Quiet Sun magnetism seen with Mn lines with strong HFS coupling

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Many of the atomic levels of the Mn atom show a strong hyperfine coupling which translates into asymmetries in the line shape of transitions between those atomic levels.

In a previous paper we demonstrated that the Zeeman effect of those levels is of the order of the hyperfine coupling in terms of energy differences.

As a consequence the atomic levels pass from a hyperfine dominated regime to a Zeeman-dominated regime (the Paschen-Back limit) for field strengths in the order of those expected in the solar photosphere.

In observational terms the transition corresponds to changes in the shape of the observed Stokes profiles that are exclusively related to field strength.

These lines show therefore amplitude changes in their Stokes profiles proportional to the magnetic flux and shape changes proportional to the magnetic strength.

This is of great diagnostic potential. We exploit them in observations taken with the ASP spectropolarimeter in a quiet sun region to determine the filling factor of the weak (500G) and strong (1500G) components of a toy model distribution for the photospheric network and internetwork regions of the observed map.

While in the network we find a similar filling of the pixel by strong and weak fields, in the internetwork the strong component is at least one order of magnitude less important (in volume terms) than the weak component.