that $H = 2 \cdot 4 \times 10^{-6}$ G. This is somewhat less than the figure given in ref. 3.

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[1] Vaughan, A. E., and Large, M. I., *Proc. Astron. Soc. Austral.*, 220 (1969).
[2] Rickett, B. J., *Nature*, **221**, 158 (1969).
[3] Staelin, D. H., and Reifenstein, E. C., III, *Astrophys. J. Lett.*, **156**, 121 (1969).

Filamentary Nebulosity in the Vicinity of Loop III

PROJECTING from the plane of the galaxy are three loops of nonthermal radio emission. Loop I, originally called the North Polar Spur, is 113° in diameter[1] and is centred on $l^{II} = 330°$; $b^{II} = 19 \cdot 5°$. The Cetus Arc, now called Loop II, is 92° in diameter[2] and is centred at $l^{II} = 100$; $b^{II} = -30°$. Loop III is 71° in diameter[3] and is centred near the north celestial pole at $l^{II} = 124°$; $b^{II} = 11 \cdot 5°$. It was proposed in ref. 1 that Loop I is the remnant of a supernova close to the Sun, as the radio emission is nonthermal and seems to come from a shell source. If the radio loops are supernova remnants, then we would expect to observe filamentary nebulosity surrounding their radio ridges, as is observed in well known supernova remnants such as the Cygnus Loop.

There have been previous attempts to detect optical emission from these high galactic latitude radio loops. Fast optical systems were used in conjunction with narrow band interference filters but no nebulosity was discovered in the early searches[5,6]. A more recent investigation[7,8], however, showed very faint diffuse nebulosity covering most of the northern part of Loop I and a 30° arc of filamentary nebulosity around the outer edge of the radio ridge of Loop II. This nebulous arc runs from $\alpha = 4$ h 0 m, $\delta = +13°$ to $\alpha = 3$ h 40 m, $\delta = -15°$ and is similar in structure to the NGC 6960 feature of the supernova remnant in Cygnus[9].

A more extensive photographic survey of the radio loops has recently been made at the high altitude observatory at the Pic-du-Midi. This was carried out with a widened field filter camera. To obtain the maximum detection limit, the nebulosity must be photographed through narrow band interference filters centred on the prominent emission lines of the nebula. Interference filters have the property of scanning down in wavelength for rays which are off-axis. Thus the light passing through the filter must be as nearly parallel as possible. An optical system[10] was used which converts light from a 30° field into a 7·8° cone. The cone then passes through the filter into a fast refocusing camera. If the absorption losses of the system are neglected, then the speed of the system is determined by the speed of the refocusing camera. Exposures of 3·5 to 5 h were made using Kodak 103aE emulsion with $f/1$ and $f/2$ refocusing cameras. A total exposure of 60 h was made on Loops I and III in an area bounded by $\alpha = 11$ h to 19 h, $\delta = -5°$ to $+70°$.

Some of the long exposures show the regions of very faint diffuse nebulosity on the outer edge of Loop I that were reported previously[7]. Two arcs of filamentary nebulosity in the vicinity of Loop III were also discovered. The first filament, (A), is 15° from the ridge of Loop III and is 20° in length. It runs from $\alpha = 11$ h 35 m, $\delta = +47°$. The second, (B), is 12° long and runs from $\alpha = 13$ h 30 m, $\delta = +55°$. Fig. 1 shows this nebulosity sketched on the radio map[4] of Loop III. Microdensitometry measurements show the filaments to have a maximum brightness of $\sim 5 \times 10^{-5}$ erg cm^{-2} s^{-1} sr^{-1} in $H\alpha + [NII]$, which corresponds to one-tenth of the brightness of NGC 7000. One remarkable feature of this nebulosity is that it lies at such a high galactic latitude. The filaments A and B are at $b^{II} = +70°$ and $+60°$ respectively, which are the greatest galactic latitudes at which any nebulosity has been discovered so far. It seems possible that these filaments are associated with Loop III just as the 30° arc of nebulosity in Cetus seems to be associated with Loop II.

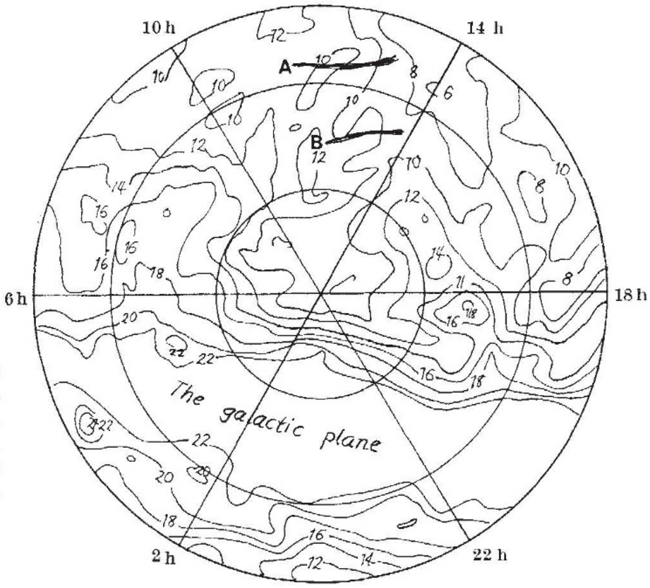

Fig. 1. The nebulosity is shown relative to the 408 MHz radio brightness contours[4] of Loop III.

The discovery of these filaments on the outer edge of the radio loop strengthens the theory that the radio loops are supernova remnants. Further mapping of the $H\alpha$ emission from the radio loops is being carried out to discover the total extent of the nebulosity. Velocity measurements of the filaments are also being made using a photographic Fabry–Perot interferometer.

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[1] Hanbury Brown, R., Davies, R. D., and Hazard, C., *Observatory*, **80**, 191 (1960).
[2] Large, M. I., Quigley, M. J. S., and Haslam, C. G. T., *Mon. Not. Roy. Astron. Soc.*, **124**, 405 (1962).
[3] Quigley, M. J. S., thesis, Univ. Manchester (1965).
[4] Seeger, C. L., Stumpers, L. G., and Van Hurck, *Philips Tech. Rev.*, **21**, 317 (1960).
[5] Davies, R. D., Harbury Brown, R., and Meaburn, J., *Observatory*, **83**, 179 (1963).
[6] Lozenskaya, T. A., and Shcheglov, P. V., *Astr. Tsirk. (USSR)*, 327 (1965).
[7] Meaburn, J., *Nature*, **208**, 575 (1965).
[8] Meaburn, J., *Z. Astrophys.*, **65**, 93 (1967).
[9] Elliott, K. H., and Meaburn, J., *Astrophys. Space Sci.*, **6** (1970).
[10] Meaburn, J., *Astrophys. Space Sci.*, **1**, 166 (1968).

Lunar Radar Mapping: Correlation between Radar Reflectivity and Stratigraphy in North-western Mare Imbrium

DELAY-DOPPLER radar maps of the Moon obtained with the 430 MHz (70 cm wavelength) radar of the Arecibo Ionospheric Observatory in Puerto Rico (Thompson, unpublished) are at present being studied to correlate geological information with the radar reflexion characteristics of the lunar surface. Preliminary evaluation of the radar data for the Sinus Iridum quadrangle (32°–48° N; 14°–38° W) has revealed that the lowest values of radar reflectivity are closely correlated with the mare materials of lowest albedo mapped by Schaber[1] as of most recent volcanic origin. These radar data were obtained with a surface resolution of 50 to 100 km² on January 24 and April 17, 1967. A detailed account of the delay-doppler