Astronomy Reports 1996 vol.40 N2, pages 187-195

A non-LTE analysis of Mg I lines in the atmospheres of late-type stars

Mashonkina L., Shimanskaya N., Sakhibullin N.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The formation of Mg I lines in the atmospheres of stars with Teff = 5500-7000 K, log g = 2.0-4.5, and [A] = 0, -2 is analyzed. It is shown that the Mg I level population is a nonequilibrium one, and that overionization takes place. This is the chief cause of departures from LTE in the equivalent widths of strong lines; for weak lines, the shift in the depth of their formation in the stellar atmosphere also plays a major role. Quantitatively, overionization is more pronounced in metal-poor stars. Departures from LTE grow with increasing stellar luminosity, peaking at Teff = 6500 K in main-sequence stars and growing with decreasing Teff in giants. Non-LTE magnesium-abundance corrections are calculated. They are at their peak for the λ4571, 3829-3838, 5172, and 5183 lines and reach 0.30 dex at Teff = 5500 K, log g = 2.0, and [A] = -2. For the λ4057, 4167, 4702, 4730, 5528, and 5711 lines, the non-LTE corrections do not exceed +0.15 dex for the entire range of physical parameters studied. The sensitivity of the results to variations in the input data (model atom, cross sections for the processes, etc.) is analyzed.