New Views of the Magellanic Clouds
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Radio Properties of Magellanic Cloud SNRs

John R. Dickel

Astronomy Department, University of Illinois, Urbana, IL 61801, USA

Abstract.
Supernova remnants in the Magellanic Clouds may have somewhat lower surface brightnesses at radio wavelengths than their counterparts in the Milky Way but otherwise they appear to be very similar. Balmer dominated SNRs have a lower radio luminosity than other shell remnants.

1. Introduction

Because of their common distance, the supernova remnants (SNRs) in the Magellanic Clouds allow us to establish some statistical properties more accurately than possible for Milky Way remnants. We can also see if there are any major differences between remnants in the different galactic environments.

2. Luminosities

Some properties can be seen in Figure 1a. There is a weak correlation between the x-ray and radio luminosities which becomes stronger if the four Balmer-dominated remnants in the MCs, indicated by the dots, are excluded. Apparently the relativistic particles responsible for the radio synchrotron emission are not readily accelerated in the shocked neutral medium which is collisionally excited to produce Balmer line emission. The underluminosity of these Balmer-dominated SNRs in the radio is not related to the supernova type as the remnant of another young type Ia explosion, N103B, (Hughes et al. 1995) has a normal radio luminosity.

The 1 GHz luminosities of MC SNRs cover a range of about a factor of 1000, similar to that of Milky Way remnants. MC SNRs tend to be larger at the same luminosity, however. For example N132D, the brightest radio SNR in the LMC has a luminosity of 2×10^{25} erg sec^{-1} Hz^{-1}, about half the luminosity of Cas A but it is over 5 times larger and so has a mean surface brightness of about 1/50 that of Cas A. The average ISM may be less dense in the MCs than in the Milky Way so remnants expand to a larger size before the radio emission is generated.

Without greater knowledge of the spectral cutoffs, it is not possible to accurately determine the integrated radio synchrotron luminosities but they are approximately 1/100 of the integrated thermal x-ray luminosities.

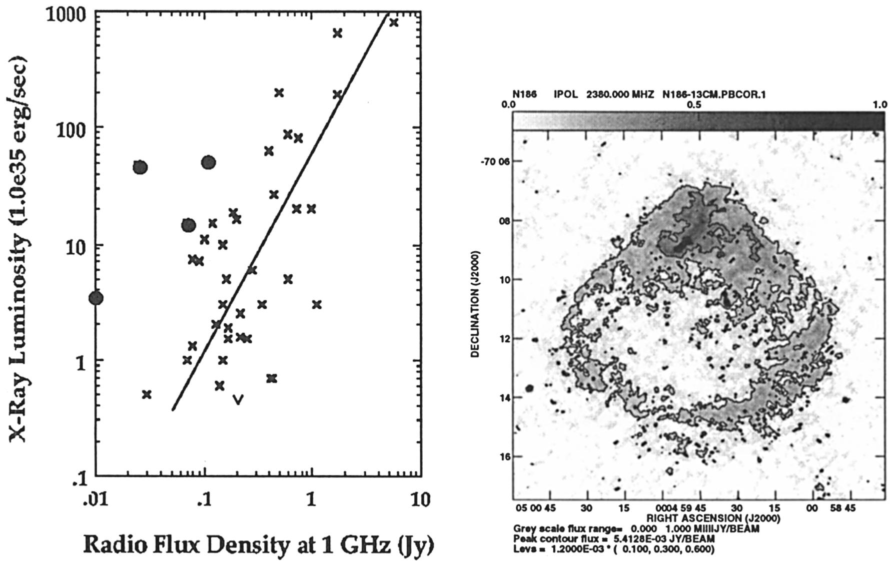

Figure 1. (a) Luminosity Comparison of MC SNRs. The fitted line has a slope of 1.8. (b) 13-cm radio image of N186 with a resolution of 6 arcsec.

3. Structure

N186, shown in Figure 1b, is 125 pc in diameter, one of the largest SNRs known. It may represent a class of object which has hit the wall of a large cavity and has only recently turned on.

Many MC SNRs show strong brightness gradients from one side to the other. These are probably associated with density gradients in the surrounding material. Good examples include N49, N23:SNR, and N103B (Dickel & Milne 1995, 1998). The general phenomenon is present in both radio and x-ray images but the radio gradient is smaller than the x-ray one. Point-by-point brightness comparisons in the two wavelength bands show no significant correlation.

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References

Dickel, J. R., & Milne, D. K. 1995, AJ, 109, 200

Dickel, J. R., & Milne, D. K. 1998, AJ, 115, 1057

Hughes, J, P., Hayashi, I., Helfand, D., Hwang, U., Itoh, M., Kirshner, R., Koyama, K., Markert, T., Tsunemi, H., & Woo, J. 1995, ApJ, 444, L81