

Molecular Environment toward the Supernova Remnant IC443

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We present the CO observations towards the well known mixed-morphology supernova remnant (SNR) IC443 to investigate its overall molecular environment. Some northern and northeastern partial shell structures of the CO gas were discovered around the remnant. It is clearly shown that one of the partial shell, about 5' extending beyond the northeastern border of the remnant's bright radio shell, seems to just confine the faint radio halo which was identified by Lee et al. (2008). On the other hand, some faint CO clumps can be discerned along the eastern boundary of the faint remnant's radio halo. Connected the eastern CO clumps, the northeastern partial shell structures, and the northern CO partial shells, we can see that it seems to form a half ring structure to surround the remnant. The CO spectra from the northeastern partial shell structures and the eastern CO clumps indicate that the LSR velocities of the emission are about -5 to -2km/s, which velocities are consistent with the LSR velocity of the quiescent, ambient gas associated with the shocked clumps B, E, F, and G. In combination with the ^{13}CO LSR velocity distribution in the field of view of SNR IC443, thus we suggest that the half ring structure of the CO emission at $V_{\text{LSR}} \sim -4\text{km/s}$ is associated with the famous SNR. We suspect that these structures probably have relation to the stellar wind of SNR IC443's massive progenitor.

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1. The -4km/s MC extending along the northwest-southeast direction is mainly located on the front of SNR IC443. It is close to and associated with the remnant.
2. We find that a half ring structure centered at (06h16m50.3s, 22d37'11") with radius of 26' appear to surround the northern part of SNR IC443. We suggest that this structure in the velocity range of -5 to -2km/s is associated with IC443. It may not be interacted with SNR IC443 directly, but associated with the stellar winds of its massive progenitor star.
3. The progenitor of the remnant is probably a 12Msun B1 V star, whatever, it is not larger than a 20Msun O9 V star.
4. A faint CO bubble with diameter of 16" in the interval of -9.2 to -7.8km/s was discovered to be located to the north of the SNR IC443.

Primary author: Dr SU, Yang (Purple Mountain Observatory)

Presenter: Dr SU, Yang (Purple Mountain Observatory)