Session 4

Mapping the magnetic field azimuth in the chromosphere

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The Zeeman effect is of limited utility for probing the magnetism of the quiet solar chromosphere. The Hanle effect in some spectral lines is sensitive to such magnetism, but the interpretation of the scattering polarization signals requires taking into account that the chromospheric plasma is highly inhomogeneous and dynamic (i.e., that the magnetic field is not the only cause of symmetry breaking). Here we investigate the reliability of a well-known formula for mapping the azimuth of chromospheric magnetic fields directly from the scattering polarization observed in the Ca II 8542 A line, which is typically in the saturation regime of the Hanle effect. To this end, we use the Stokes profiles of the Ca II 8542 A line computed with the PORTA radiative transfer code in a three-dimensional (3D) model of the solar chromosphere, degrading them to mimic spectropolarimetric observations for a range of telescope apertures and noise levels. The simulated observations are used to obtain the magnetic field azimuth at each point of the field of view, which we compare with the actual values within the 3D model. We show that, apart from intrinsic ambiguities, the method provides solid results. Their accuracy depends more on the noise level than on the telescope diameter. Large-aperture solar telescopes, like DKIST and EST, are needed to achieve the required noise-to-signal ratios using reasonable exposure times.