MODELS OF ACTIVE REGIONS IN THE TRANSITION ZONE FROM UV OBSERVATIONS

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The Harvard College Observatory UV spectroheliometer aboard the OSO-4 spacecraft has obtained the enhancement of active regions, i.e. the ratio of their intensity to that of the quiet Sun I_a/I_q, for several lines formed in the transition region between the solar chromosphere and the corona (The subscripts *a* and *q* indicate *active* and *quiet* regions, respectively.)

Using Athay's formulation (1966) for the flux (erg cm^{-2} s^{-1}) of a resonance UV line, and the expression $N_a/N_q = (F_a/F_q)^{2/3}$ (De Loore, 1970) for the relationship between mechanical energy flux F and electron density N, we derive the following equation:

$$I_a/I_q = \frac{(dh/dt)_a}{(dh/dt)_q} [F_a/F_q]^{4/3}.$$

Evaluating the temperature gradient for the quiet Sun from the Goldberg-Dupree (1967) model, and adopting the OSO-4 data for I_a/I_q, it is possible to deduce the temperature gradient in active regions, assuming appropriate mechanical energy flux ratios. Models of the active regions can then be obtained with some hypothesis about the boundary conditions.

For the temperature gradient in active regions to be steeper than the quiet Sun temperature gradient, F_a/F_q should not be less than 4; that is, the electron density enhancement amounts to a factor 2.5.

References

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Space Science Reviews **13** (1972) 638.