Effects of angle-dependent partial frequency redistribution on polarized line profiles

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Abstract

Scattering of the anisotropic radiation field by atoms and molecules gives rise to the so-called second solar spectrum (the linearly polarized spectrum of the Sun). The partial frequency redistribution (PRD) in line scattering is essential for interpreting the observed linear polarization in strong resonance lines. This polarization is particularly sensitive to the form of the PRD function used in the polarized line transfer equation. For practical applications in astrophysical line formation theory, the angle-averaged PRD functions are commonly used in the literature. This is because the use of angle-dependent PRD complicates the radiative transfer problem both analytically and numerically. In this talk we present our work on polarized line formation with angle-dependent PRD. We discuss techniques developed to handle the angle-dependent PRD functions and the numerical methods to solve the concerned polarized transfer equation. We show that the angle-dependent effects are somewhat less important for scattering polarization in the absence of magnetic fields, while they play an important role for line polarization in the presence of magnetic fields.

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