Contributed Talk

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The potential of many-line inversions of photospheric spectropolarimetric data in the visible and near UV

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Our knowledge of the lower solar atmosphere is mainly obtained from spectropolarimetric observations, which are often carried out in the red or infrared spectral range and almost always cover only a single or a few spectral lines. In preparation for the development of a slit spectropolarimeter for the third science flight of the balloon-borne observatory Sunrise we investigate the feasibility of spectropolarimetry in the short-wavelength range, 3000 Å – 4300 Å, where the line density but also the photon noise are considerably higher than in the red. For an ensemble of state-of-the-art magneto-hydrodynamical atmospheres we synthesize exemplarily spectral regions around 3140 Å (containing 352 lines), around 4080 Å (265 lines), and, for comparison reasons, around 6302 Å (80 lines). The spectral coverage is chosen such that at a spectral resolving power of 150000 the spectra can be recorded by a 2K detector. The synthetic Stokes profiles are degraded with a typical photon noise and afterwards inverted. The atmospheric parameters of the inversion are compared with the original MHD quantities. We find that from many-line inversions significantly more information can be obtained than from the traditional approach at identical wavelengths. A comparison of the three considered wavelength regions shows that the many-line approach at 4080 Å provides equally good results than at 6302 Å, the determination of the line-of-sight (LOS) velocity is even more precise by a factor of two. Compared with the red, the many-line approach at 3140 Å provides indeed larger uncertainties for the magnetic field strength, but similarly good temperatures, and LOS velocities that are more precise by roughly a factor of two. We conclude from our results that many-line spectropolarimetry at short wavelengths offers high potential in solar physics.