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Modeling the polarization of strong chromospheric lines and its magnetic sensitivity

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A primary goal in today's solar physics research is to develop remote sensing methods for measuring the elusive magnetic fields of the chromosphere and transition region. A very promising strategy is to exploit the fingerprints that the magnetic field leaves in the polarization of strong resonance lines through the joint action of the Zeeman, Hanle, and magneto-optical (MO) effects. Significant efforts have been put in this research field during the last decade, from both the observational and theoretical point of view. In this talk, we first highlight the diagnostic potential of the aforementioned effects, recalling the underlying physics and pointing out the computational aspects inherent to their modeling. Subsequently, we present a new code capable of solving the radiative transfer problem for polarized radiation in strong resonance lines, accounting for the Zeeman, Hanle, and MO effects, as well as for partial frequency redistribution (PRD) in scattering processes, in comprehensive 3D models of the solar atmosphere. The code, named TRIP, provides synthetic data of unprecedented accuracy, which are crucial to reliably interpret a variety of spectropolarimetric observations of chromospheric lines, including those of HI Ly-α and MgII h and k provided by the three CLASP sounding rocket experiments. Moreover, it can be used to generate accurate datasets for the training of machine learning inversion algorithms.

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