INTENSITIES, POLARIZATION AND ELECTRON DENSITY OF THE SOLAR CORONA DURING THE TOTAL SOLAR ECLIPSE OF 1961, FEBRUARY 15: (FINAL RESULTS) PAPER II

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RIASSUNTO. — Si riportano i grafici finali di log (K + F), log N, P_{K+F}, α, relativi alla corona solare fotografata durante l'eclisse di Sole del 15 febbraio 1961; si riporta inoltre il grafico dei coefficienti a + b, secondo Ludendorff, con il valore relativo ai nostri dati.

ABSTRACT. — We report final graphs of log (K + F), log N, P_{K+F}, α, related to the solar corona photographed at the total solar eclipse of February 15, 1961; further we report the graph of the Ludendorff's a + b coefficients with the value obtained from our data.

Concluding a previous publication ([1]) we have computed and drawn the final graphs of the solar corona, photographed during solar eclipse of February 15, 1961, specified below:

Figure 1 shows the isophotes of log $(K + F)$ in units 10^{-10} of the average brightness of the sun's disk; these isophotes have been obtained from three graphs in polarized light previously reported in ([1]) by means of the formula

$$\log (K + F) = \log H(a + b + c)$$

where a, b, c, are the intensities in the same point of the corona given from three polaroids having a position angle of 120° with respect to each other; $H = 62.09$ is the constant trasforming our photometric measurements in absolute units.

The reliability of our graph is shown by comparison with figure 2 which reports the isophotes obtained in integral light by Waldmeier ([2]) during the same eclipse: the good agreement of these results obtained by different methods is evident. Further, the small differences in the

(*) Ricevuta il 5 aprile 1963.

form of the isophotes may be imputed to the criteria adopted in interpolating between the scanning (whose intervals are probably different) on the plates, at the microphotometer.

Figure 3 shows the lines of equal electron density, in log N, computed by a formula found resolving the van de Hulst's integral equations, by means of the Volterra's method ([3]). The lines of this graph have sharper gradients than those of log $(K + F)$ graph, produced by the solution of integral equations: this fact has already been observed by van de Hulst ([4]) and is visible in the graphs of von Klüber ([5]).

These results for the polar zones and the streamers are only indicative; actually, while in both these regions the assumption of spherical symmetry in coronal brightness is lacking, for the streamers the polarization is not even radial: for this reason it would be preferable to use different equations, ([6]), ([11]), for computing the electron density. Nevertheless we may conclude that the values of log N reported for these zones are certainly lower than the actual ones ([6]), ([11]).

Graph of the lines of equal polarization, P_{K+F}, is shown in figure 4: these lines are obtained by averaging the observed values along each radius of the corona. We observe that the values of polarization are higher in the zones of the streamers: this has been observed already by Schmidt ([6]) and reported in ([4]). Further, close lines of equal polarization seem to appear in the same regions, like we can see also in the graph of von Klüber ([5]) for the eclipse of 1952.

In figure 5, deviations from radiality of polarized vectors, along various radii, are given. We note deviations of about 20° along the north solar pole, and more than 25° along and near the bright streamer in the north-east direction and in other points nearer to the sun's disk. These deviations have been discussed in our work ([1]), and other authors have found this same effect in past eclipses ([6]), ([7]).

Finally the figures 6 shows the Ludendorff's $a + b$ coefficients graph, against the phase of the solar cycle, reported by Kuiper ([4]). This graph, widely investigated and further correlated with the frequence of the solar prominences by Abetti ([8]) and Biozzi ([9]), shows the relation between the shape of the corona (by means of the « flattening » $a + b$, extrapolated at $r = 2$, in several eclipses) and the phase of the solar cycle. We have plotted the value $a + b = 0.18$ obtained from our observations: this value is near to the $a + b = 0.17$ found by Waldmeier ([2]), for the same eclipse and fits well in the graph.

All the computations for constructing the graphs have been done using the 1620 IBM electronic computer of the Brera Observatory in Milano, for which one of us has prepared a special program, detailed specifications of which are reported in another paper ([10]).

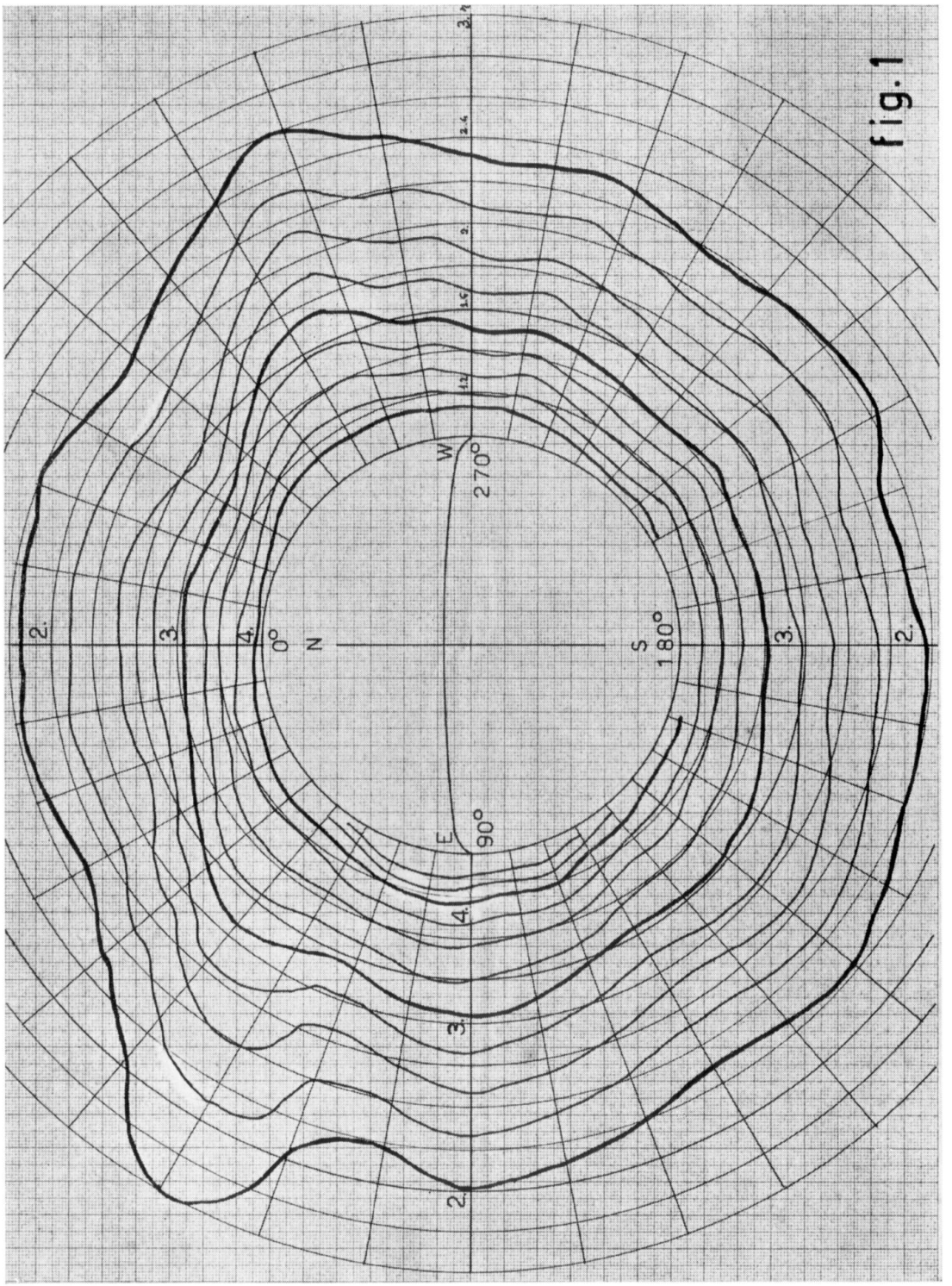

Figure 1: Isophotes of log (K + F) in units 10^{-10} of the average brightness of the sun's disk, for the solar corona during the total solar eclipse of 1961, February 15.

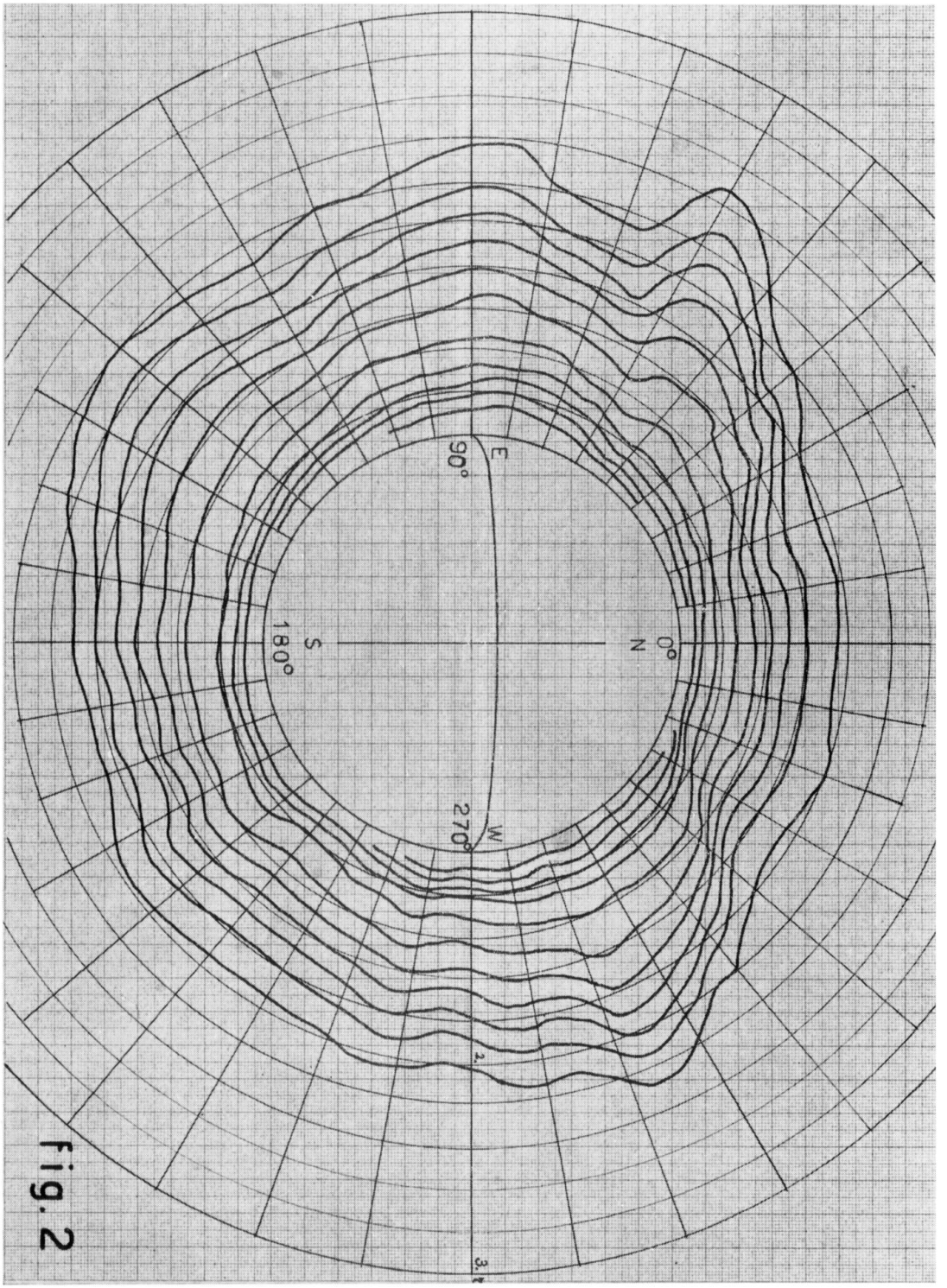

Figure 2: The isophotes obtained for the same eclipse by Waldmeier, in integral light.

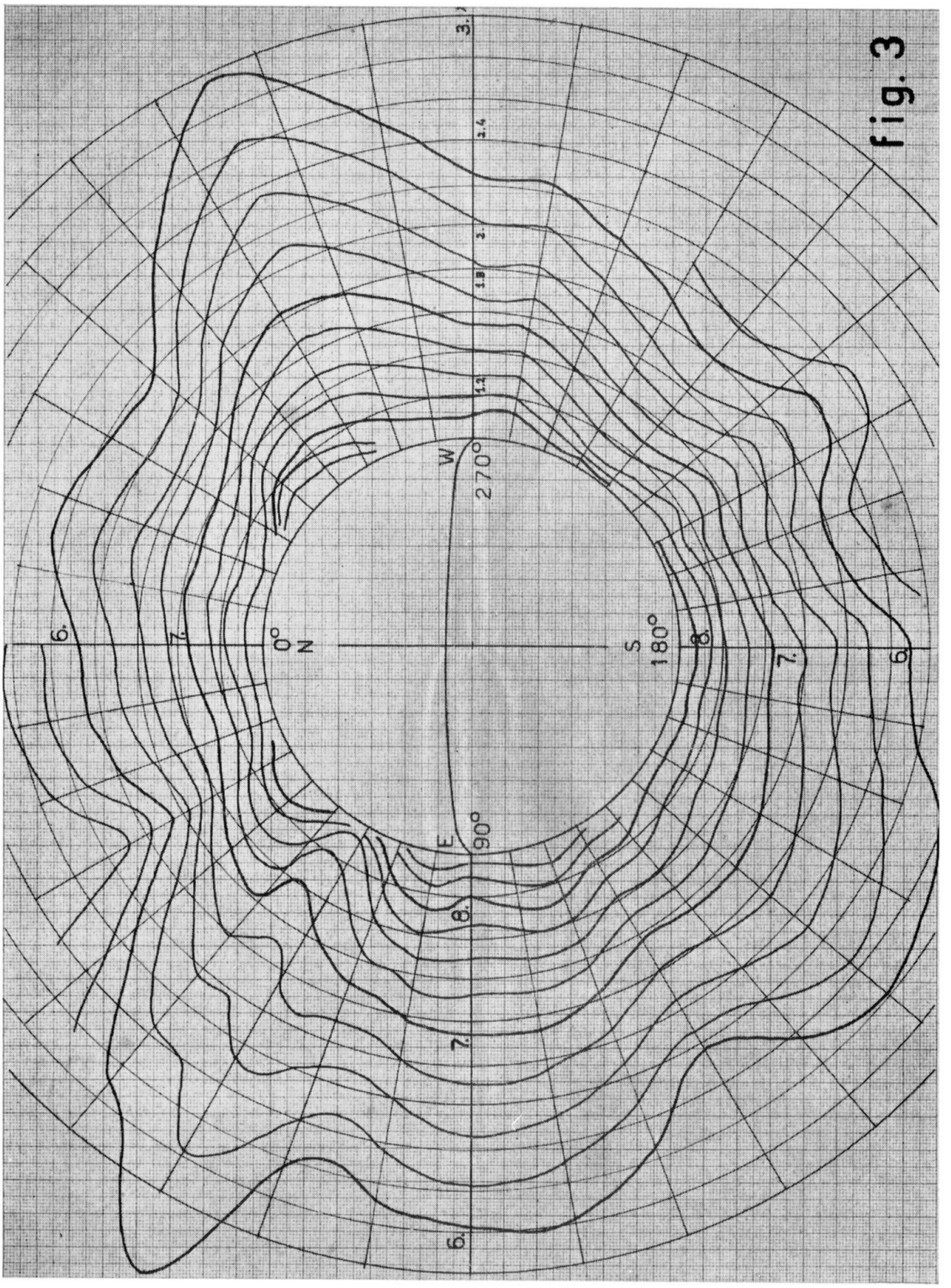

Figure 3: Lines of equal electron density, in log N, for the solar corona during the total solar eclipse of 1961, February 15.

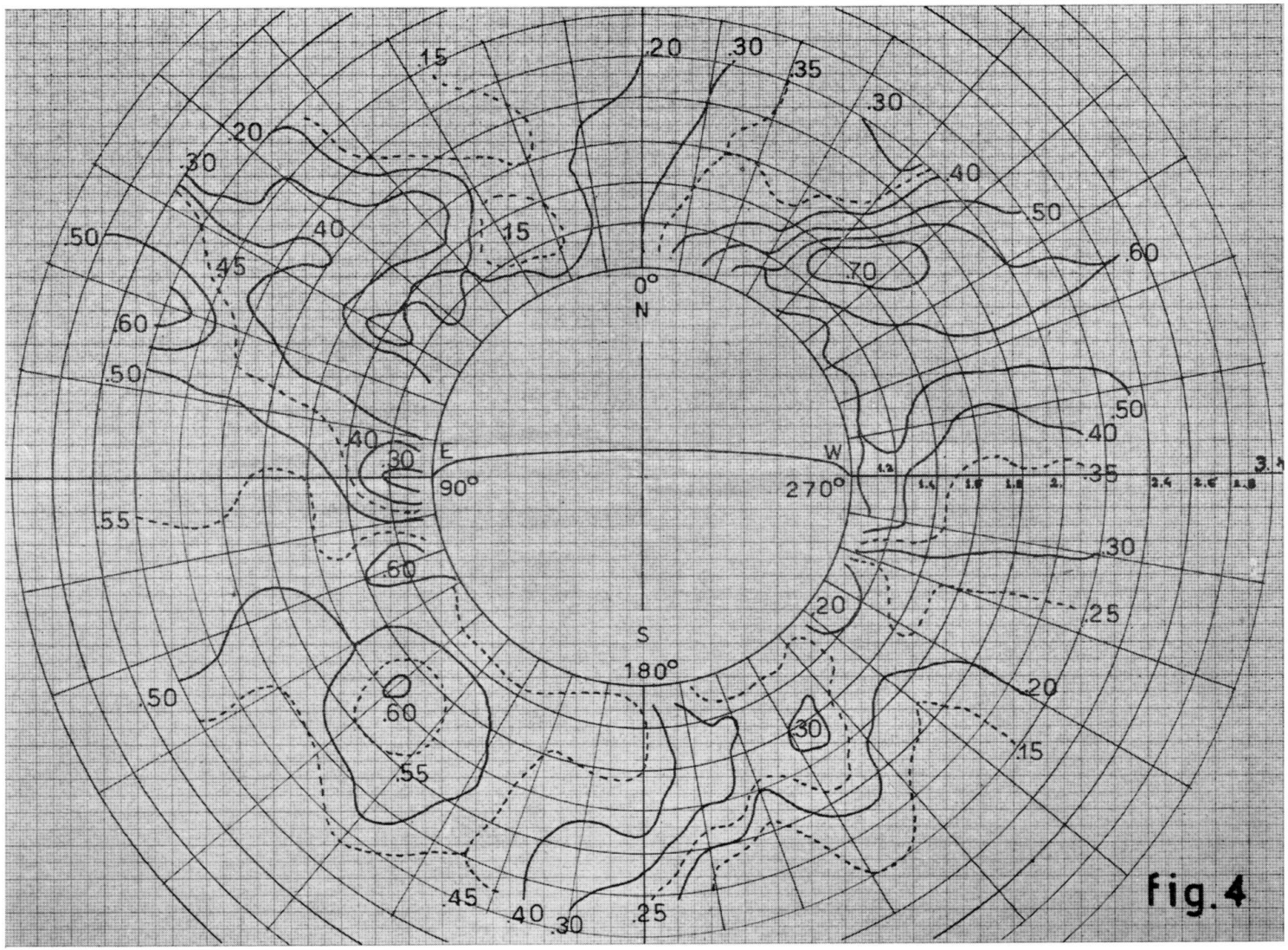

Figure 4: Lines of equal polarization, P_{K+F}, for the solar corona during the total solar eclipse of 1961, February 15.

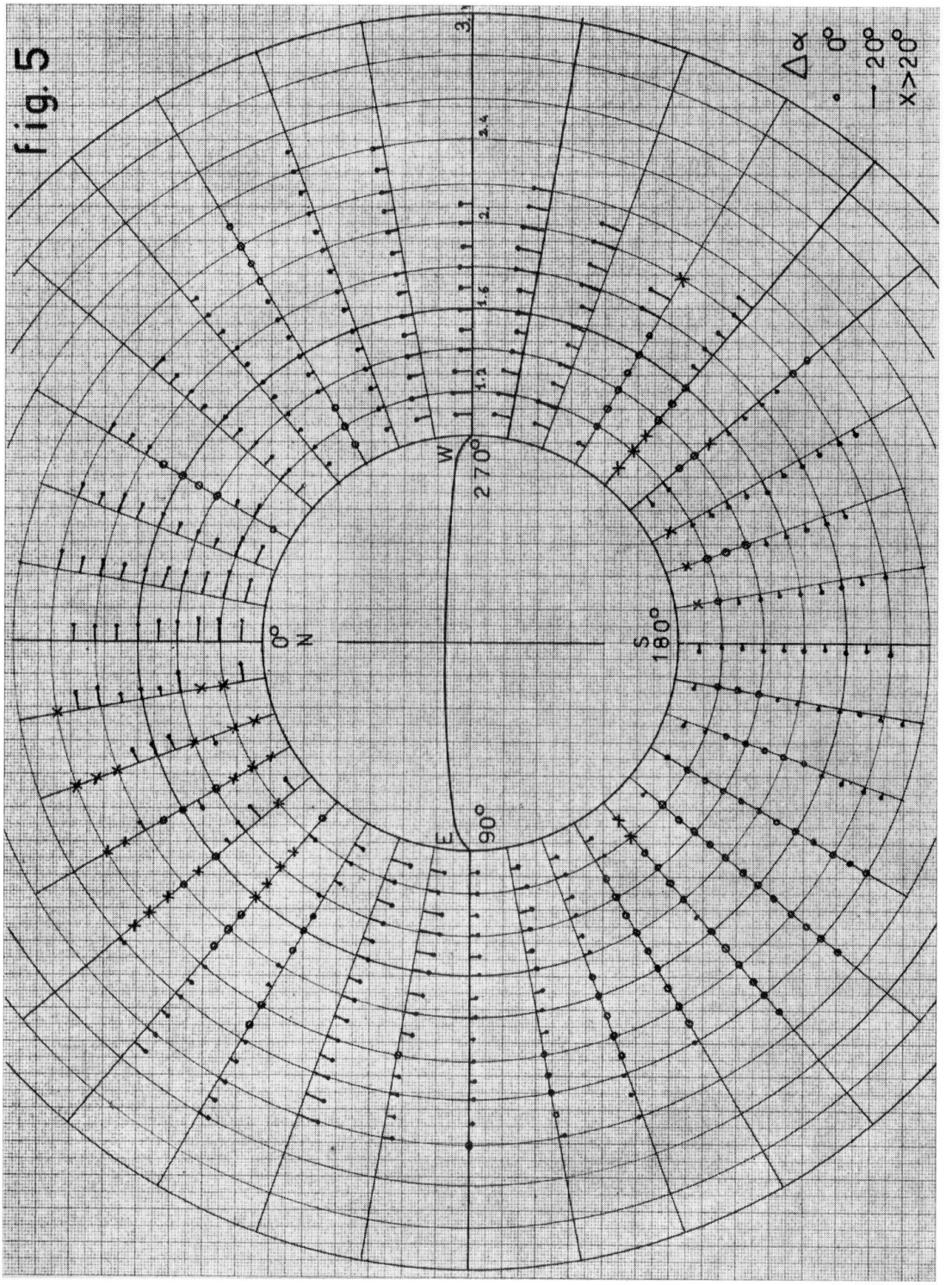

Figure 5: Deviations from radiality of polarized vectors, for the solar corona during the total solar eclipse of 1961, February 15.

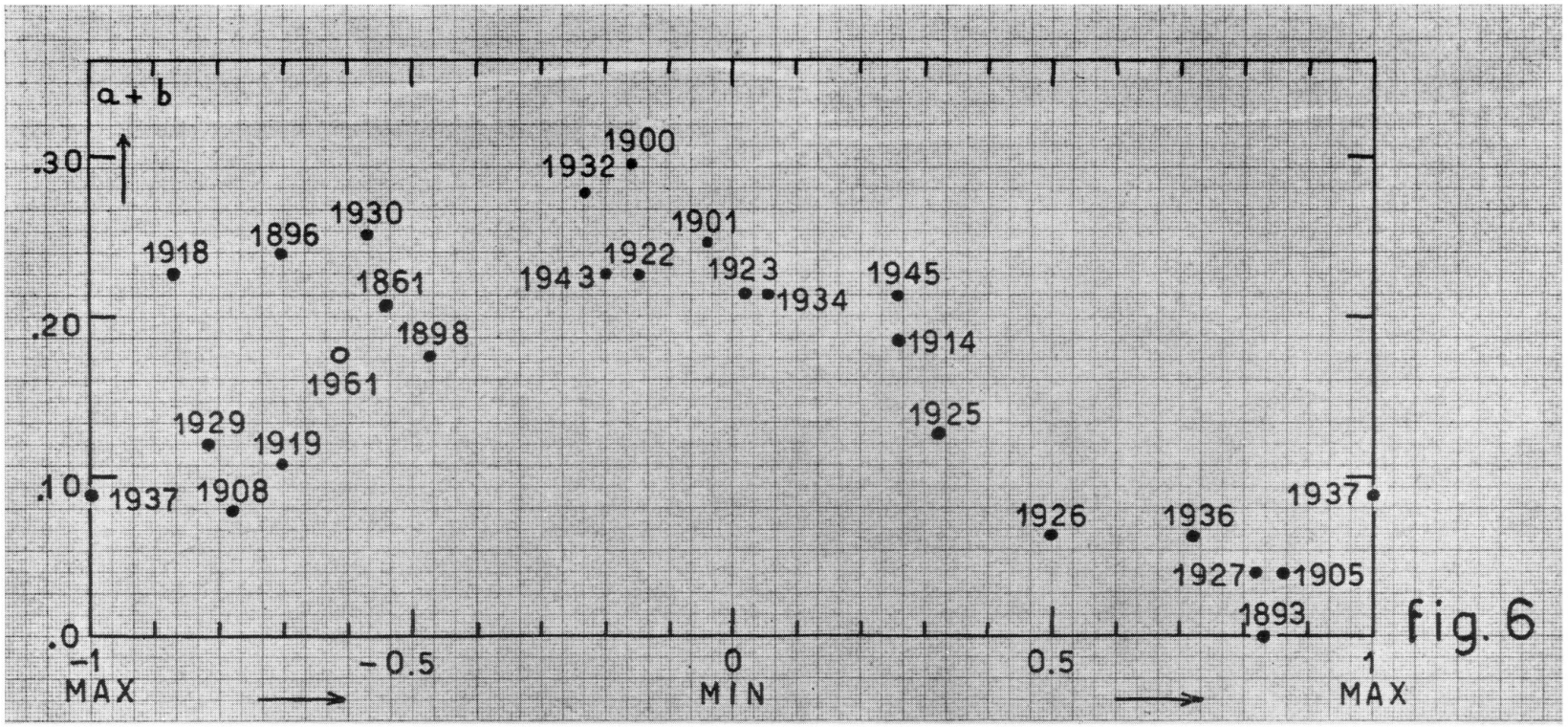

Figure 6: « Flattening » a + b coefficients (Ludendorff) against the phase of the solar cycle: in the cercle the value for the total solar eclipse of 1961, February 15.

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