Structure of Non-thermal Radio Source G 55.7+3.4 in the Direction of CP 1919

Caswell and Goss[1] have reported the detection of an extended radio source G55.7+3.4 at 2,700 and 178 MHz in the direction of the pulsar CP 1919, and because of its non-thermal spectrum they have proposed that it might be a galactic supernova remnant (SNR) associated with the pulsar. They pointed out, however, that the age (5×10^4 yr) and distance (7.5 kpc) of the assumed supernova remnant G55.7+3.4, calculated from its observed parameters, did not agree with those (age 10^7 yr and distance 300 to 1,800 pc) of the pulsar CP 1919 calculated from the observed period, its rate of slowing down, 21 cm absorption studies and dispersion measure. But[1] these estimates are crude and consequently the apparent association should not be discarded as a chance coincidence. To investigate this apparent association further, we have mapped the region G55.7+3.4 at 11 and 21 cm wavelengths, with the 300 foot resurfaced telescope of the National Radio Astronomy Observatory.

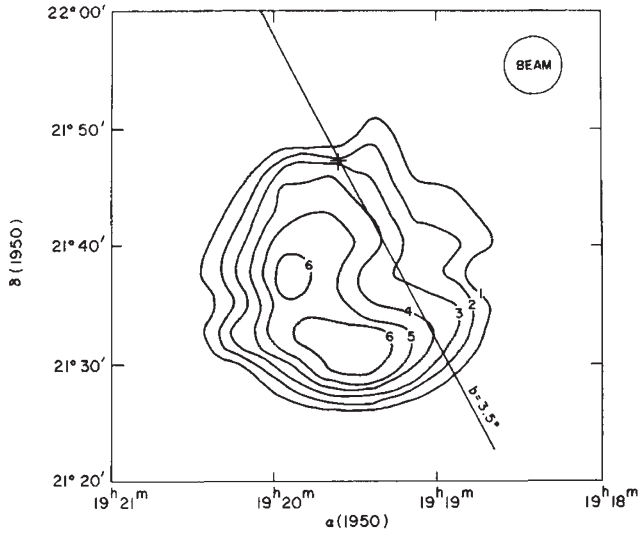

Fig. 1 Intensity contours of G55.7+3.4 at a wavelength of 11 cm. Contour unit is 0.016 K in brightness temperature. The r.m.s. noise is 0.006 K. The position of the pulsar CP 1919 is marked by the cross.

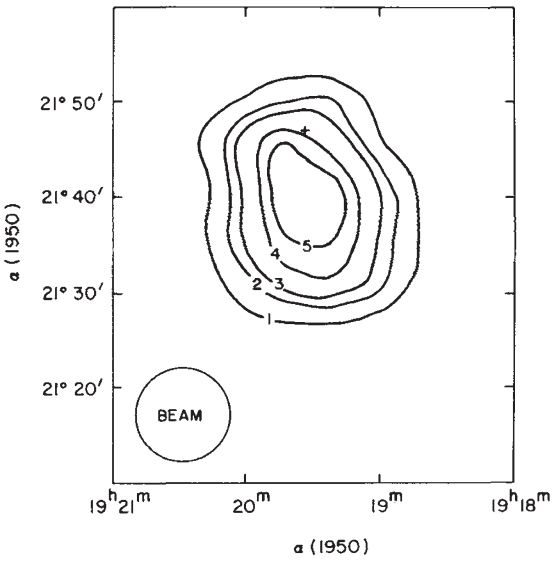

Fig. 2 Intensity contours of G55.7+3.4 at 21 cm wavelength. Contour unit is 0.084 K in brightness temperature. The r.m.s. noise is 0.02 K. The position of the pulsar CP 1919 is marked by the cross.

We took drift scans at approximately half beamwidth intervals in declination (2.75 arc min interval at 11 cm and 4.75 arc min at 21 cm). At each declination a minimum of four scans were taken. The contour maps at 11 and 21 cm wavelengths are shown in Figs. 1 and 2 respectively. At 11 cm the source is resolved; it has two peaks and the overall shape resembles the shell structure of many known supernova remnants. The map at 21 cm is similar to that obtained by M. Davis (presented at the New York Pulsar Conference in 1968). The structural details seen at 11 cm are not observed at 21 cm because of the comparatively poor resolution. Fig. 3 shows the flux density spectrum based on our computed flux densities at 11 and 21 cm as well as the flux density determined by Caswell and Goss[1] at 178 MHz. The source G55.7+3.4 has a spectral index of 0.54.

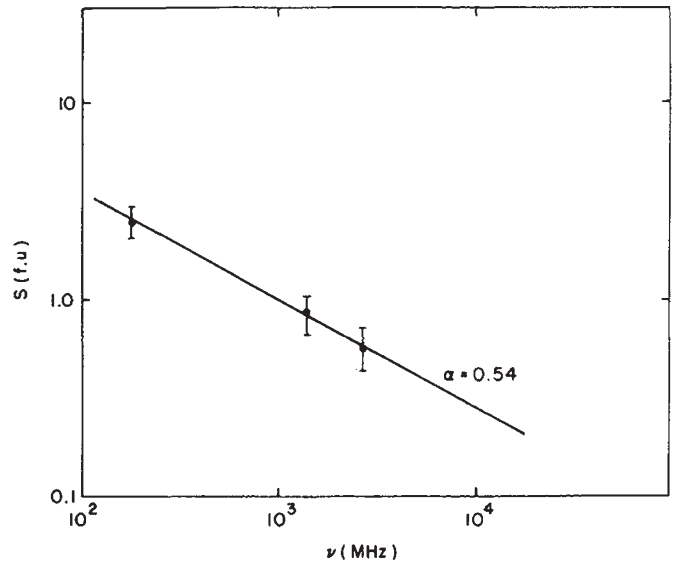

Fig. 3 Integrated flux density spectrum of G55.7+3.4.

The structure and spectrum of the source G55.7+3.4 obtained from our observations suggest that the source G55.7+3.4 may, indeed, be a supernova remnant. We have estimated the approximate distance and linear diameter of SNR G55.7+3.4 from the observed surface brightness (2.7×10^{-22} W m^{-2} Hz^{-1} sr^{-1} at 1,000 MHz) and angular diameter of 20 arc min using Milne's surface brightness–linear diameter relationship[2] for supernova remnants. Its distance and linear diameter are 7 kpc and ~40 pc respectively. By comparison with other remnants we obtained an upper limit of 10^5 yr for the age of G55.7+3.4.

From our observations, we cannot confirm that the SNR G55.7+3.4 is associated with the pulsar CP 1919. The position of the pulsar is marked by a cross in Figs. 1 and 2; it is situated far away from the centre of the remnant. It is, however, possible that CP 1919 is a runaway pulsar with a velocity of ~200 km s^{-1}, computed from the age and distance of the associated SNR G55.7+3.4.

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[1] Caswell, J. L., and Goss, W. M., *Astrophys. Lett.*, 7, 142 (1970).
[2] Milne, D. K., *Austral. J. Phys.*, 23, 425 (1970).

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