THE WAVELENGTH DEPENDENCE OF GRANULATION (0.38–2.4 μm)

(Research Note)

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Abstract. Using 2 pinhole photometers the intensity of the undisturbed photosphere was recorded simultaneously in 6 and in 4 wavelength regions. The rms value of the intensity variation in each of the 10 wavelength regions decreases slightly with increasing value of the heliocentric angle; this result confirms recent observations by other authors and supports the critique of the results given by Edmonds (1964).

We report the detection of a secondary maximum in the wavelength dependence of the intensity variation at λ = 1.5 μm.

During 1974–76 we have recorded several series of scans across the solar disc, using the 35 cm tower telescope (Brahde, 1967) of Oslo Solar Observatory (Jensen, 1968). The solar image (≈27 in diameter) is focused on the aperture plate of one of two pinhole photometers; a six-channel photometer (Eriksen and Maltby, 1973) and a similar four-channel photometer. The wavelengths of the photometers are shown in Figure 2 (top). For each photometer channel the intensity is sampled with a ten bits AD-converter at a rate of 33 Hz, corresponding to 0.45 arcsec. The time constant of the system is 20 ms. Detailed descriptions of the data handling programs are given by Hansen (1976) and Albregtsen (1977).

We present here a series of observations obtained on August 16, 1976 (zenith angle 78°6–68°5) during good seeing conditions. For values of the heliocentric angle θ < 65° we have computed the normalized rms intensity variation

$$\Delta I = S/\{I\},$$

where S is the rms value of the variation in the recorded signal and \(\{I\}\) is the average value of the signal within 3 arc min. Figure 1 gives \(\Delta I\) versus θ for the wavelength region centered on 0.578 μm. A slow decrease in \(\Delta I\) with increasing value of the heliocentric angle is found for all 10 wavelengths. This result confirms the observations by Turon and Léna (1973), Pravdjuk et al. (1974) and Altrock (1975) and suggests that the results of Edmonds (1964) are doubtful.

The pinhole radius was 0°5 for the six-channel photometer and 1°0 for the four-channel photometer covering the wavelengths 1.55, 1.75, 2.11 and 2.40 μm.

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Fig. 1. The normalized rms intensity variation, $\Delta I$, at 0.578 μm versus heliocentric angle, $\theta$. The pinhole radius is 0.5.

Fig. 2. The rms intensity variation, $\Delta I$, as observed with a pinhole radius of 1′0 is plotted versus wavelength, $\lambda$, (---•---). For comparison the value of $\Delta I$ calculated by Musman and Nelson (1976) (----) is given. The wavelengths of the photometer channels are given at the top of the figure.