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Spectroscopic Monitoring of Symbiotic Stars from the Vainu Bappu Observatory

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Abstract. We present here the preliminary results of the long term monitoring of the optical spectrum of symbiotic stars from the Vainu Bappu Observatory. Spectra of EG And, AX Per, BX Mon, RX Pup, RW Hya, AS 210, and StHα 149 were obtained during 1999–2002. The spectral type of the secondary is estimated on the basis of the observed absorption indices.

1. Introduction

Long term monitoring of optical and near-infrared spectra of symbiotic stars has been initiated since 1999, using the telescopes at the Vainu Bappu Observatory (VBO) and the Mt Abu Infrared Observatory. The data obtained will be combined with those in other frequencies to study the various problems posed by the activity in these binaries, such as the multiple outbursts, variability in the emission lines, and luminosity of the hot component, and also to obtain information about mass transfer and accretion in these systems.

We present in this paper the first results of the monitoring of the optical spectra using the 2.3 m Vainu Bappu Telescope at VBO. Low resolution ($\lambda/\Delta\lambda \sim$ 1000) optical spectra in the range 4000–9000 Å of the symbiotics EG And, AX Per, UV Aur, BX Mon, RX Pup, RW Hya, AS 210, and StHα 149 were obtained. UV Aur, BX Mon, RX Pup, and RW Hya were observed on more than one occasion.

2. Results

The observed flux-calibrated spectra are shown in Figures 1–4.

The spectrum of EG And is dominated by the cool star. No emission lines are present. The spectrum is similar to that of 7.8/2/96 presented in Munari & Zwitter (2002). AX Per shows a spectrum devoid of high ionization lines and is similar to a brightened state spectrum. It is hence likely that AX Per was in an active state during the time of the observations.

In the spectrum of UV Aur, on both occasions the Balmer lines, with the exception of Hα, are present in absorption. The spectrum of BX Mon, in addi-

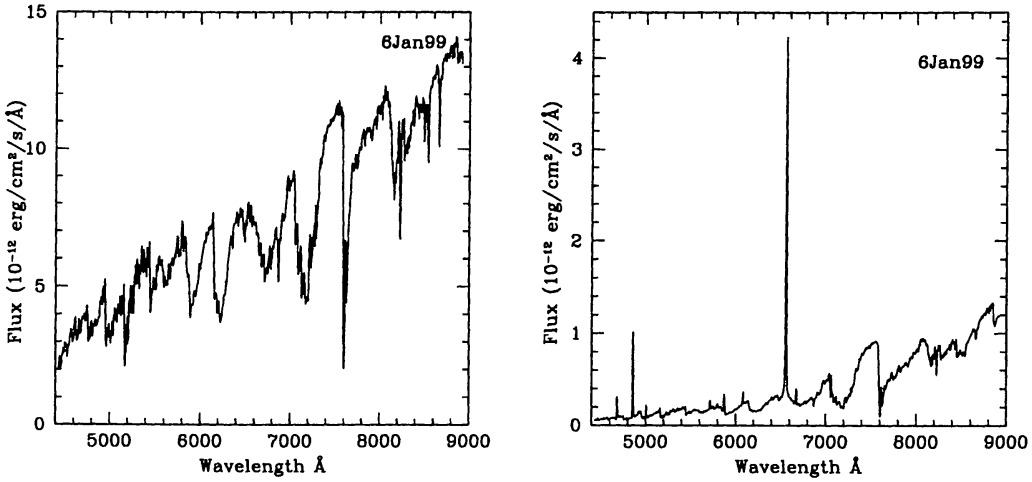

Figure 1. *Left:* Spectrum of EG And obtained on 1999 Jan 6. *Right:* Spectrum of AX Per obtained on 1999 Jan 6.

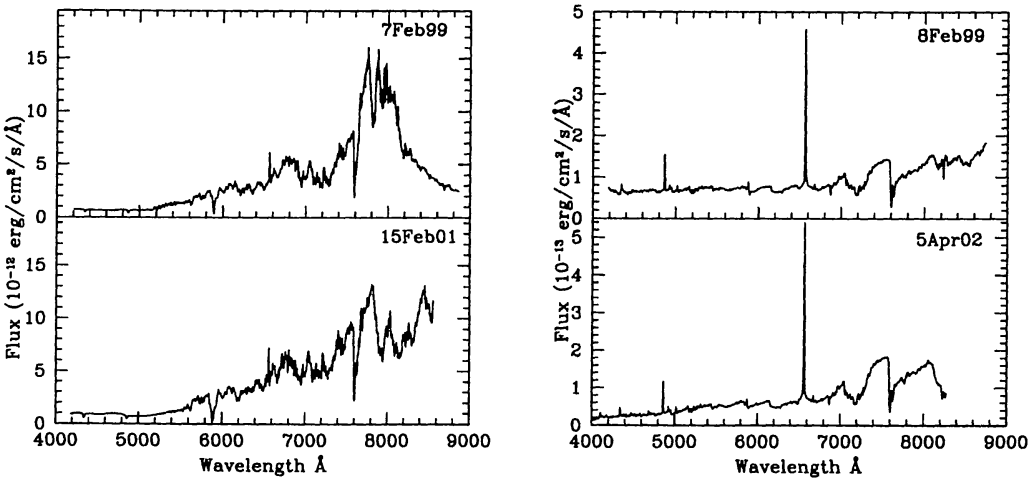

Figure 2. *Left:* Spectra of UV Aur obtained on 1999 Feb 7 and 2001 Feb 15. *Right:* Spectra of BX Mon obtained on 1999 Feb 8 and 2002 Feb 15.

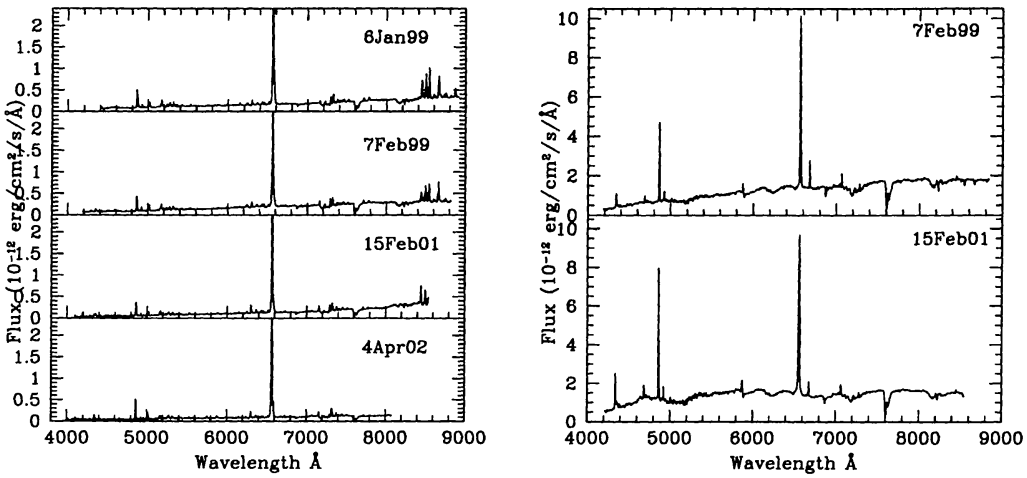

Figure 3. *Left:* Spectra of RX Pup obtained on 1999 Jan 6, 1999 Feb 7, 2001 Feb 15, 2002 Apr 4, and 2002 Apr 5. *Right:* Spectra of RW Hya obtained on 1999 Feb 7 and 2001 Feb 15.

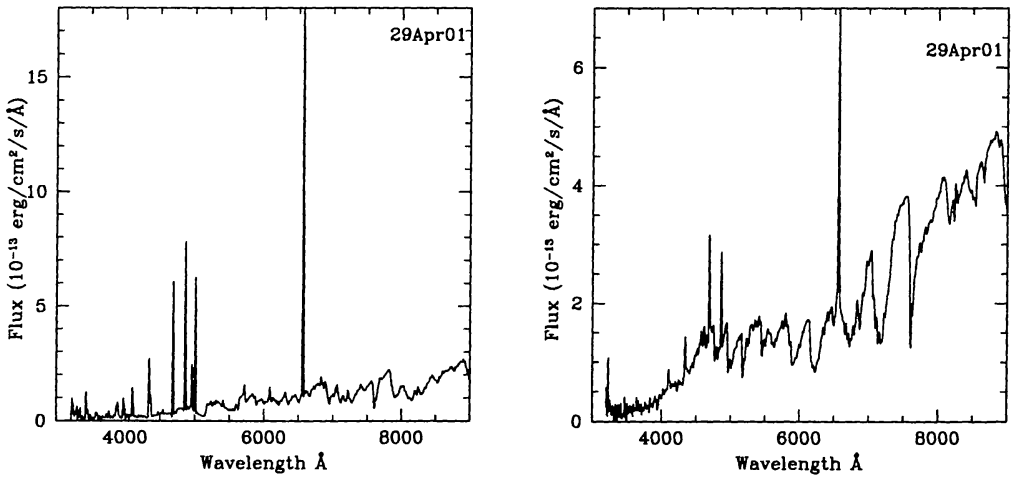

Figure 4. *Left:* Spectrum of AS 210 obtained on 2001 Apr 29. *Right:* Spectrum of StHα 149 obtained on 2001 Feb 29.

tion to the Balmer emission lines, also shows lines due to Fe II and He I. He II 4686 is also present in the spectrum of 2002 April 5.

The spectrum of RX Pup is very similar to that of the recurrent nova RS Oph at quiescence. Prominent lines due to hydrogen Balmer series, Fe II, He I, O I 7774, 8446, and the Ca II IR triplet are present in emission. The Balmer increment is very steep, with the Hα/Hβ ratio varying between 9.7 (1999 Jan) to 14.0 (2002 Apr). The lines due to [O I] 6300, 6363 and [O III] 4959, 5007, which were weakly present in 2001 Feb spectrum, strengthened in 2002 Apr. The 2001 Feb and 2002 Apr spectra show a component redward of Hα at 6584 Å. This could be due to [N II] or a high velocity component of Hα similar to that seen in RS Oph (Iijima et al. 1994).

The spectrum of RW Hya shows strong emission lines due to hydrogen Balmer and He I. The O I 8446 line is weakly present in emission, while the O I 7774 line is present in absorption. The Ca II IR triplet is also present in absorption.

The spectrum of AS 210 shows narrow emission lines with a steep Balmer decrement. He II 4686 and [O III] lines are strongly present. The Raman-scattered O VI 6830 line and the Bowen fluorescence O I lines at 3430 and 3444 Å are also seen. No emission lines are present in the redward region of the spectrum, where the contribution from the secondary is seen to be dominant.

The spectrum of StHα 149 shows strong Balmer emission lines and the He II 4686 line superimposed on the dominant spectrum of the cool star.

3. Secondary Spectral Type

The spectral type of the secondary was estimated using the TiO and VO absorption band indices for the following symbiotics:

EG And: Present—M 2.6; previous estimates—M 3.0 (Mürset & Schmid 1999; Belczyński et al. 2000).
AX Per: Present—M 4.0; previous estimates—M 4.5 (Mürset & Schmid 1999), M 6.0 (Belczyński et al. 2000).
BX Mon: Present—M 4.0 ; previous estimates—M 5.0 (Mürset & Schmid 1999), M 5.0 (Belczyński et al. 2000).
RW Hya: Present—M 1.0 ; previous estimates—M 2.0 (Mürset & Schmid 1999), M 2.0 (Belczyński et al. 2000).
StHα 149: Present—M 3.5; previous estimates—M2.0 (Belczyński et al. 2000).

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