P 14

FLUX TUBE DIAGNOSTICS BASED ON INFRARED H-BAND LINES

K. Muglach, Institut für Astronomie, Universität Graz, Austria

S. K. Solanki, Institut für Astronomie, ETH–Zentrum, Zürich, Switzerland

We present the results of an analysis of a spectrum covering 1.5–1.8μ (H-band) in Stokes I and V, obtained at solar disk centre in the network with a Fourier Transform Spectrometer. See Stenflo et al. (1987) for a description of the data. By analysing the Stokes V profiles we obtain information on the magnetic elements in the observed region. The analysis includes a statistical approach based on a regression of the line parameters of all (i.e. approximately 100) identified unblended iron lines in the H-band, as well as numerical transfer calculations of the Stokes parameters of selected line. We obtain the following main results:

1. The zero-crossing wavelengths of the lines are shifted by less than 0.25 km s^{-1} on average from their rest wavelengths. Therefore, in contrast to earlier results (Harvey, 1977; Stenflo et al., 1987) we can clearly say that the H-band lines are consistent with an upper limit of 0.25km s^{-1} on downflow velocities in solar flux tubes.

2. The Stokes V profiles are found to be asymmetric, with stronger blue wings than red wings. Both the amplitude and area asymmetry are analysed. Whereas the amplitude asymmetry behaves relatively similarly to that of lines in the visible, the area asymmetry is approximately a factor of two smaller.

3. The Zeeman splitting substantially affects the widths of the Stokes V profiles of H-band lines in the solar network. The weak field approximation breaks down for lines with $g_{\rm eff} \gtrsim 0.5$–1.0, but only lines with $g_{\rm eff} \gtrsim 2.0$–2.5 can be considered completely Zeeman split. The majority of the lines therefore is in a state of intermediate Zeeman splitting in flux tubes, like the 5250.2Å line in the visible. A regression analysis of the Stokes V profiles gives kG field strengths.

4. Test calculations have shown that the Stokes V profiles can be used to set limits on the temperature in the deeper layers of flux tubes. By comparing the observations to synthetic profiles calculated in models which differ only in their lower layers, but correspond to the Network flux tube model of Solanki (1986) in their upper layers, we have been able to set an upper limit on the continuum contrast $\delta_c = I_c^{\rm Fluxtube}/I_c^{\rm Quiet}$. $\delta_c \lesssim 2$ at the 2σ level and $\delta_c \lesssim 1.75$ at the 1.5σ level. Only a very low lower limit of $\delta_c \gtrsim 0.8$ can be set.

5. The macroturbulence broadening of the Stokes V profile is found to be of the order of 2km s^{-1} and is therefore of the same order as in the visible (a microturbulence of 1km s^{-1} was assumed).

References

Stenflo, J.O., Solanki, S.K., Harvey, J.W.: 1987, *Astron. Astrophys.* **173**, 167

Solanki, S.K.: 1986, *Astron. Astrophys.* **168**, 311

Harvey, J.W: 1977, in *Highlights of Astronomy*, E.A. Müller (Ed.), Vol. 4, Part II, p. 223