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PHOTOELECTRIC ANALYSIS OF THE SOLAR GRANULATION IN IR

Serge Koutchmy

AFGL/NSO/SP, Sunspot, New Mexico 88349 (USA)
and
Paris Institut d'Astrophysique, CNRS. France

ABSTRACT. Results of both image analysis and statistical analysis of 1D scans of the IR granulation observed in the opacity minimum region are briefly presented. The same technique was applied at 600 nm and results partially presented by Koutchmy and Lebecq, 1986, *Astron. Astrophys.* 169, 323. All observations were collected at the prime focus of the Sac Peak VTT using high signal-to-noise ratio measurements with a specially-designed pinhole PbS spectro-photometer; imaging has been made using both 2D scanning of the telescope and processed video-scans of an IR-vidicon. Images of the IR granulation and of sunspot umbral dots and penumbral filaments are presented for the first time. The main results are:

- A. 1. Uncorrected for the smearing RMS of intensity fluctuation at $1.75 \mu\text{m}$ are typically $\pm 2.1\%$; scans performed at $\cos \Theta = 1, .8, \text{ and } .7$, corrected for the foreshortening, show a slight decrease to the limb.
2. Power spectrum analysis of the IR scans shows evidence for more power at higher frequencies, and, conversely, less power in the low frequency tail.
3. Histograms of intensity fluctuations show a more pronounced than in the optical region "bi-distribution" of intensity variations corresponding to the dark intergranular lanes (with a larger number) and to the bright granules.
4. Cross-correlation analysis of the scans shows:
 - a. A typical lifetime of granules of 3.25 min instead of 6 min (decrement value) found at 600 nm with the same method.
 - b. Displacements of granules in rough agreement with the solar rotation.
5. Image reconstruction of a region observed around a sunspot at $\cos \Theta = 0.71$ shows a definite positive contrast of facular features at low spatial resolution.
- B. 1. Time sequences of IR diffraction-limited granulation images were obtained

at a slow rate of 2 images of 512x512 per sec (limited by the speed of the computer processing). Umbral dots were observed for the first time in the opacity minimum region with improved quality as far as image blurring and image motion are concerned when comparison is made with the visible image obtained simultaneously at 800 nm.

2. Although the ultimate spatial resolution achieved is far from what can be currently obtained with high speed photography in the optical region, the great advantages offered by working in IR (especially the gain offered in Zeeman sensitivity) make this technology very promising for sunspot and magnetic elements studies, including out-of-disc analysis.

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