Towards solar many-line inversions

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Currently established practical noise values for unrestored spectro-polarimetric data are ranging from 10^{-3} to 10^{-5} of the continuum intensity (For instance: van Noort 2012, Iglesias et al. 2016). At the highest spatial resolution and after the application of spectral image reconstruction, the absolute noise number typically resides more in the 10^{-2} regime. In this contribution we discuss how the increased absolute noise numbers can be mitigated.
In contrast to stellar physics, for the analysis of spatially highly resolved solar spectra the simultaneous observation and inversion of only a few (often only one) spectral lines is still the norm. In this contribution we present the first diffraction-limited spectro-polarimetric data from FISS-SP, a slit-scanning instrument at the 1.6m Goode Solar telescope, and for the first time we combine the simultaneously observed information of more than 80 lines. In comparison to the results from an inversion using only a line doublet, we find more fine-structure and a better constrained atmospheric configuration (i.e., in terms of consistency and physicality).
The line-selection process and the interpretation of the fit results is not straight forward. We will discuss some of the issues, implications, and findings.