0 Ia	– – –	a	BR
HD 4817	K3 Ia	– – –	s	B

a – always visible.
s – sometimes visible.
B – emission on blue side only.
R – emission on red side only.
BR – emission on both sides.
C – emission at center.

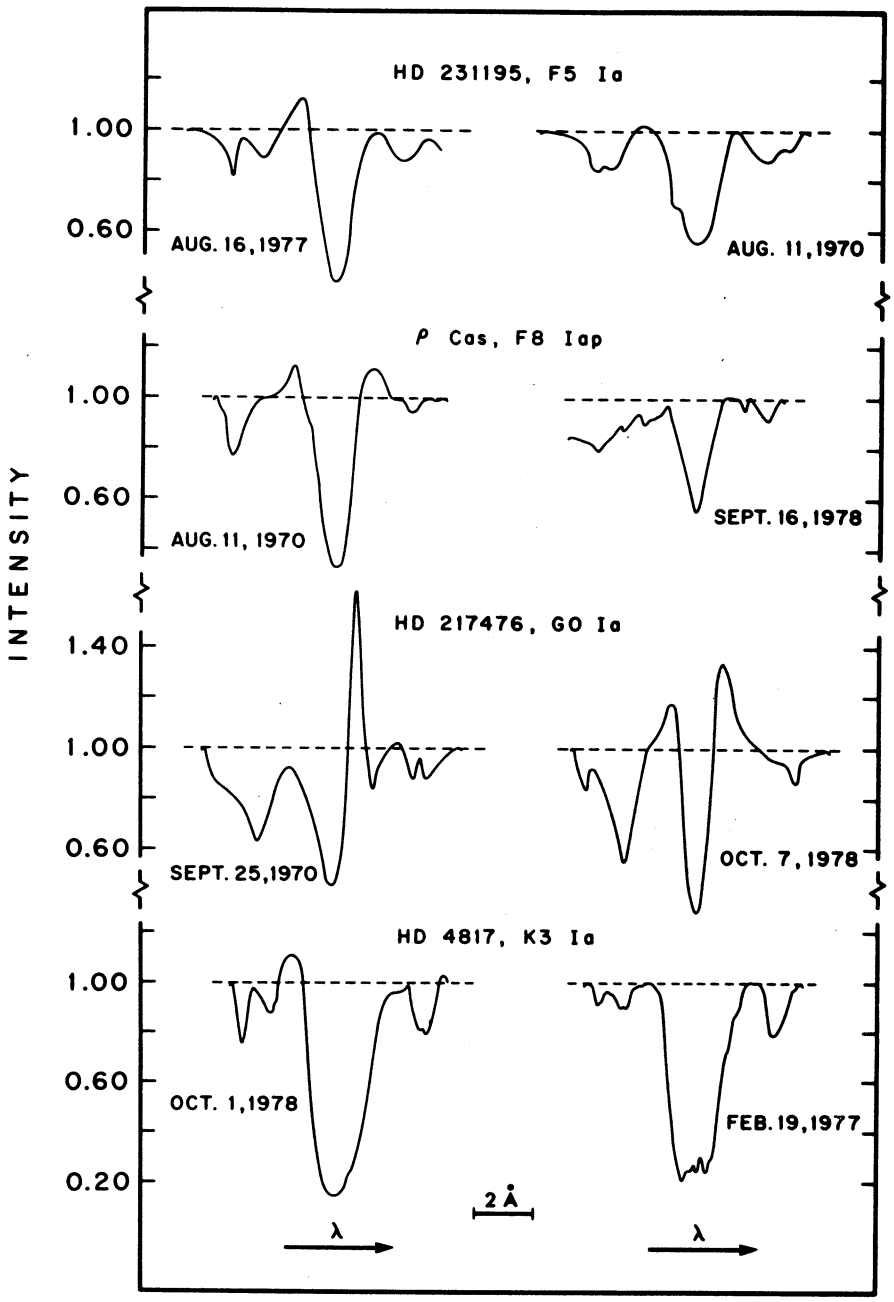

Fig. 1. Representative Hα line profiles in F-K supergiants. All stars show variable Hα profiles. The emission components are sometimes, but not always, present.

profile. As we can see, all 8 stars show Hα emission at certain times suggesting that all of these very luminous stars, emission is variable in intensity and shape, indicating considerable activity as can be seen in Figure 1, which shows representative Hα profiles for 4 of the stars.

At present, the time scale of such changes is not determined. The strongest emissions in Hα were observed in HD 217476 and ρ Cas, two of the most luminous stars. Since no emission was detected in any of our spectra of supergiant stars with less broad lines than the 8 stars chosen for this study, the lower limit of M_V were emission occurs for F-K supergiants is estimated to be between 8 and 7. Rosendhal (1973) estimated lower limits of M_V for Hα emission in other spectral types and found a limit of $M_V \simeq -5.8$ for B0-B1 stars, and $M_V \simeq -6.8$ for B8-A3 stars.

The type of Hα emission is given in column 5 of ble 1, where B indicates emission on the blue side of sorption line R on the red side, BR on both sides, d C at the centre. As can be seen, some of our stars ow Hα emission of different types at various times. In rticular, the very luminous supergiant HD 217476 = HR 8752) shows considerable variability. It is in- esting that this star is also a radio star, and according recent ultraviolet observations, is a binary system tickland and Harmer 1978).

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DISCUSSION

Mirabel: Could you make further comments on the observations in radio of these objects? In particular, which radiotelescope was used, beamwidth and typical radio flux?
Smolinski: The survey observations were made jointly with P.A. Feldman and L.A. Higgs at 10.5 GHz with the 46-m telescope of the Algonquin Radio Observatory. The beamwidth was 2'.7, the flux density for the radio star HR 217476 (= HR 8752) was about 26 mJy. There are other observations for three objects at other frequencies.
Niemela: For those stars which are members of binary systems, do you have orbits and estimates of the masses?
Smolinski: Two of our stars (HR 8752 and 89 Her) are probably binary systems. The radial velocity curves are not yet well determined, so the orbital elements are only roughly known.
Pişmiş: (Comment) Your data showed clearly the expansion of the atmospheres. It might well be that the expansion is not isotropic and that the star is rotating or describing an orbit. In this case many of the variations you found could perhaps be explained, since this situation offers more degree of freedom in your model.

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