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# SPECTROSCOPIC INVESTIGATION OF SZ Lyn AND SS Psc

The discrepancy between the hydrogen and ionized calcium spectral classes is a characteristic feature of RR Lyrae stars. This discrepancy is determined by the parameter ΔS (Preston, 1959), measured in tenths of a spectral class. ΔS changes with the phase of light variation, reaching the highest values in pre-maximum phases. One can note one more discrepancy for the stars in question, viz. the difference between the ionized calcium and metal spectral classes.

Parallel photoelectric (Garbuzov, 1980a, 1980b) and spectroscopic observations of SZ Lyn and SS Psc were performed to investigate in detail the changes of hydrogen spectral classes: Sp(H), ionized calcium spectral classes: Sp(KCa II) and spectral classes determined from the other metals: Sp(ml) (mainly Fe I, Ca I and Ti II, all 13 criteria) with the phase of light variation. Spectroscopic observations were carried out from October 1979 to January 1980 with the diffraction-grating spectrograph of the 122 cm reflector of the Crimean Astrophysical Observatory of the Academy of Sciences of the USSR. The linear dispersion of the spectrograph is 125 Å/mm. The exposure time was $0^p.14$ for SZ Lyn and $0^p.1$ for SS Psc. Spectra were exposed on Kodak 103aO emulsion. For SS Psc the plates were baked for 52 hours at t = 63°C in rarefied air. The criteria for the quantitative spectral classification were taken from Fenina (1975). The systems of equivalent widths of both investigations coincide with each other.

SZ Lyn. The pulsation period of SZ Lyn is $0^d.12$, its light varies in the limits of $9^m.12$ to $9^m.62$ in V. The deviations of O-C residuals with the period of $1146^d$ can be explained by the binary nature of the star. The results of the classification are given in Figure 1. Phases of light variation are calculated with respect to linear elements (Barnes and Moffett, 1975):

$$\text{Max hel JD} = 2438124.3977 + 0^d.12053481 \cdot E.$$

The hydrogen spectral class (Sp H) shows smooth variation with the phase of light variation. The ionized calcium spectral class (Sp KCa II) at the phases of $0^p.0$ - $0^p.6$ nearly coincides with Sp H; at the phases of $0^p.6$ - $0^p.9$ it appears earlier. The intensity of KCaII at these phases abruptly weakens by twice the original value. The maximum of the calcium curve precedes the maximum of the hydrogen curve.

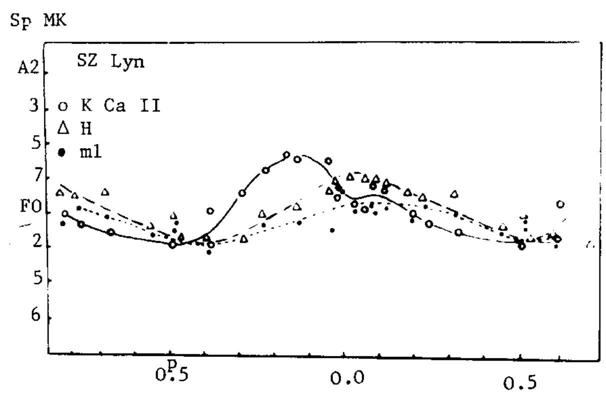


Figure 1

The metal spectral class practically coincides with the spectral class determined from hydrogen absorption lines, only for the phases 0.85 - 0.20 it is a little later. The amplitude of the change of metal line intensity (except K Ca II) is small.

SS Psc. The period of pulsation of this star is $0^d.28$, its light changes from $10^m.76$ to $11^m.18$ in B. Initially SS Psc was classified as an RRc star. The change of spectral classes with the phase of light variation is, on the whole, similar to that in the spectrum of SZ Lyn. This fact and the value of $\Delta(B-V)/\Delta V = 0.39$ put SS Psc together with SZ Lyn and VZ Cnc. These stars are characterized by the normal metal content, and the coincidence of hydrogen and metal spectral classes qualitatively show it.

The greatest discrepancy between the hydrogen and the ionized calcium spectral classes is in the premaximum phases. The shock wave effects may affect the intensity of hydrogen and ionized calcium spectral lines. Thus, in the spectrum of SZ Lyn we observe the faint splitting and the emission in the core of hydrogen line Hα at these phases (Garbuzov, Zaikova, 1983). This phenomenon can be interpreted as a results of moving out of the shock wave through the stellar atmosphere. The emission is poor and it cannot change the intensity of hydrogen spectral lines essentially. The ionization potential of Ca II is rather low, 11.8 eV. Calcium is completely ionized in the atmospheres of hot stars. The K Ca II line is very weak in the spectra of A0 stars (its equivalent width is about 0.3 Å) whereas in F0 stars the equivalent width of this line is about 3 Å. Analysis of the change in the K Ca II equivalent width of SZ Lyn shows the presence of a powerful mechanism in the stellar atmosphere, not connected with the change in B-V and V, that produces the variability of this line. A strong change in the equivalent width of the K Ca II line at nearly constant B-V, observed at some light variation phases of SZ Lyn, is caused by the action of this mechanism. It may also be due to the ionization of the upper atmosphere induced by the moving of the shock wave and by the ultraviolet radiation from behind the front of the shock wave. Another mechanism is possible, which is also connected with the movement of the shock wave. As a result of the shock wave movement the absorption lines are shifted into the short wavelength region, it will be there that the photons of continuum, moving out from deep layers of the stellar atmosphere, will be absorbed (irradiation effect). So there will be the additional surge of the energy to the gas and then its heating. Thus the rise of $\Delta S$ at premaximum phases may be the shock wave effect.

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