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# ON A DIFFERENCE IN THE DIMENSIONS OF PHOTOSPHERICAL GRANULES IN THE VICINITY AND FAR FROM THE SUNSPOT PENUMBRA

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# ON A DIFFERENCE IN THE DIMENSIONS OF PHOTOSPHERICAL GRANULES IN THE VICINITY AND FAR FROM THE SUNSPOT PENUMBRA *

(FRANCE)

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(Presented by M. André Danjon)

Abstract 11369

A difference is noted between the dimensions of photospherical granules measured in the vicinity and far from the penumbra of sunspots. This phenomenon is attributed to the effect of the magnetic field of the spots.

* * *

One of us [1] found some years ago that the dimensions of photospherical granules are smaller in the vicinity of the penumbra of sunspots than those measured far from the spots. The cause of this difference in dimensions was attributed to the peculiar conditions existing in the vicinity of the spots, due to thermal gradients and more particularly to the intensity of the magnetic field. Dollfus [2] attributed that difference to intense radial magnetic fields, just as A. E. Danielson did [3] when utilizing photographs taken by the stratoscope and finding smaller dimensions for the granules in certain regions in the vicinity of a sunspot.

Working on solar granulation with the aid of a Gautier refractor of 40 cm aperture at the National Observatory of Athens,

* Sur une différence des dimensions des granules photosphériques au voisinage at loin de la pénombre des taches solaires.

we found on good quality photos very pronounced differences of character above in granule dimensions. In order to study this phenomenon relative to sunspot structure and to the intensity of their magnetic fields, we have selected four negatives among the best taken with the aid of the above-mentioned device by M. G. Banos, whose data are compiled briefly in Table I hereafter:

TABLE I

| No. | Date 1960 | U.T. | Filter (Å) | Heliographic coordinates | Emulsion |
|---|---|---|---|---|---|
| 1 | 31 May | 06h44'30" | 6000 | 10S -32 W | Duplopan-Gevaert |
| 2 | 22 Sept | 06 14 24 | 5250 | 20S-13 W | " |
| 3 | 22 Sept | 06 00 36 | 5250 | 19S - 25E | " |
| 4 | 22 Nov. | 08 05 45 | 6000 | 7N - 17 W | " |

The magnetic field intensity of the above sunspot groups was communicated to us by the Potsdam and Mount Wilson Observatories. The dimensions of granules were measured in the selected regions on the first negatives with the aid of observatory's Ridell measuring device.

Noted in the Figures 1 and 2 the regions where the dimensions of photospherical granules were measured: a and b refer to measurements made in the vicinity of spot penumbra and c — to those made far from it. On the photos 3 and 4, a and c point to regions in which measurements were respectively effected in the vicinity and far from the penumbra. The spots' magnetic field intensities and the results of measurements of granule dimensions are given in Table II (next page). These data allow the following conclusions:

The dimensions of photospherical granules in the vicinity of sunspots of complex structure and with intense magnetic fields are smaller than those measured far from the spots.

TABLE II

| Groupe - Date | Magnetic field intensity | Difference in granule dimensions | Mean error | Comments |
|---|---|---|---|---|
| 1. (31 May) | Mt.Wilson S 2200 G for 30, 7 May | c — a = 0"51<br>c — b = 0"43 | ±0"10<br>±0"16 | Complex struct. group |
| 2. (22 Sep) | Potsdam S2300-N2700 G (for 22, 4 Sep) | c — a = 0"84<br>c — b = 0"69 | 0"22<br>0"19 | Remarkable compl. structure group two nuclei of opposed magnet. polarity in the same penumbra. |
| 3. (22 Sep) | Potsdam S 2500 G (for 22, 4 Sep) | c — a = 0"21 | 0"12 | Unipolar spot of small surf. |
| 4. (22 Nov) | Mt.Wilson N 1500 G. (for 20, 3 Nov) Potsdam N 2500 G (for 24, 5 Nov) | c — a = 0"06 | 0"18 | Unipolar spot of small surf. |

The dimensions of photospherical granules in the vicinity of unipolar sunspot penumbra show to the contrary very small differences relative to the dimensions measured far from spots, even if they present intense magnetic fields.

It is quite probable that this difference in the dimension of granules in the vicinity and far from the penumbra of spots of complex structure (bipolar and multipolar groups) is due to the shape of magnetic fields and their intensity repartition. The nonexistence of appreciable differences between the dimensions of granules measured near and far from the penumbra of unipolar spots may be explained by

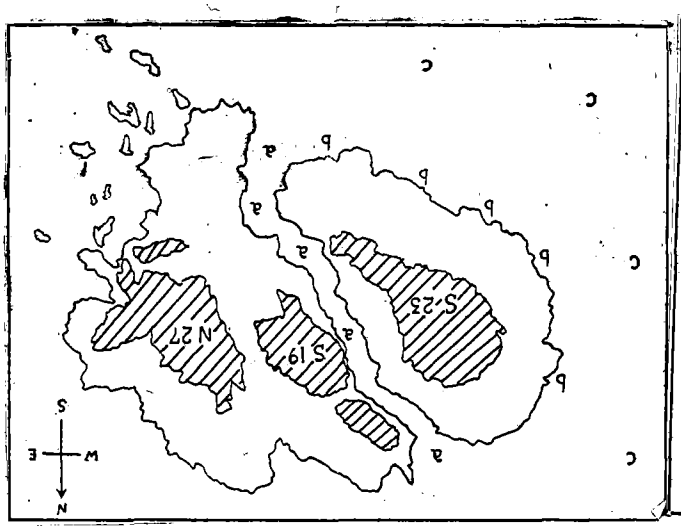


Fig. 1

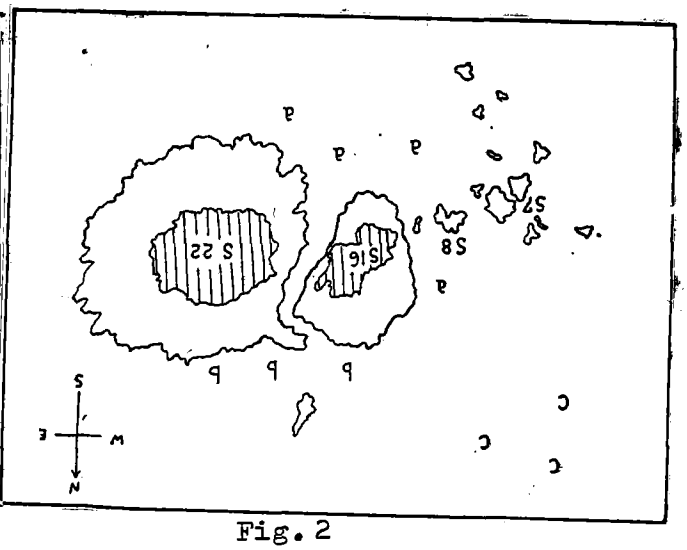


Fig. 2

the fact that, according to the law of variation of magnetic field intensity in simple and isolated spots, the latter becomes zero at about the limit of the penumbra and of the photosphere.

**** THE END ****

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