LIMITS ON THE PRESENCE OF SULFUR IN THE YOUNG SNRs LMC N132D AND SMC 1E0102.2-7219

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Abstract: A new area-spectroscopy search for sulfur as a tracer of the "Si Group" of elements in the ejecta of the young SNRs, LMC N132D and SMC 1E0102.2–7219, yields negative results for [S II]$\lambda\lambda$6719, 6731 and [S III]$\lambda\lambda$9064, 9532.

Observations of very young supernova remnants (SNRs) offer the opportunity to observe interstellar material consisting of relatively uncontaminated stellar ejecta whose composition and kinematics are directly pertinent to the progenitor star. Members of this relatively rare class are the galactic objects Cas A, Puppis A, and G292.0+1.8; N132D and 0540–69.3 in the LMC; 1E0102.2–7219 in the SMC; and an unresolved object in NGC 4449 (*cf.*, summary table in Winkler and Kirshner 1985). Of these, we have selected the Magellanic Cloud objects, N132D and 1E0102.2-7219, which have known distances, lie in relatively unobscured (albeit cluttered) fields, and have angular sizes of the order of 20″, for further study with the CTIO 1.5 m telescope*.

Previous works establish that these SNRs consist of ring-like structures a few pc in diameter expanding with velocities in the range 2000-3000 km/sec and having kinematical ages of the order of 1000 yr, that the expanding material contains no hydrogen or helium but consists primarily of oxygen, and that stationary material of relatively normal composition is also present (Dopita and Tuohy 1984; Lasker 1980).

The absence of spectroscopic evidence for products of nucleosynthesis from the "Si Group," particularly S, which we may reasonably expect at the level of $\approx 0.1M_\odot$ (compared to $3M_\odot$ for O) from models of stellar evolution (*e.g.*, Johnston and Yahil 1984) motivates a further search. (Abundances from the Johnston-Yahil model are much higher for the dominant species, Si, which does not have any convenient lines in the optical, and about a factor of 10 lower than S for Ca and Ar.)

In order to take observations as independent as possible from specific models of the ionization and excitation conditions in the ejecta, we included observations of both accessi ble ionization states of sulfur (S^+ and S^{++}), the ionization potentials of which bracket that of O^+, which is known to be present. We used the CTIO 1.5 m telescope with the cassegrain spectrograph and the GEC CCD to obtain an area map covering the spectral regions $\lambda\lambda$6200–7700, sensitive to [S II]$\lambda\lambda$6719, 6731 and $\lambda\lambda$8300–9900, sensitive to [S III]$\lambda\lambda$9064, 9532. The pixel size was 2″ along the slit,

* The younger LMC object, 0540–69.3 was excluded from this program because of its smaller angular size; however, one does note that Dopita and Tuohy (1984) have detected Doppler-shifted [S II] and Ca I] in it.

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which was oriented E-W, and 6″ perpendicular to it. In each SNR an area the size of the expanding ring was searched with a grid of 600 sec exposures; additionally, one location in each, selected for the presence of rapidly moving [O III]λ5007, was examined for [S III] with exposures totaling 6000 sec.

No new rapidly moving spectral features were detected in a preliminary inspection of the spectra. The corresponding upper limits, which vary with the exposure time, the assumed area of the rapidly moving material, and the presence of night-sky emission lines at specific search wavelengths, are in the range 10^{-4} to 10^{-6} erg sec^{-1} sr^{-1} and further reductions to improve the limits are in progress. Depending on physical conditions in the ejecta, the lower of these values may be relevant to stellar evolution models.

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