Self-consistent multilevel PRD

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Abstract

The atomic density matrix formalism has enabled the self-consistent derivation of both polarised radiative transfer and statistical equilibrium of the multilevel atom (Bommier, 2016, A&A, 591, A59). This derivation sums up the perturbation series of the matter-radiation interaction, in the weak radiation field limit. This formalism is convenient for modelling the polarised profiles of stellar atmosphere spectral lines, in the general case of partial redistribution (PRD). This new formalism will be presented, together with a numerical application developed for the case of the solar Na I D line doublet observed close to the solar limb, taking into account fine and hyperfine structure and interferences and off-diagonal coherences, together with Rayleigh and Raman scattering.

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