STRUCTURE AND PHYSICS OF SOLAR FACULAE

II. The Non-Thermal Velocity Field above Faculae

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(Received 19 February; in revised form 27 July, 1981)

Abstract. The OSO-8 satellite enabled us to study various characteristics of the profiles of Si II, Si IV, C IV, and O VI lines above active areas of the Sun, as well as above quiet areas, and to derive some physical properties of the transition region between chromosphere and corona (CCT): (i) The study of the lines shows a general tendency for the microvelocity fields on the average to be nearly constant for the heights corresponding to $T > 10^5$ K; however they seem to slightly increase with height in quiet areas, and decrease in active areas. (ii) A multicomponent model of the CCT is however quite necessary, and its geometry is far from being a set of plane-parallel columns. It is similar to an association of moving knots within the non-moving principal component of the matter. (iii) The proportion of mass, in the knots relative to that in the non-moving component, is several times larger in active regions than in quiet regions. (iv) In the knots, the non-thermal microvelocity fields are smaller in active regions and seem to decrease for $T$ increasing above $10^5$ K, contrary to what happens in the steady principal component. Of course, we consider that micro-turbulence and Doppler shift are two aspects of the same distribution of velocity.

a. Introduction

The general features of our program are described in Paper I of this series (Dumont et al., 1982) and some aspects have been given in a preliminary paper (Pecker et al., 1977). In the present paper, we limit our analysis to the inference of velocity fields from the line profiles. The use of line intensities to determine optical depths, electron densities and other parameters of models will be dealt with in Paper III, which will complete our study of the chromosphere-corona transition region (hereafter CCT). We study here only the kinematics of the CCT, i.e. velocity fields of all scales, above active and quiet regions.

The observed profiles have been decomposed, see Section 1 and Figure 2, in one, two or three gaussian profiles, giving us the possibility of a determination of macro and microvelocities. In Section 2, Figure 3, we have plotted the measurements of the micro-turbulence fields ($\xi$) as a function of the temperature $T$, which shows an interesting phenomenon: The average $\xi$ values do not increase when $T > 10^5$ K and no significant difference is visible between quiet and active regions. The large scale velocity is then
Fig. 1. Observed line profiles. Top: An observation of the two lines of C IV (154.82 and 155.18 nm). Bottom: An average of 200 successive profiles of the O VI 103.2 nm line. In both figures we show profiles from active (A) and quiet (Q) regions near the center of the Sun. Intensities are in arbitrary unit.