

Non-LTE effects for Na I lines in X-ray illuminated stellar atmospheres

Sakhbullin N., Shimansky V.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The formation of Na I lines in X-ray illuminated atmospheres is investigated by abandoning the assumption of local thermodynamic equilibrium (LTE). Calculations are performed on the basis of a 21-level Na I model atom for the LTE model atmospheres of irradiated F-G stars obtained with allowance for a reflection effect in the first approximation. The state of extreme "overrecombination" is shown to exist for the populations of all Na I levels in the case of external illumination. Absorption features in the profiles of "cool" and "normal" Na I lines have been found to be enhanced compared to the LTE approximation. Effects of the angle of incidence and intensity of the external radiation on the formation of level populations and line profiles when abandoning LTE are analyzed. The existence of overrecombination for Na I is explained by the small X-ray heating function and the large optical cooling function. Na I level populations are shown to depend weakly on the presence of "overionization" for Na II in the atmospheres of irradiated stars. © 2000 MAIK "Nauka/Interperiodica".

Keywords

Binary stars, stars - structure and evolution, Stellar atmospheres