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DISCOVERY OF A SECONDARY SPECTRUM IN THE SB1 SYSTEM HD 434

ILIEV, I.KH.[1]; BUDAJ, J.[2]; ŽIŽŇOVSKÝ, J.[2]; ZVERKO, J.[2]

[1] Institute of Astronomy, National Astronomical Observatory, P.O.B. 136, BG – 4700, Smolyan, Bulgaria
e-mail: iliani@astro.bas.bg

[2] Astronomical Institute, Slovak Academy of Sciences, 059 60 Tatranská Lomnica, Slovak Republic
e-mail: budaj@ta3.sk, ziga@ta3.sk, zve@ta3.sk

Radial velocity variations of HD 434 (HIP 728, BD +27°3, SAO 73772, $m_V = 6.47$) were discovered by Shajn (1951) who also classified the spectrum as A2s. Palmer et al. (1968) classified the star as A4Vm and estimated its $v \sin i = 60$ km s^{-1}. Hube & Gulliver (1985) reported a preliminary orbit based on 38 spectrograms of a reciprocal dispersion 15 Å/mm. Later on, Margoni et al. (1992), using photographic spectra of 42 Å/mm, confirmed the orbital elements. Nevertheless, in the same year Sreedhar Rao & Abhyankar (1992) published the radial velocity curve obtained from 33 photographic spectra (33 Å/mm and the resolution of 0.66 Å) which differs significantly in V_0 and K from that of Hube & Gulliver (1985). They also speculated about a secondary spectrum and concluded that the secondary component should be at least $1\overset{\mathrm{m}}{.}5$ fainter in the visible so that it was not seen in their and previous spectra. CCD observations were called for.

Our spectroscopic observations were carried out with the 2-m RCC telescope of the Bulgarian National Astronomical Observatory in the frame of our observational program on Am-stars in binary systems. Photometrics AT200 camera with a SITe SI003AB 1024 × 1024 CCD chip, (24 μm pixels) was used in the Third camera of the coudé spectrograph to provide spectra in two different spectral regions 100 Å wide and centered on 6440 Å and 6720 Å with $R = 32000$. The typical S/N ratio is 250–350. Wavelength calibration has the r.m.s. error of 0.005 Å. IRAF standard procedures have been used for bias subtracting, flat-fielding and wavelength calibration. Telluric lines have been removed using spectra of hot, fast rotating stars. Rectification, equivalent widths and radial velocities were measured using the EQWREC2 code (Budaj & Komžík 2000). The log of observations is listed in Table 1.

Table 1: List of observations, HD 434

Date	HJD (2400000 +)	Region [Å]
03.01.2001	51913.1625	6667–6770
04.01.2001	51914.1977	6389–6492

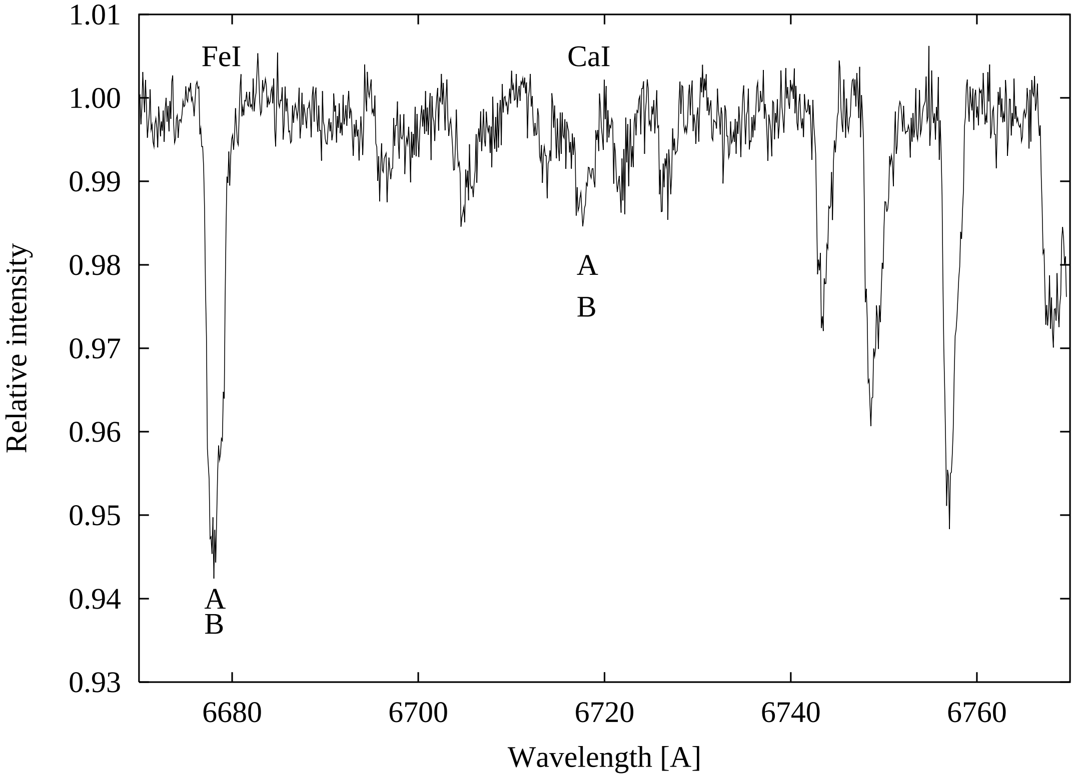

Figure 1. HD 434, phase = 0.97. Both components are mixed

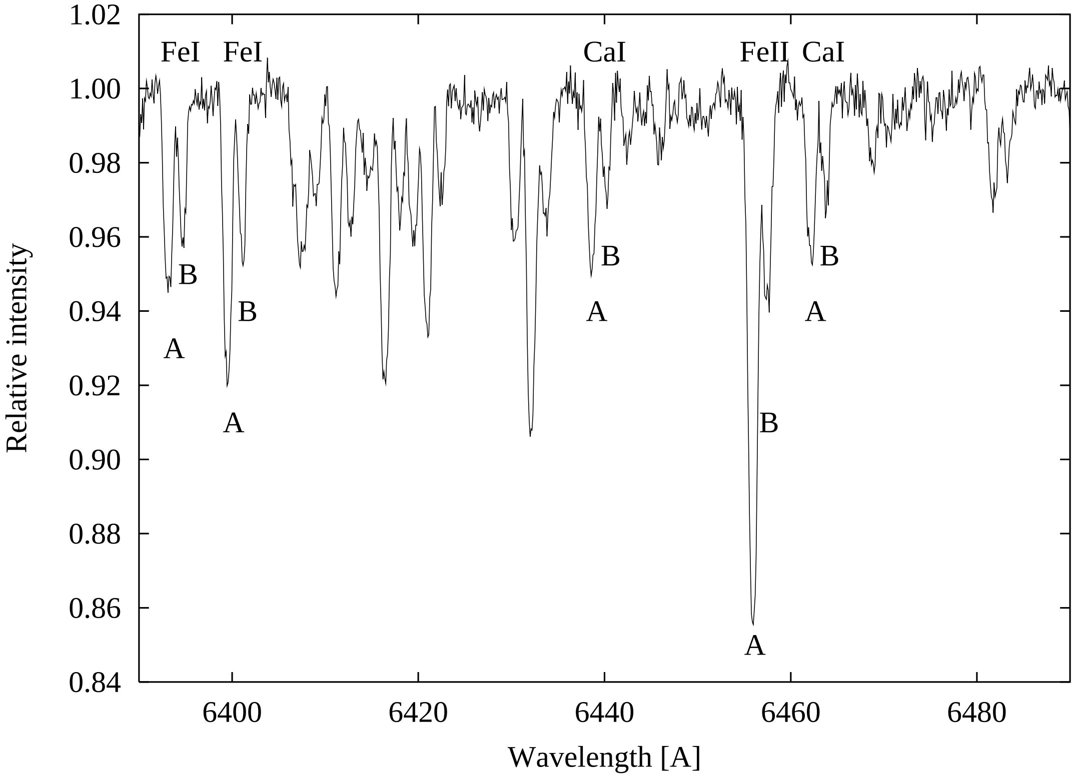

Figure 2. HD 434, phase = 1.00, next day. Both components are clearly resolved

The secondary component lines are not seen in our first spectrum of HD 434 (orbital phase 0.97, Fig. 1) (phases were computed following the ephemeris

$$T = 2447186.26 + 34\overset{\mathrm{d}}{.}25999 \times E,$$

(where T is the time of periastron passage) given by Sreedhar Rao & Abhyankar (1992)). However, a clear secondary spectrum was observed next day (orbital phase 1.00, Fig. 2) although the orbital period is quite long. It appeared due to the high eccentricity of the orbit ($e = 0.41$). From the ratio of equivalent widths of the Ca I 6718 and Fe I 6678 lines, ([Ca/Fe] = 0.27), we can infer that at least the brighter A component has strong Am peculiarity. This ratio is about 0.9 for normal stars but can be as low as 0.2 for the strongest Am stars (Boesgaard 1987, Burkhart & Coupry 1989, 1991, 1997, Iliev et al. 1998). The spectrum obtained at phase 1.00, with clearly separated lines of components, allows us to obtain more information. It is apparent that the projected rotational velocity of the A component is much lower than previously thought (about 32 $\mathrm{km\,s^{-1}}$, half of the previous value). We were also able to determine the value of $v \sin i$ of the B component and it seems to be very much the same, about 27 $\mathrm{km\,s^{-1}}$. From the Ca and Fe lines of this spectrum it seems that not only the A but both components exhibit pronounced Am anomalies. Although we have no spectrum from the region 6667–6770 Å at phase 1.00 (the [Ca/Fe] ratio used for classification purposes has to be determined from the lines of Ca I 6718 and Fe I 6678), we found that the Ca I lines are weak, what is a typical feature of Am stars. Radial velocities measured from the spectrum at phase 1.00 are: $v_\mathrm{A} = -21.8 \pm 0.4$ $\mathrm{km\,s^{-1}}$, $v_\mathrm{B} = 52.2 \pm 0.3$ $\mathrm{km\,s^{-1}}$. The orbital period is rather long ($\approx$ 34 days), and possible synchronization in this system would give another support to the hydrodynamical synchronization mechanism of Tassoul & Tassoul (1992) which remains operative for rather large orbital periods up to $P_\mathrm{orb} \approx 100$ days. The pronounced Am anomalies of both components and the rather eccentric orbit seem to conform the hypothesis of Budaj (1996, 1997, 1999) about a stabilization mechanism in binary systems competing with diffusion processes.

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