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Fast Solar Polarimeter (Prototype): Preliminary Results of Stokes Measurements in the Sr I 4607 Å Line at VTT/TESOS

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Abstract. Scattering polarization measurements at spatial scales in the $0.1'' - 1''$ regime are a very promising complementary diagnostic for the Sun's atmosphere and magnetism at small spatial scales (e.g., Trujillo Bueno et al. 2004). So far, for the Sr I line at 4607.3 Å, which exhibits a large scattering polarization signal (Stenflo et al. 1997; Gandorfer 2002), only theoretical predictions for the strength and spatial distribution of linear polarization signals at sub-arcsecond scales close to disk center are made available by Trujillo Bueno & Shchukina (2007), whereas observational feedback is still very rare.

Here, we present preliminary results of two observational campaigns with the prototype of the Fast Solar Polarimeter (FSP, Iglesias et al. 2016) attached to the TESOS filtergraph, which is located at the German Vacuum Tower Telescope (VTT) in Tenerife, Spain.

We measured the center-to-limb variation of spatially averaged Stokes Q/I profiles in the Sr I line at 11 wavelength positions to check for systematic errors and to compare with previous results by other instruments. We find that our results are in agreement with previous findings reported in the literature (i.e., Stenflo et al. 1997).

In May 2015, we observed the Sr I line in the quiet Sun at $\mu = 0.6$ from the north solar limb with a spatial sampling of $0.08''\text{pixel}^{-1}$ and noise levels significantly below 1% per pixel for linear polarized signals with 1.25 s integration time. To obtain lower noise levels ($< 0.1\%$), while conserving sufficient spatial resolution to resolve solar granulation, we carefully used spatial, spectral, and temporal averaging, as well as a MOMFBD restoration (see van Noort et al. 2005). We compare our findings in the Sr I line with the neighboring, but not scattering sensitive Fe I line at 4607.6 Å.

Our statistical analysis of Stokes Q/I signals in the line core of Sr I reveals that the polarization amplitude is correlating with the intensity of the continuum image. We find stronger linear polarimetric signals corresponding to intergranular lanes of the Stokes I image, which is in contrast to the findings of Malherbe et al. (2007) at $\mu = 0.3$.

The results have been published as an article entitled "Detection of spatially structured scattering polarization of Sr I 4607.3 Å with the Fast Solar Polarimeter" (Zeuner et al. 2018).

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