

ELECTRIC CURRENT IN A SUNSPOT

(Research Note)

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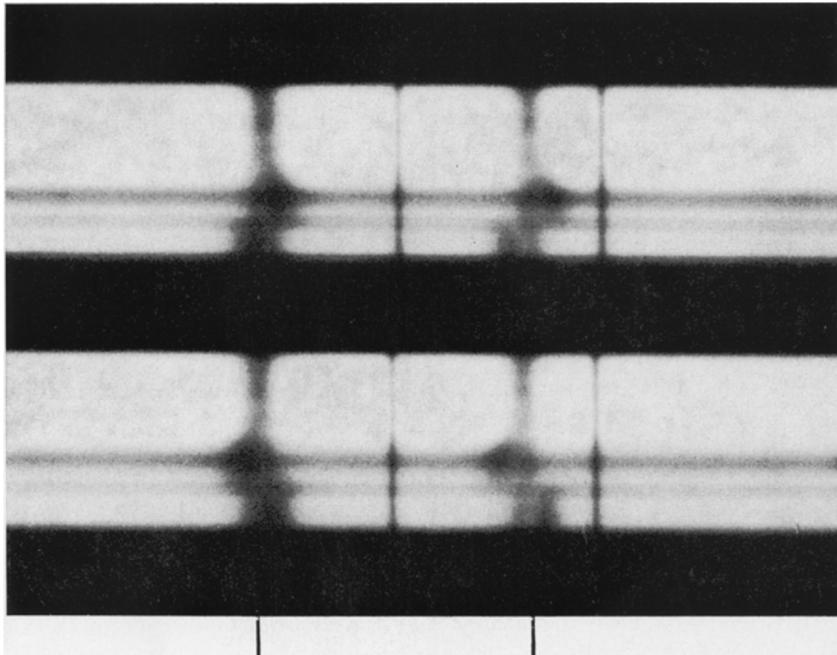
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An observation of a total electric current of magnitude 3.8×10^8 amperes per kilometer height in a δ -type sunspot is described.

On August 7, 1968, the Zeeman pattern in the iron line 6302.508 \AA of a δ -type sunspot at the position $N11^\circ, E15^\circ$ was photographed through a $\lambda/4$ plate and analyzer (Figure 1) with the vacuum spectrograph of the McMath-Hulbert Observatory.

In the two umbrae of opposite polarity, the magnetic field strength has the nearly uniform value of 2400 gauss. The reversal of field direction at the point of separation of the polarities is abrupt, indicating the presence of an electric current in the region of line formation.



6301.517

6302.508

Fig. 1. Zeeman pattern of the δ -type spot for orthogonal orientations of the $\lambda/4$ plate of circular analyzer. The umbra at the top is of N polarity.

The σ components seem to indicate fields entirely in the line of sight. The π component is present throughout the two umbrae; visual examination with a rotating polaroid revealed no polarization.

An electric current (calculated from the circulation of the magnetic field strength) of magnitude 3.8×10^8 amperes per kilometer height in the line forming region is necessary to account for the change in the magnetic field. This compares well with the theoretical estimate of Chapman (1943) for the electric currents generating sunspot magnetic fields.

Reference

Chapman, S.: 1943, *Monthly Notices Roy. Astron. Soc.* **103**, 117.