Session 3

3D RT Modeling of the Scattering Polarization in the Wings of Mg II h&k

Andrii V. Sukhorukov, Javier Trujillo Bueno, and the CLASP2 team
IAC

We aimed to investigate the spectro-polarimetric measurements of quiet solar chromosphere targets in the wings of Mg II h&k, observed by the CLASP2 rocket experiment on April 11, 2019. To interpret these data through forward modeling, we developed two numerical modules for the radiative transfer (RT) code PORTA (Stepan & Trujillo Bueno, 2013). Both modules solve the polarized transfer equations in 3D for a two-term atom considering the J-state interference as well as partial redistribution in scattering (PRD). One module neglects the magnetic field effects, while the other includes them via selected magneto-optical terms. To facilitate resonance scattering in 3D we approximated it by applying the atomic coherent scattering function in the observer's frame. This approximation dramatically reduces computational costs but keeps the magnetic sensitivity in the wings. With these modules, we numerically solved the 3D RT problem in the h&k wings of a two-term model atom of Mg+ using a model atmosphere from the enhanced network simulation by the radiation-MHD code Bifrost (Carlsson et al. 2016). Synthetic images as well as slit spectra in all Stokes parameters for different viewing angles were generated, analyzed, and compared against observations.

In this talk, I will justify the coherent scattering approximation, explain the computational demands, and show synthetic spectrograms as well as profiles. We will see how the following effects relate our synthetic data to observations: local symmetry breaking on granulation, global symmetry breaking as center-to-limb variations, PRD and the upper-term interference that define the wing shapes, and the magneto-optical effects that influence them all. Additionally, I will mention the role of the instrumental resolutions of the spectro-polarimeter.