

## Non-LTE effects in Mg I lines for various types of stars

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### Abstract

We have performed a detailed statistical-equilibrium analysis based on a 49-level model of the magnesium atom for the atmospheres of stars of various spectral types:  $T_{\text{eff}} = 4500\text{-}12000$  K,  $\log g = 0.0 - 4.5$ , and  $[M/H] = 0$  to  $-3$ . In the atmospheres of stars with  $T_{\text{eff}} > 5500$  K, deviations from LTE for Mg I are due to photoionization by ultraviolet radiation from the 3p level; i.e., neutral magnesium is in a state of "superionization." When  $T_{\text{eff}} < 5500$  K, the populations of the Mg I levels differ from their LTE values due to radiative processes in bound - bound transitions. We analyzed Mg I lines in the solar spectrum in order to empirically refine certain atomic parameters (the van der Waals broadening constant  $C_6$  and cross sections for photoionization and collisional interactions with hydrogen atoms) and the magnesium abundance in the solar atmosphere. We studied non-LTE effects for five Mg I lines for a wide range of stellar parameters. In the case of dwarfs and subdwarfs, the magnitude of non-LTE corrections to magnesium abundances does not exceed 0.1 dex for the  $\lambda\lambda$  4571, 4703, 5528, and 5711 Å lines but can be as large as  $\pm 0.2$  dex for the  $\lambda\lambda$  3829-3838, 5172, and 5183 Å lines. The non-LTE corrections for giants and supergiants do not exceed 0.15 dex for the  $\lambda\lambda$  4571 and 5711 Å lines but can reach  $\pm 0.20$  dex and even more for the  $\lambda\lambda$  4703, 5528, 3829-3838, 5172, and 5183 Å lines. © 2000 MAIK "Nauka/Interperiodica".

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