Molecular Clouds in the LMC Observed with NANTEN: IV. Comparison with SNRs

H. Saito, R. Abe, A. Hara, T. Hayakawa, S. Kato, A. Kawamura, A. Mizuno, N. Mizuno, H. Ogawa, T. Onishi, K. Tachihara, K. C. Xiao, N. Yamaguchi, R. Yamaguchi, and Y. Fukui

Department of Astrophysics, Nagoya University, Chikusa-ku, Nagoya 464-8602, Japan

Y. Yonekura

Earth and Life Sciences, Osaka Prefecture University, Gakuencho 1-1, Sakai, Osaka 599-8531, Japan

Abstract. We have made ^{12}CO(J=1–0) observations of the LMC with NANTEN. We report the results of a comparison between CO clouds and SNRs in the LMC. Among the 35 known SNRs, only 10 are possibly associated with CO clouds. These 10 CO clouds and SNRs deserve follow-up studies for possible interactions. We present overlays of CO clouds on the optical images of some of these SNRs.

1. Introduction

The interaction of supernova remnants (SNRs) with dense molecular clouds is an important subject in astrophysics. Molecular clouds swept up by supernova blast waves provide an important laboratory in which the physical processes associated with shocks can be studied. The LMC is well suited for the study of SNR and molecular cloud interactions. Thirty-five SNRs have been identified in the LMC from X-ray, optical, and radio continuum observations (Mathewson et al. 1983, 1984, 1985; Smith et al. 1994).

We have made a survey for giant molecular clouds in the LMC in the ^{12}CO(J=1–0) emission, using the NANTEN 4-meter millimeter wave telescope at Las Campanas Observatory in Chile. The survey covered 6 × 6 square degrees with a 2′ grid spacing. We have identified ∼100 distinct clouds. The results of these observations are presented by Fukui et al. (1999). In this contribution, we report the results of a comparison between the CO clouds and the SNRs.

2. Comparison and Results

The sizes of the cataloged SNRs range from a few pc to ∼100 pc, and their ages are 10^2–10^6 yrs. We carried out a comparison between the 35 SNRs and the 100 giant molecular clouds. We define: (1) "SNR with CO cloud" – SNRs associated with molecular clouds; the SNR is superposed on a CO cloud or in the immediate neighborhood of a CO cloud; see Fig. 1a; and (2) "SNR near CO
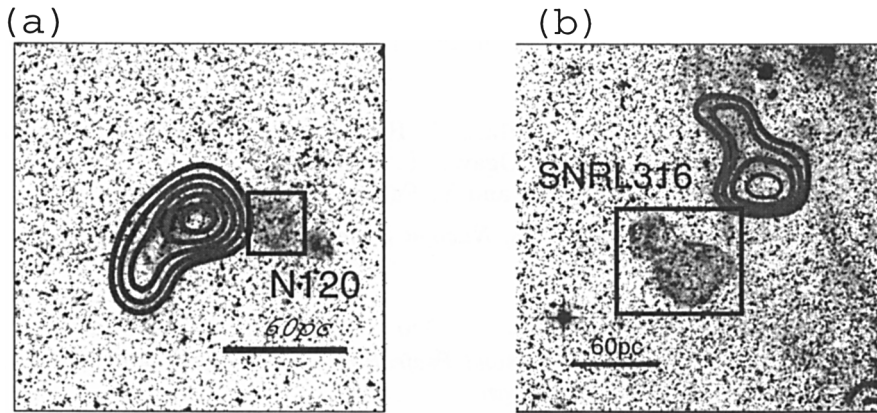
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Figure 1.   Contour maps of velocity-integrated $^{12}CO(J=1-0)$ emission. The optical images are taken from the DSS. SNRs are in a black square. (a) "SNR with CO cloud". (b) "SNR near CO cloud".

cloud" – SNRs located near molecular clouds; the distance between the SNR and a CO cloud is ≤ 30 pc; see Fig. 1b. Out of the 35 known SNRs, only 5 are associated with CO clouds. These CO clouds have virial masses of $\sim 1-3 \times 10^5$ $M_\odot$. Another 5 SNRs are located near CO clouds. These CO clouds are more massive, $\sim 8 \times 10^5$ $M_\odot$. In both cases, the CO clouds associated with SNRs tend to be of intermediate masses among the present sample (M $\sim 10^4-10^6$ $M_\odot$), suggesting that giant molecular clouds are significantly dissipated prior to a supernova explosion.

References

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