A NOTE ON THE EFFECT OF SCATTERED LIGHT ON THE FACULA-TO-PHOTOSPHERE CONTRAST

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The measured facula-to-photosphere contrast in the continuum radiation corrected for the scattered light should yield a hotter average facula model than the models derived without such a correction.

Заметка к влиянию рассеяния света на контраст фотосфера-факел. Измеренный контраст фотосфера-факел в непрерывном излучении, исправленный на рассеянный свет, может привести к более горячей в среднем модели факела чем модели, полученные без такой поправки.

1. *Introduction*

Using an approach exactly identical to that of Kneer and Mattig (1968, hereafter abbreviated as KM) we conclude that applying proper corrections for scattered light the true facula-to-photosphere contrast C_t can be obtained from the measured contrast C_m in the continuum radiation. The aim of this note is to discuss the consequences of such a correction to the measured facula-to-photosphere contrast data. The scattered light is taken to be essentially photospheric and to originate in the earth's atmosphere and the instrument. It appears that the corrected contrast data will lead to a hotter average facula model than the one derived with the help of the uncorrected data.

2. *Effect of scattered light on the facular intensities*

For C_t and C_m we can write:

$$C_t = \frac{I_f(\varrho)}{I(\varrho)} - 1 \quad \text{and} \quad C_m = \frac{I'_f(\varrho)}{I'(\varrho)} - 1 .$$

From an equation identical to the equation (6) of KM, we can show that

$$C_t = \frac{C_m}{1 - A(\varrho)} . \tag{1}$$

Here $I(\varrho)$ and $I_f(\varrho)$ are the true photospheric and facular intensities, respectively, at a centre-to-limb distance ϱ while $I'(\varrho)$ and $I'_f(\varrho)$ denote the respective observed intensities uncorrected for the scattered light. The factor $A(\varrho) = KS(\varrho).\, I'(O)/I'(\varrho)$ accounts for the scattering in the atmosphere and the instrument. The significance of this term and the method for its determination have been discussed in KM.

3. *Discussion*

The possible method for obtaining the $I_f(\varrho)$ from the measured $I'_f(\varrho)/I'(\varrho)$ are as follows:

(1) Multiplying this ratio by a factor $[I'(\varrho)/I'(O)] \times$ $\times\, I(O)$. The value of $I(O)$ for the desired wavelength may be taken from some photospheric absolute energy distribution curve for the centre of the disk. If $I'(\varrho) : I'(O)$ and $I'_f(\varrho)/I'(\varrho)$ are obtained with the same instrument and under the same atmospheric conditions then the result of the above multiplication is $I'_f(\varrho)$, i.e., the uncorrected absolute facular intensity. As a variation of this method some authors (cf., e.g., Kuzminikh, 1964) have used $I'(\varrho)/I'(O)$ data obtained with a different instrument and at a different site than those for the actual $I'_f(\varrho)/I'(\varrho)$ observations. It is difficult to say what the resultant is if a product of the type $[I'_f(\varrho)/I'(\varrho)]\,[I''(\varrho)/I''(O)]\,I(O)$ is used. Obviously, the resultant is not equivalent to $I_f(\varrho)$.

(2) Making a product of the type $[I'_f(\varrho)/I'(\varrho)] \times$ $\times\, [I(\varrho)/I(O)]\, I(O)]$. This also does not lead to $I_f(\varrho)$.

To sum up, it is necessary to use equation (1) for obtaining the true contrast C_t from the measured contrast C_m. This means that the observations of $[I'_f(\varrho)/I'(\varrho)]\,[I'(\varrho)/I'(O)]$ and those needed for estimating $KS(\varrho)$ should be made with one and the same instrument and under the same atmospheric conditions.

Equation (1) shows that the true contrast will always be greater than the measured contrast, consequently, the true average facula model will be hotter than those derived from the uncorrected observations.

The study of the relative behaviour of various Fraunhofer lines in facula and photosphere should be reconsidered for the role played by the scattered light in such studies. The scattered photospheric radiation will modify the facular absorption line profiles and the extent of the correction needed may vary from one line to another. The observed diminution