Session 3

Exploring the UV solar spectrum: the polarization of Fe II lines between 250-280 nm.

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Spectropolarimetry of the solar ultraviolet spectrum has opened a new window to study the magnetism of the upper layers of the solar chromosphere. Theoretical investigations and the results of the CLASP (2015) and CLASP2 (2019) suborbital space missions demonstrated the diagnostic potential of the polarization produced by scattering processes and the Hanle and Zeeman effects in some ultraviolet spectral lines, such as Lyα, Mg II h & k, or the Mn I resonance lines to uncover the physics of the upper chromosphere and the transition region.

Although the near-UV spectral region between 250 and 280 nm also includes a significant number of Fe II lines, we lack theoretical and observational investigations about their polarization signals and magnetic sensitivity. In this work, we present the first detailed theoretical study about their intensity and polarization, including the effects of radiative transfer and the Hanle and Zeeman effects.

To this end, we have developed a comprehensive Fe II atomic model that includes all the potentially useful lines in this spectral region. The emergent Stokes profiles have been calculated by solving the problem of the generation and transfer of polarized radiation in a semi-empirical atmospheric model representative of the quiet Sun, and including or neglecting the contribution of arbitrary magnetic fields. We present a selection of Fe II spectral lines with significant linear and circular polarization signals and evaluate their diagnostic capabilities by studying their scattering polarization signals, formation heights, and magnetic sensitivity through the action of the Hanle and Zeeman effects. In addition, we include a detailed study of a weak Fe II emission line that is located in the far wings between the Mg II h & k lines, whose intensity and polarization has been recently observed by the CLASP2 mission.