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# Call line formation in the spectra of irradiated atmospheres

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## Abstract

We have studied the effect of external radiation on the formation of LIE and non-LTE Call lines in the spectra of A - M-star atmospheres. Three frequency distributions were chosen for the external radiation: X-ray radiation specified by the power law Iv + = I0v-0.6 at 1-16.5 keV and UV radiation specified by blackbody distributions with the temperatures Trad = 50000 and 15000 K. We analyze the influence of variations in the irradiating flux and its angle of incidence on the profiles and equivalent widths of the λλ3933, 3968 Å resonance doublet and the λλ8498, 8542, 8662 Å infrared triplet. For any type of external radiation, allowing for deviations from LIE decreases the reflection effects for the Call lines. We conclude that the Call profiles do not display emission components in the spectra of optically thick stellar atmospheres irradiated by X-rays. Therefore, Call emission lines observed in the radiation of cataclysmic variables must be formed in an optically thin plasma. Call emission lines are likely to form in the spectra of stars with UV irradiation if Call is the dominant ionization state in atmospheric layers close to the depths at which the continuum is formed. As a result, the spectra of symbiotic variables with hot primaries can contain Call lines originating on the surfaces of the M-giants and supergiant secondaries due to reflection effects. These lines can be used to analyze the reflection effects and the temperature structure in the atmospheres of the secondaries only if non-LTE effects are included. In the spectra of close binaries with cool white dwarfs, Call emission lines originate in the irradiated atmospheres of the secondaries under conditions close to thermalization. These lines can be used to study the reflection effects and calcium abundances even in an LTE approximation. We calculated the profiles and equivalent widths of Call lines in the spectra of the four precataclysmic variables BE UMa, EG UMa, MS Peg, and HR Cam. The observed and theoretical reflection effects in the λλ3933, 8542 Å emission lines for the specified parameters of the systems and a solar calcium abundance in the atmospheres of the red dwarfs are in good agreement. © 2004 MAIK "Nauka/Interperiodica".

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