

**FINAL TECHNICAL REPORT FOR THE ADP GRANT
NAG 5-7003**

Total Grant Period: 2/1/98 - 7/31/00

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Title: Energetics of Supernova Remnants

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1. Program Description

We proposed to carry out a multi-wavelength analysis of SNR energetics for a large number of Large Magellanic Cloud (LMC) SNRs in different stages of evolution and with different ambient interstellar environments. This analysis will provide insight as to how the energy of a SNR is partitioned in different forms, such as thermal, kinetic, and magnetic energies. The variety of SNR environments will allow us to evaluate the effects of local ISM conditions in the energy distributions in the SNRs, and how some of the energy is transferred to the surrounding ISM.

The main dataset used in this study is from the ROSAT archive, and the secondary dataset is from the ASCA archive.

2. Progress of the Program

During the first year of the grant period, we examined and analyzed archival ROSAT data for all known LMC SNRs. We used the X-ray data to derive physical properties of the hot gas in these SNRs, then we compared these with physical properties derived from optical and radio data. We made a detailed case study for two SNRs, N11L and N86, that show blow-out structures; these results were reported in a paper published in the *Astrophysical Journal*. We extracted available ROSAT High Resolution Imager (HRI) images of LMC SNRs and made an X-ray atlas of LMC SNRs. This atlas was published in the *Astrophysical Journal Supplement*.

During the second year of the grant period, we further used ROSAT Position Sensitive Proportional Counter (PSPC) observations of LMC SNRs to analyze the thermal properties of the SNR interiors. In addition, we have found one new SNR candidate based on its X-ray emission. This SNR candidate has been reported in a paper published in the *Astronomical Journal*.

We conclude that this program has been successfully completed.

3. Relevant Publications During the Grant Period

Hot Gas in the Large Magellanic Cloud

Chu, Y.-H.

1998, in *The Magellanic Clouds and Other Dwarf Galaxies*, p. 11-24

SNRs in the Magellanic Clouds II: SNR Breakouts from N11L and N86

Williams, R.M., Chu, Y.-H., Dickel, J.R., Smith, R.C., Milne, D.K., Winkler, P.F.

1999, *ApJ*, 514, 798-817

SNRs in the Magellanic Clouds III: An X-ray Atlas of LMC SNRs

Williams, R. M., Chu, Y.-H., Dickel, J. R., Petre, R., Smith, R. C., Tavarez, M.

1999, *ApJS*, 123, 467-485

SNRs in the LMC: A Multiwavelength Study of Energetics and Environments

Williams, R. M., Chu, Y.-H., Dickel, J., Smith, R.C.

1999, in *New Views of the Magellanic Clouds*, IAU Symposium 190, p. 145-146

N63A: a Supernova Remnant in a Cloudy Medium

Chu, Y.-H., et al.

1999, in *New Views of the Magellanic Clouds*, IAU Symposium 190, p. 143-144

Supernova Remnants in the Large Magellanic Cloud

Williams, R. M.

1999, PhD thesis, University of Illinois at Urbana-Champaign

RXJ050736-6847.8: A Large Supernova Remnant around an X-ray Binary in the Large Magellanic Cloud?!

Chu, Y.-H., Kim, S., Points, S. D., Petre, R., Snowden, S. L.

2000, *AJ*, 119, 2242-247