EFFECTS OF FLUX TUBES ON CONVENTIONAL CHROMOSPHERIC DIAGNOSTICS

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Abstract

Magnetic flux tubes are usually envisioned as small discrete structures sparsely distributed throughout an otherwise uniform "intertube" medium. An important distinction between the flux tubes and the surrounding atmosphere is the presence of a strong chromospheric temperature inversion at high pressures in the flux tubes, while the intertube component has only a mild, low pressure chromosphere, if any at all. This implies that the flux tubes will be enormously brighter in conventional chromospheric diagnostics than the intertube component. However, the unresolved magnetic elements cover perhaps only 10% of the "quiet" Sun at chromospheric heights. Consequently the intense K and k emission cores are severely diluted. The net result is a weak emission reversal that is not characteristic of either the flux tube or intertube chromosphere. Even in the thermal microwave continuum longward of 100 μm, the flux tubes can contribute significantly to low spatial resolution spectra. Consequently, the spatially averaged microwave emission is also not characteristic of either of the distinct components.

If magnetic flux tubes are indeed the dominant class of atmospheric inhomogeneity in the Sun and other cool stars, then single-component interpretations of spatially unresolved data can be completely misleading, especially for inferring important auxiliary quantities, for example chemical abundances, line broadening parameters and chromospheric energy budgets. In the latter case, chromospheric radiative cooling rates derived from empirical mean models could be overestimated by up to an order of magnitude.

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