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I. PHYSICS

Astrophysics (Solar Chromosphere)

DETERMINATION OF THE ABUNDANCE OF HELIUM IN THE SOLAR CHROMOSPHERE AND STRUCTURE OF THE TRANSITION REGION BETWEEN THE CORONA AND THE CHROMOSPHERE

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PRIMARY objective of this observation is to determine the abundance of helium relative to hydrogen, using chromospheric emission lines in the visible wavelength region. Although the solar helium abundance is related to such important problmes as the solar neutrino, the evolution of solar system and the abundance variation in the solar wind, it is poorly known in the solar atmosphere that the latest determination from solar prominences gave the helium to hydrogen number ratio to be 10 ± 2.5 per cent (Heasley & Milkey, 1978) and 16 ± 4 per cent (Hirayama *et al.*, 1978). Our observation is a result of the natural question whether the abundance derived from the chromosphere coincides with either one of the above values. Older observations are insufficient because data are lacking at the highest layer of the chromosphere or at the top of the spicules where the abundance can be well determined (Hirayama, 1972).

Secondary objective is to determine the height of the transition zone by the change of the gradient of the hydrogen emission lines.

Third one is to see where the helium lines of He II 4686 and He I 4713 originate by measuring line widths from the grazing incidence spectrograph in which the height extension of the chromosphere is compressed relative to intrinsic line profiles (Suemoto & Hiei, 1962).

Keywords : Chromospheric Emission Lines; Solar Neutrino; Hydrogen Emision Line Gradient.

EQUIPMENT

(1) 60cm slot spectrograph fed by a 30cm coelostat and 20 cm Cassegrain objective (f/15), with a dispersion of 0.038 mm/Å in the second order covering from 3200Å to 6600Å. Long frame camera (16cm) was driven at the maximum speed of 1.8 sec/frame. Kodak Tri-X 35mm film.

(2) 3.5m spectrograph (f/27) fed by the same coelostat with a grazing incidence objective grating incident angle being 75°.

Dispersion 0.45mm/Å, covering only He I 4713Å and He II 4686Å lines, 35mm Nikon motor-driven camera with Kodak Tri-X film at the maximum speed of 1.5 sec/frame.

SUMMARY OF PRELIMINARY RESULTS

Although at the totality the sun was covered with high cumulous clouds, we were able to secure the whole series of the flash spectra by lengthening the exposure

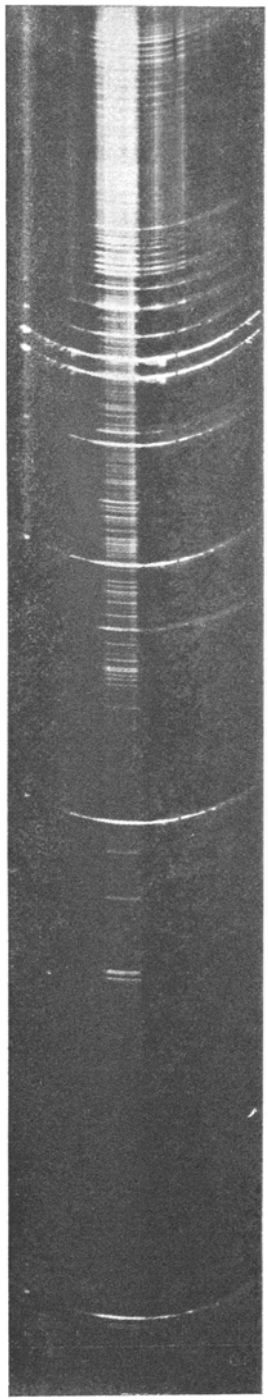

FIG. 1

time by three times (Fig. 1). The objective will be satisfied because we are mostly interested in relative intensities while the absolute scale is highly uncertain.

Flash spectra taken with the grazing indicence objective grating spectrograph have all been measured and the primary result as shown in Fig. 2 is that the doppler width of the He II 4686 is much wider than that of He I 4713 except in the low chromosphere in contrast to the case of quiescent prominences where Hirayama and Nakagomi (1974) obtained the same widths in He II and He I. However, the widths of He I 4471 show that it is emitted fairly low temperature region in accordance with the case of quiescent prominences : the observed doppler width of 10km-^{1} can

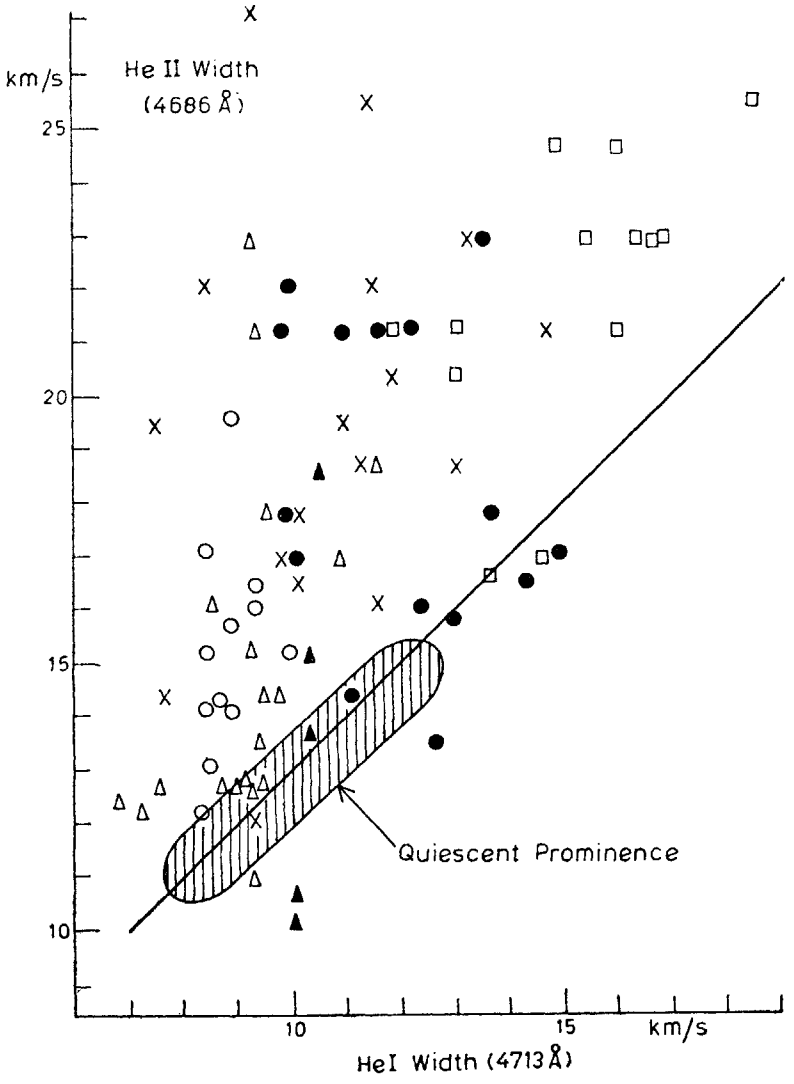

FIG. 2

be interpreted as the sum of a thermal width of 8000k and a non-thermal motion of $8.2 km^{-1}$.

The helium abundance problem and other problems will be studied subsequently using flash spectrum taken with the 60cm slot spectrograph.

Location

San Marco Project of the Italian Rocket Range, near Malindi, Kenya (2°59′38″ S, 40°11′ 38″ E and 7.3m above sea level).

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