THE COMPLEX STRUCTURE OF THE Ca II H AND K LINES IN THE SPECTRUM OF THE A0ep STAR WITH INFRARED EXCESS HD 190073

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Abstract. Radial velocities and profiles of the components of the H and K lines in the spectrum of HD 190073 are analyzed in a 24-spectrum sample covering the period 1943–74. A 2-to-1 ratio in the radial velocities of some components is shown not to be significant on a spectrum-to-spectrum basis, contrary to suggestions by Merrill (1951) and Scargle (1973). The details of the H and K complex structure are correlated with the profiles of the Balmer lines. Radiative forces acting selectively via a resonance scattering mechanism of Ca^+ atoms are capable of producing the main features of the complex profiles of H and K in HD 190073 and in other stars exhibiting similarities to HD 190073 (such as P Cygni Balmer lines and infrared excess).

DISCUSSION

Bidelman: Why is this such a rare phenomenon?

Swings: It is not a rare phenomenon. I have a list of about 10 objects which show several components in the H and K lines.

Bidelman: Isn't it probable that the H1 and K1 line components are interstellar?

Swings: The velocity of H1 and K1 corresponds exactly to the radial velocity of the star, to within ± 1 km s^{-1}. The lines also show emission wings around both sides which, it seems to me, come from the chromosphere of the star.

Harmanec: Can you comment about the behavior of the sodium lines in this same object?

Swings: The sodium lines are in emission. There might be a small absorption component.

Doazan: Can you comment on the infrared spectrum?

Swings: The Ca II triplet is in emission but at 230 Å mm^{-1} dispersion you do not see any structure. But Polidan may comment on that, since he has better spectra.

Polidan: We have looked at the star and it shows no structure whatsoever in the calcium triplet. The lines are simple, very strong emission lines, much stronger than one would expect from the K-line strength. They also appear to be optically thick; that is, all three lines have the same intensity.

Snijders: We have heard now about the 4s-4p H and K resonance lines and the 4p-3d infrared triplet. Yesterday emission in the forbidden 3d-4s transitions in some Be stars was mentioned. Were these forbidden lines observed in this star?

Swings: The forbidden lines of Ca II at λ 7291 and λ 7323 were not observed in this star.

Goldberg: Calcium is one part in a million of the total amount of gas in stellar atmospheres and I don't see how you can consider the motion of the calcium independently of the drag expected on it by the surrounding gas.

Swings: In the second of our two papers (submitted for publication in Astronomy and Astrophysics), we try to answer the question "Why is the ejection of atoms from HD 190073 limited to Ca II?" The probability for an atom to be ejected will actually be important if five requirements are fulfilled: Ca II meets all of them. Next, I believe it was shown a long time ago that Ca II emission was observed in the solar chromosphere up to heights greater than for, say, hydrogen. We therefore do not consider a 'pure calcium' star but we assume that there are layers in the extended atmosphere of HD 190073 having a high calcium abundance. We also consider collisions to be negligible in the regions where the resonance scattering mechanism is supposed to be efficient.

A. Slettebak (ed.), Be and Shell Stars, 321.