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Observations of solar scattering polarization at high spatial resolution

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Abstract. The weak, turbulent magnetic fields that are hypothesized to permeate most of the solar photosphere are difficult to observe, because the Zeeman effect is virtually blind to them. The Hanle effect, acting on the scattering polarization in suitable lines, can in principle be used as a diagnostic for these fields. However, the prediction that the majority of the weak, turbulent field resides in intergranular lanes also poses significant challenges to scattering polarization observations, because high spatial resolution is usually difficult to attain. We aim to measure the difference in scattering polarization between granules and intergranules. We present the respective center-to-limb variations, which may serve as input for future models. We perform full Stokes filter polarimetry at different solar limb positions with the CN band filter of the *Hinode*-SOT Broadband Filter Imager, which represents the first scattering polarization observations with sufficient spatial resolution to discern the granulation. The CN band is known to have a significant scattering polarization signal, and is sensitive to the Hanle effect. *Hinode*-SOT offers unprecedented spatial resolution, in combination with large polarimetric sensitivity. We extend the instrumental polarization calibration routine to the observing wavelength, and correct for various systematic effects. The scattering polarization for granules (i.e., regions brighter than the median intensity of non-magnetic pixels) is significantly larger than for intergranules. We derive that the intergranules (i.e. the remaining non-magnetic pixels) exhibit $(9.8 \pm 3.0)\%$ less scattering polarization for $0.2 < \mu \leq 0.3$, although systematic effects cannot completely be excluded. These observations constrain

MHD models in combination with (polarized) radiative transfer in terms of CN band line formation, radiation anisotropy, and magnetic fields.