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Various Types of Hα Emissions and Absorptions in Be/Shell Stars

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Among the Be stars, one distinguishes two types of spectra. The term Be/Shell used here is to designate the set of stars showing spectra of either of these two types: (i) Be spectrum and (ii) Be shell spectrum. In the Be spectrum, emission line either shows no reversal or a more or less central reversal. In the Be shell spectrum, Balmer lines and singly ionized lines exhibit narrow and deep absorption core, which may or may not be broadened by emission wings. In the present investigation we are reporting the spectroscopic observations of 14 Be/shell stars. The Hα line profiles of different stars possess various shapes. Most of the Be/shell stars exhibit very strong single peaked emission at Hα line. Four stars show strong double peaked asymmetrical Hα emission. Two of these programme stars display asymmetrical deep broad absorption with shallow limb towards the long ward wavelength. Other two objects show strong central absorption with two emission components. From the line profiles we have also measured the parameters like: equivalent width (W) and Ip/Ic ratio.

Key Words: Be stars, Shell stars, Emission profile, Absorption profile.

INTRODUCTION

Be stars are mainly characterized by the appearance of Balmer emission and/or shell absorption lines in their optical spectra. These line features originate in an envelope of circumstellar matter. The short-to-long term variations of stellar flux and emission line profiles are common in Be stars[1,2] but origin and connections are still an unresolved problem. NRP in the mass loss mechanism in Be/Shell stars[3,4] which is also one of the cause of variability of lines in these objects. Be stars rotate at or near to their critical rotational velocities[5].The observed properties of Be stars are consistent with the coexistence of a dense circumstellar disk flattened in the plane perpendicular to the rotation axis and variable stellar wind[6-9,2]. The gas in the so-called decretion disk is traditionally believed to be ejected from the star and not accreted from an external source[10,11].

One of the most fascinating and remarkable change in the spectra of Be stars is the V/R variation between the violet and red intensity peak of the double emission lines. The Be stars usually present V/R variations on long-time-scales.

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According to the statistical studies of Be/Shell stars, about 67% in the northern hemisphere and about 76% in the southern hemisphere, are V/R variables and display quasi-periodic variations mainly in the 2-13 years range. The mean value of variation is about 7 years[12, 13]. The short-term periodic and non-periodic variations are also frequently present in Be/Shell stars. Stag[14] has estimated that short-term variability seems to occur in about half of the Be/Shell stars. They usually show radial velocity variations and line profile changes with the same period.

OBSERVATIONS AND DATA REDUCTION

The observations were carried out from April 30 to May 2,2006 by using IUCAA's 2m telescope mounted with Faint Object Grism Spectrograph (IFOSC7) having resolution of 4.4A and blazed to 5000A. The instrument is mounted at the telescope's direct Cassegrainian port. IFOSC7 employs as EEV 2kx2k thinned, black illuminated CCD μm with 13.5μm pixels having field of view of about 10.5arcminutes. Long slit of 100 μm width was used in front of the spectrograph. The data has been standardized. The steps were bias subtraction, division by the normalized flat field, wavelength calibration and normalization to the stellar continuum. The wavelength calibration was carried out by using the helium neon comparison spectrum.

RESULTS AND DISCUSSION

The observed line profiles are displayed in Fig. 1 and Fig. 2

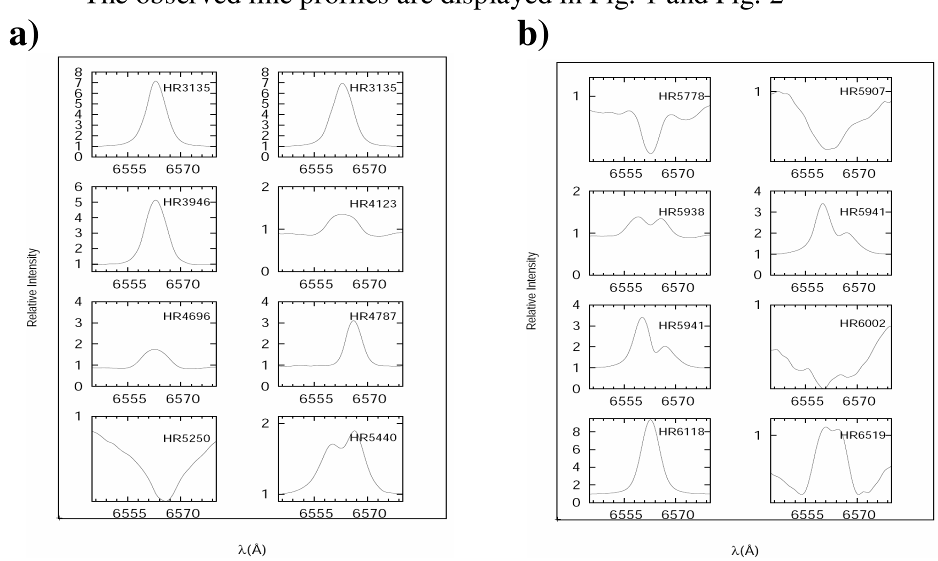

Fig. 1.a, b Hα profiles of various Be/shell type stars

The Be/Shell stars of the present study are listed in Table 1.

Table 1 Various parameters of Be/shell stars

HR No.	Star Name	Mag.	Sp. Type	W(Å)	Ip/Ic	Date of Observation	Exp.T. (s)
3135	Mon	6.51	B2.5Ve	-46.04	7.15	2 May 2006	200
3135	Mon	6.51	B2.5Ve	-46.65	6.94	2 May 2006	100
3946	Hya	6.21	B5V	-33.36	5.14	2 May 2006	100
4123	Hya	5.60	B8/B9IV/V	-0.46	1.34	2 May 2006	80
4696	5 ζ Vrv	5.22	B8V	-1.74	1.74	2 May 2006	40
4787	5 κ Dra	3.87	B6IIIpe	-11.72	3.10	2 May 2006	10
5250	47 Hya	5.15	B8V	8.04	0.61	30Apr 2006	60
5440	ή Cen	2.31	B1.5Vne	-11.66	1.89	2 May 2006	5
5778	4 θ Crb	4.14	B6Vnne	4.60	0.69	30 Apr 2006	20
5907	Sco	5.42	B2V	3.36	0.79	1 May 2006	60
5938	4 Her	5.75	B9pe	-2.32	1.38	30 Apr 2006	80
5941	48 Lib	4.88	B3-4III	-22.04	3.41	30 Apr 2006	20
5941	48 Lib	4.88	B3-4III	-21.33	3.40	30 Apr 2006	40
6002	11 Sco	5.78	B9V	7.54	0.73	30 Apr 2006	30
6118	7 Oph	4.42	B2Vne	-58.77	9.36	30 Apr 2006	10
6519	51 Oph	4.81	A0V	-4.28	1.01	30 Apr 2006	15

The measured parameters of the observed line profiles are also given in this Table. Stars possess various shapes of emission and absorption profiles at the Hα line. Present observations show that majority of stars exhibit single-peaked string emission of Hα line. Four stars display the emission peak to be divided into the components with unequal height and asymmetrical shape. Two of the stars show asymmetrical deep broad absorption with shallow limb towards right side. Other two objects show string central absorption with two weak emission components. The brief description of the observed behavior of programmed stars is given below:

- The Be stars HR 3135, HR 3946, HR 4787 and HR 6118 show single, strong and symmetrical peak. This strong emission line lies well above the continuum level.
- Stars HR 4123 and HR 4696 show broad symmetrical very strong single emission peak which lie above the underlying absorption.
- The stars HR 5938 and HR 6519 shows double strong emission peak divided into two components: V and R with V>R. This strong emission lines lies above the underlying absorption.
- The stars HR 5907, HR 5250 and HR 6002 show broad asymmetrical absorption peak and emission line, well below the continuum level.

- The star HR 5778 shows broad asymmetrical absorption at Hα. Absorption line shows weak V and R emission components superimposed on strong and broad underlying absorption.
- Star HR 5941 shows strong peaked emission divided into two components V and R with V>R. This strong emission line lies well above the continuum level.
- Star HR 5440 shows strong double peaked emission divided into two components V and R with V<R. This strong emission line lies well above the continuum level.

Conclusions

It is concluded that four Be stars exibit single, strong symmetrical peak. Two stars show very strong single emission peak lying over the absorption.Other two stars show strong emission divided into two commponents. Three stars possess assymmertical absorption .The emmission features origibnate from the circumstellar envelope.

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