SPECTRAL LINES: DIAGNOSTICS

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SUMMARY

I discussed three aspects of employing spatially-averaged solar lines as diagnostics of small-scale photospheric structure:

(i) - partial redistribution vs. turbulence. Coherency in the inner wings of scattering lines increases not only the profile sensitivity to the poorly known collisional damping (as compared to complete redistribution); it also increases the profile sensitivity to the poorly understood microturbulence, by a sudden change in source function at the edges of the Doppler core. Are all unknowns that are fudged together into apparent "microvelocities" indeed Doppler-redistributing? How does their apparent anisotropy come in?

If the "horizontal" microturbulence increases towards the chromosphere, it should cause redistribution-enhanced emission cores that are not observed (Rutten and Milkey 1979), so is the chromospheric micro rather macro?

(ii) - advertising the extreme limb. Diagnosing subtle radiative transfer phenomena is easier if they cause a change of sign, i.e. emission. The extreme solar limb shows many interesting photospheric emission features, and merits more attention. Examples: normal Fe I, Al I lines show PRD wings (Rutten and Stencel 1980); weak Fe II lines show pumping from below (Cram et al. 1980); Canfield's (1969, 1971) classical Ce II analyses remain the most clearcut example of photospheric NLTE at work.

Pierce's (1968) list is largely a compilation of photospheric NLTE lines. The recent KPNO linear-polarization data are in particular of interest (Stenflo et al. 1983a, 1983b).

(iii) - quality of mean models. The current spatially-averaged model atmospheres show a split for the upper photosphere: the HSRA, VAL-IIM and VAL-IIIc models are all alike and cool, whereas the Bell et al., Ayres Ca II H&K and Holweger-Müller models are all alike but hot.

The latter model, most popular with abundance determiners, is wrong through misinterpretation of Fe I line formation and in fact supports the HSRA (Rutten and Kostik 1982); the theoretical Bell et al. model may well be wrong by assuming LTE and RE (Nordlund, private opinion). If Ayres' H&K modeling is also wrong, are then the cool models perhaps not too bad in the upper photosphere? There, granules have subsided, fluxtubes haven't expanded yet, and waves are the major dynamical-

structural phenomenon - perhaps not too badly mimicked by micro-macro turbulence?

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