NON-STATIC STRUCTURE OF THE CHROMOSPHERE-CORONA TRANSITION REGION

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Abstract. The emission measure $Ne^2\,dh$, which is so useful in reducing XUV as well as radio data, is redefined as $f(T)\,dT$ where $f(T)$ is called 'thermal emission measure'. Theoretical predictions for $f(T)$ on the basis of a simple, one dimensional, steadily expanding atmosphere are presented. Depending upon the boundary conditions, and essentially upon the mass flux, two very different behaviours show up.

(1) With a mass flux compatible with an extrapolation of the solar wind flux, $f(T)$ would correspond to a transition region controlled by a constant conductive flux. It can be fitted, as was shown e.g. by Athay (1966), with the XUV observations of the integrated disk for lines formed at temperatures higher than about 2×10^5 K.

(2) But only with a mass flux enhanced by a factor of 50 to 100, can we interpret the radio spectrum and the XUV observations of lines formed at temperatures less than 2×10^5 K.

The suggestion is made that a single model can reconcile both behaviours: below 2×10^5 K the emitting region is squeezed so that it covers 1–2% of the surface that it occupies at higher temperatures where all structures begin to merge, filling the whole corona. This variation with height compares with usual models derived from spatially resolved observations; as usual the underlying magnetic field is expected to support this channelling.

DISCUSSION

Kundu: I'd like to make a comment about the radio model of Lantos and myself based upon center-to-limb brightness distributions at 1-, 3-, and 9-mm wavelengths. It will also answer the remark made by Dr Jefferies to the effect that the radio observations are not in accord with optical models. Indeed, Lantos and myself have shown that using the model of Avery and House on the spicular density and temperature and using a much higher relative surface area occupied by spicules (40–50%) below the transition region, the millimeter brightness distributions can be explained. It seems that the magic parameter is the relative surface occupied by spicules which increases rather sharply from about a few per cent to about 40–50% below about 2000 km – the transition layer.

Schmidt: I think what Dr Kundu has said is completely right but it has to be separated completely from solar wind fluxes, which concerns much more external layers.

Zirin: In response to both these remarks, I would like to point out that although one can perhaps match the lack of millimeter limb brightening, the point that Simon and I made some years ago is that we have the same problem through the entire radio range, i.e. the lack of limb brightness at centimetric and decimetric wavelengths. In that range also we have a lack of limb brightening and we do not have a model to explain it. It may be that the amount of hot material is considerably less than the existing models attribute, and that leads me to this business of the hundredfold discrepancy with the solar wind. I find it very difficult to understand the existence of such a discrepancy when we hardly know really what spicules are, and I don't see any point in getting upset about it.

R. Grant Athay (ed.), Chromospheric Fine Structure, 91.