ON THE WAVELENGTH OF THE GREEN CORONAL LINE - Fe XIV

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ABSTRACT. A wavelength of the green coronal line (Fe XIV) has never been determined in a laboratory. It was deriwed only from observations and results, although of a few, are different. We used for a determination of wavelength of this line spectral observations from Lomnický Štít coronal station on July 31, 1981. From this observations more as 2990 spectra have been measured, and in the places, where its intensity was more as 20 coronal units (n = 482), the wavelength was determined. We obtained following value: λ = 530.2765 nm.

О ДЛИНЕ ВОЛНЫ ЗЕМНОЙ КОРОНАЛЬНОЙ ЛИНИИ - Fe XIV. Длина волны зеленой корональной линии никогда не была определена в лаборатории. Определения основаны на наблюдениях и очень отличаются друг от друга. Для определения мы применили спектральные наблюдения из корональной станции Ломницки штит 31-ого июля 1981 г. Из этого наблюдения были промерены 2990 разрезов спектра и в местах, где интенсивность линии превышала 20 корональных единиц (n = 482), была определена длина волны. Мы получили величину: λ = 530.2765 нм.

O VLNOVEJ DĹŽKE ZELENEJ KORONÁLNEJ ČIARY - Fe XIV: Vlnová dĺžka zelenej koronálnej čiary nikdy nebola určovaná v laboratóriu. Všetky určenia vyplývajú z pozorovaní a jeden od druhého sa veľmi líšia. Pre naše určenie sme použili spektrálne pozorovania z koronálnej stanice Lomnický Štít, ktoré boli vykonané 31. júla 1981. Z týchto pozorovaní sme premerali 2990 spektier a v miestach, kde intenzita čiary presahovala 20 koronálnych jednotiek sme určili jej vlnovú dĺžku (n = 482). Dostali sme výsledok: λ = 530,2765 nm.

The introduction of modern methods of processing and computer technology into procedures of treating the results of observations has made it possible to solve problems which have hitherto proved unsolvable due to their laboriousness.

One of these problems was the more accurate determination of the wavelength of the green coronal line. This wavelength is required in determining the radial velocities in the corona from the Doppler shifts of the emission line. The existing results are given in Tab. 1 which we mostly adopted from Livingston's and Harvey's paper (1982).

Table 1

Published wavelengths of the green line

	eclipse	note
530.31	1893-1918	
530.280	1918	
530.30	1918	
530.280	1926	
530.29	1929	
530.30	1930	
530.291	1930	
530.285	-	outside eclipse
530.277	1936	
530.32	1936	
530.286	-	outside eclipse
530.19	1952	
530.34	1965	
530.2775	-	outside eclipse
530.281	1973	

To determine the wavelength, we used the observations of July 31, 1981, in which the Lomnický Štít coronograph recorded 144 spectra in the neighbourhood of the green coronal line with a dispersion of 0.59 nm/mm. The spectra were processed in Bulgaria using a Joyce-Loebl microdensitometer.

In taking pictures with the coronograph, the spectrum of the corona is obscured by the spectrum of the diffused light of the photosphere in the atmosphere (the aureola spectrum). We assumed that the aureola was formed by the light of the whole solar disk, that the absorption lines were not affected by solar rotation, and that they can, therefore, be used as reference lines. The absorption lines of the aureola interfer with the emission line of the corona and, therefore, before actually determining the wavelength we have to reconstruct the shape of the emission line.

We shall demonstrate the measurement and processing procedures on Fig. 1. In each of the spectrum records we made photometric sections from a height of 40" above the photosphere up to the height at which the emission line is ob-

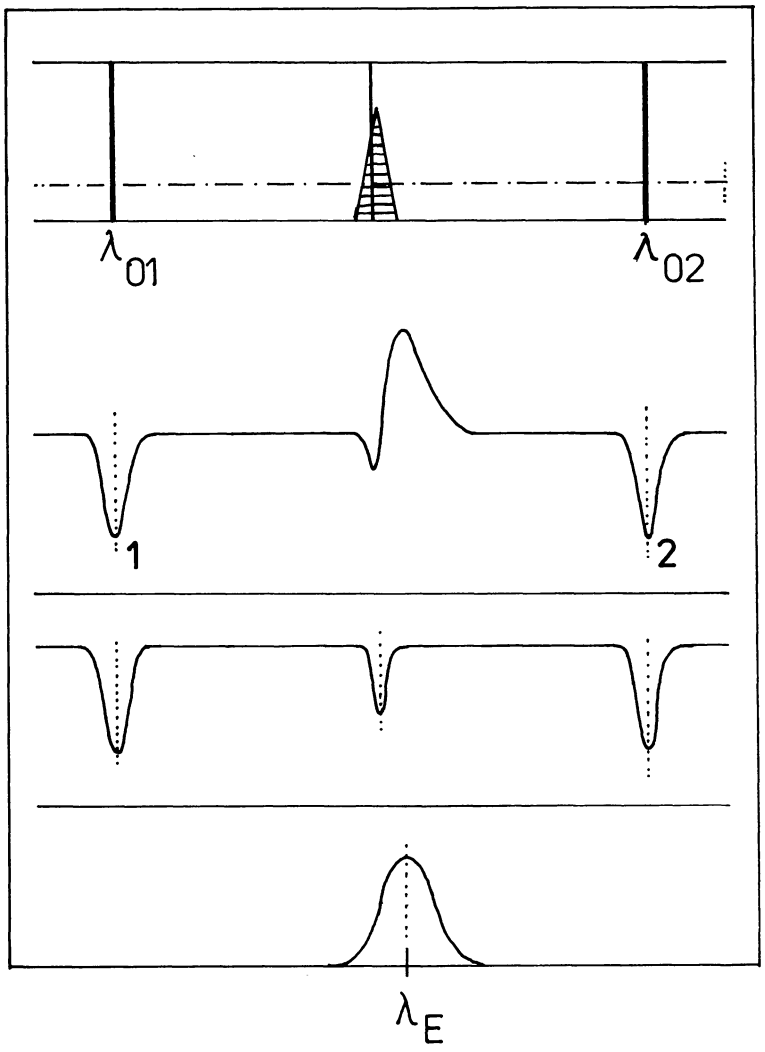

Fig. 1: The principle of the wavelength determination.

scured by the background noise. The distance between the sections was 5". The section contained 650 measuring points. Lines 1 and 2 (528.17979 nm and 531.66801 nm) served to determine the wavelength scale and the instrument distortion. These parameters were used to reconstruct the background spectrum, and by subtracting it from the values of the intensities of the photographed spectrum, we obtained the pure profile of the coronal emission line. The details of the processing procedure will be published elsewhere (Rybanský et al. 1986).

The profile of the emission line can be approximated by the Gauss function

$$i(\lambda) = i_o \exp \left\{ - \left[(\lambda - \lambda_o)/\delta^2 \right]^2 \right\} , \qquad (1)$$

where parameter λ_o is the wavelength being sought.

Using this procedure, we processed a total of 2990 photometric sections. However, to determine the wavelength, we only used those whose total observed intensity was larger than 20 coronal intensity units. There were 220 such sections above the E-limb and 262 above the W-limb. We determined the resultant wavelength as the average of the averages above the E and W-limbs, and arrived at the following value:

$$\lambda = 530.2765 \text{ nm} \pm 0.0005 \text{ nm}.$$

The standard deviation of the -values and the extreme values correspond to radial velocities of 2.3, - 6.6 and +11.2 km s^{-1}. The accuracy of the determination was estimated from the results of repeated measurements.

REFERENCES.

Livingston, W. and Harvey, J.: 1982, Proc. Indian natu. Sci. Acad., 48, Supplement No. 3, 18.

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DISCUSSION

M.A. Mogilevsky
Удалось ли обнаружить вращение короны ?

M. Rybanský
Удалось, но точность низкая. Дифференциальное вращение не заметно.