Spectropolarimetric diagnostics of photospheric magnetic fields from the Hanle and Zeeman effects

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Abstract

We present results of spectropolarimetric studies aimed at determining the magnetism of the photospheric regions that look “empty” in solar magnetograms, that is, the Sun's “hidden” magnetism. First, we analyze the Hanle effect in the Sr I 460.7 nm line, one of the Ti I multiplets and molecular lines. Then, we report on the quiet Sun magnetic fields seen by “Zeeman eyes”. We pay special attention to the spectral region around 1083.0 nm. It is a powerful diagnostic window which contains information coming simultaneously from the chromosphere (He I 1083.0 nm triplet) and from the photosphere (Si I at 1082.7 nm). We conclude that the strength of the hidden field fluctuates on the spatial scales of solar granulation, with rather weak fields above the granular regions, but with a distribution of stronger fields in the intergranular regions. The ensuing magnetic energy density is so significant that the energy flux turns out to be substantially larger than that required to balance the chromospheric energy losses