LETTERS TO NATURE

PHYSICAL SCIENCES

Search for Optical Circular Polarization in the Crab Nebula

IT has recently been suggested by Gunn and Ostriker[1] and by Rees (paper presented at the IAU symposium 46 on the Crab Nebula, Manchester, August 1970) that the magnetic field in the Crab Nebula which causes relativistic particles to emit synchrotron radiation may be an oscillating 30 Hz electromagnetic field from the pulsar rather than a static field. Rees has shown that if this is the case, the nebula should show a component of circular polarization of order a few per cent in visible light. This is predicted to have opposite sense in the NW and SE regions of the nebula, supposing that the spin axis of the pulsar is in the direction of linear polarization.

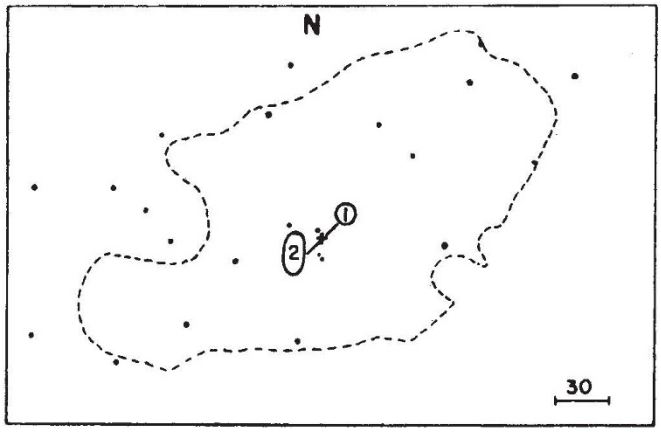

Fig. 1 The Crab Nebula, showing the outline of the nebula, the principal stars, and the two regions where the circular polarization of the nebula was measured (labelled 1 and 2). The line joining the two regions, and passing through the pulsar (indicated by a cross), is the approximate direction of the linear polarization of the nebula at the pulsar[3].

This letter reports an attempt to detect the predicted circular polarization. We observed the Crab Nebula on November 4 and 6, 1970, with the polarimeter described by Angel and Landstreet[2] on the 82 inch telescope at McDonald Observatory. No filters were used, resulting in a pass band of roughly 4000–5800 Å, and the Pockels cell was set to give a quarter wave retardation at λ4600. The polarimeter has a slight sensitivity to linear polarization when it is being used to measure circular polarization, with an apparent effect equal to about 2% of the linear component. To eliminate the effect due to the strong linear polarization of the Crab Nebula, alternate observations were made with the polarimeter in its normal position on the telescope, and rotated by 90° about the optical axis. The rotation does not affect the signal due to true circular polarization, but spurious signals induced by linear polarization reverse sign and are eliminated when an average is taken of measurements in the two orientations.

Measurements were made of the two regions of the Crab Nebula indicated in Fig. 1. Region 1 is centred at $\Delta\alpha = +1^{s}\cdot2$ and $\Delta\delta = -10''$ from the position of the pulsar, and region 2 is at $\Delta\alpha = -0^{s}\cdot8$ and $\Delta\delta = +13''$. A 7.2 inch diaphragm was used, but because of poor seeing and telescope drift the measured polarizations are averages over the regions indicated. No significant polarization was detected, the measured values after corrections for the night sky background being $+0.024 \pm 0.040\%$ in region 1 and $+0.034 \pm 0.047\%$ in region 2. The quoted standard deviations arise from counting statistics. It is apparent that if any circular polarization is present in these regions, it is substantially smaller than that expected from Rees's theory.

We thank Professor Brian Warner and Mr Edward Nather for cooperation, and the director of McDonald Observatory for making the 82 inch telescope available to us. This work was supported by grants from the Research Corporation, the National Research Council of Canada, and by the US National Aeronautics and Space Administration.

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Received November 23, 1970.

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[2] Angel, J. R. P., and Landstreet, J. D., *Astrophys. J. Lett.*, **160**, L147 (1970).
[3] Woltjer, L., *Bull. Astron. Insts. Netherlands*, **14**, 39 (1958).

Editor's note: Next Monday's *Nature Physical Science* will contain an article by Rees discussing the polarization of the Crab Nebula.

Absence of Radio Emission from Maffei I

SPINRAD *et al.*[1] have suggested that the infrared object discovered by Maffei[2] during a search for T Tauri variables is the nucleus of an exceptionally close giant elliptical galaxy, the main body of which is obscured by absorption in our galaxy. Though the observations point strongly in this direction, the suggestion is nevertheless a considerable extrapolation from the actual observations and it is therefore important to try to get additional information on the properties of the object.

We have made a 12 h observation of a field surrounding Maffei I with the synthesis radio telescope at Westerbork to look for continuous radiation at 1,415 MHz. As our diagrams show, the result was negative. With the noise figure of about ±0.0012 flux units attained, this means that the upper limit