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THE DOUBLE-LINED SPECTROSCOPIC BINARY AV SCL

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We report the first detection of spectral lines from the companion star of the spectroscopic binary AV Scl (= HD 1909, B9 IV HgMn). Its SB1 nature had been noted from sporadic radial velocity measurements (Buscombe 1963, Buscombe & Kennedy 1968, Buscombe, Chambliss & Kennedy 1968, Hube 1970, Bond, Perry & Bidelman 1971) which span the range $\pm$ 30 km s^{-1} with an apparent period between 5 and 10 days. Variations in the Strömgren u band flux at the level of 0.030 magnitude with a period of 7.2 days were reported by Schneider (1987). The photometric variations should be interpreted cautiously due to photometric variability of the comparison stars used in that study. The brightness variations of AV Scl are characterized as being of the α^2 CVn type in the GCVS. Elemental abundances have been most recently studied by Adelman et al. (1996), and earlier by Buscombe, Chambliss, & Kennedy (1968) and Guthrie (1984). From these studies it is evident that AV Scl is a HgMn star, however, no detection of spectral lines from the secondary star had previously been reported.

Spectral observations of AV Scl were executed during program ESO 67D-0579(A) on 2001 June 23 with the Ultraviolet-Visual Echelle Spectrograph (UVES) on the Very Large Telescope of the European Southern Observatory. The spectra were taken using the dichroic-1 and -2 modes of the UVES with a slit width of 0.″4 for the blue arm and 0.″3 for the red arm. The spectral coverage is nearly complete from approximately 3100 Å to 1 μm. Average resolving powers of R = 80000 and 110000 are achieved for the UVES blue and red arms, respectively.

We have identified spectral lines of the binary companion over the entire range of the observed spectrum. Their strength is weaker than for the primary star lines for ions, while for the spectrum of Fe I the companion lines are more comparable to those of the primary. No detection of Hg II λ3984 is made for the secondary and lines of Mn II, while strong in the primary star spectrum, are not noticeable in the secondary. Therefore, it is unlikely that the companion is also a HgMn star. The relative velocity between the two stars is derived from wavelength shift of $\lambda_{pri} - \lambda_{sec} = -3.058$ Å for the Si II multiplet 2 $\lambda\lambda$6347, 6371 lines, which corresponds to the secondary lines being redshifted relative to the primary by 144.05 km s^{-1}. This relative velocity is consistent with spectral lines at other wavelengths. The figure illustrates spectral lines from both stars.

We have performed a preliminary analysis of the spectrum by its comparison with synthetic spectra generated using the ATLAS/SYNTHE codes while making the assumptions that the companion is a cooler main sequence star of solar-like chemical composition.

Reasonable fits to the spectrum are achieved using the atmospheric parameters T_{eff} = 12400 K, $\log g = 4.0$ for the primary and T_{eff} = 9000 K, $\log g = 4.0$ for the secondary. The luminosity ratio, $L_{pri}/L_{sec} = 12$ at 6350 Å, is determined from an equivalent width measurement technique (Wahlgren et al. 1994) using the lines Si II 6347, 6371 Å. Both stars display a projected equatorial rotational velocity of $v \sin i = 12$ km s^{-1} as determined from synthetic spectrum fitting of the observation.

The high relative velocity and implied spectral type (A4V) of the secondary star makes AV Scl appear similar to other cool HgMn binaries, such as χ Lupi, HR 4072, and ι CrB. Further consideration should be given to determine whether AV Scl is a multiple star system. The photometric variations, if real, are not known to exist in other HgMn stars and therefore may not be the result of rotational modulation of the flux. High precision photometric monitoring should be undertaken to determine whether observed flux variations are the result of an eclipsing system. In addition, spectral monitoring is needed to determine the orbital parameters and mass ratio before a more accurate determination of the atmospheric parameters and elemental abundances can be undertaken.

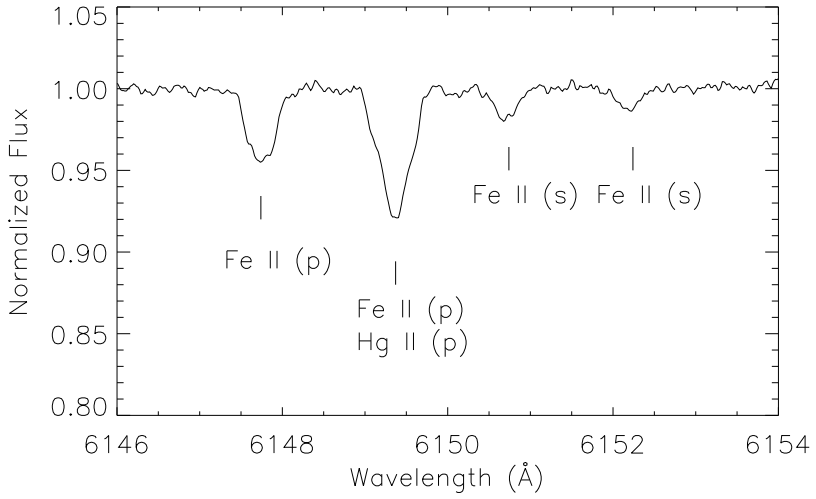

Figure 1. A portion of the spectrum of AV Scl displaying the lines Fe II $\lambda\lambda$6147,6149 for both the primary (p) and secondary (s) components on date JD 2452074.441. The primary star spectrum has been shifted to the laboratory restframe.

References:

Adelman, S.J., Philip, A.G.D., Adelman, C.J., 1996, *MNRAS*, **282**, 953
Bond, H.E., Perry, C.L., Bidelman, W.P., 1971, *PASP*, **83**, 643
Buscombe, W., 1963, *MNRAS*, **126**, 29
Buscombe, W., Kennedy, P.M., 1968, *MNRAS*, **139**, 341
Buscombe, W., Chambliss, C.R., Kennedy, P.M., 1968, *MNRAS*, **140**, 369
Guthrie, B.N.G., 1984, *MNRAS*, **206**, 85
Hube, D.P., 1970, *Mem R.A.S.*, **72**, 233
Schneider, H., 1987, *Hvar Obs. Bulletin*, **11**, 29
Wahlgren, G.M., Adelman, S.J., Robinson, R.D., 1994, *ApJ*, **434**, 349