THE MOLECULAR GAS IN THE SUPERNOVA REMNANT IC 443

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ABSTRACT

Although a few highly perturbed regions characterized by gas motions with velocities larger than 20 km s^{-1} have been discovered during the last several years in the supernova remnant (SNR) IC 443, the nature of these perturbed clumps and their relationship to the quiescent molecular gas near the SNR remains unknown. In part, this is due to a lack of large-scale, high angular resolution observations. We have therefore carried out a systematic survey of this SNR in the CO (J=1→0) line, covering a roughly 50' x 50' region spaced by 2'. The observations were made with the 14 m telescope of the Five College Radio Astronomy Observatory (FCRAO), which has a resolution of 45" and a single sideband receiver temperature of 200 K at 2.6 mm wavelength.

Five new clumps were discovered, bringing the total number of known perturbed regions to eight [Figure 1; Huang, Dickman, and Snell 1986, *Ap. J. (Letters)*, **302**, L63]. To study the physical structure of these clumps in more detail, we have made more complete maps of the clumps in both the CO (J=1→0) and (J=2→1) transitions with the FCRAO telescope. These maps show that the extent of perturbed gas in a typical clump is several arcmin, or a few pc at a distance of 1.5 kpc.

We have also obtained the first detection of highly perturbed ^{13}CO (J=1→0) emission toward clump B ($\alpha = 6^h\ 14^m\ 15^s$, $\delta = 22°\ 27'\ 50"$; epoch 1950). Spectra of the ^{13}CO and CO (J=1→0) emission are shown in Figure 2. Our data suggest an average $CO/^{13}CO$ intensity ratio of ~ 60 for the perturbed gas, which implies relatively optically thin CO emission. This value is consistent with the intensity ratio of the CO (J=2→1) and (J=1→0) lines in clump B. If the gas is optically thin in all perturbed clumps, they contain no more than a few solar masses, a value several orders of magnitude smaller than that of the quiescent cloud.

Speculation on the origin and fate of the clumps and their relationship to the quiescent cloud will be discussed in the workshop.
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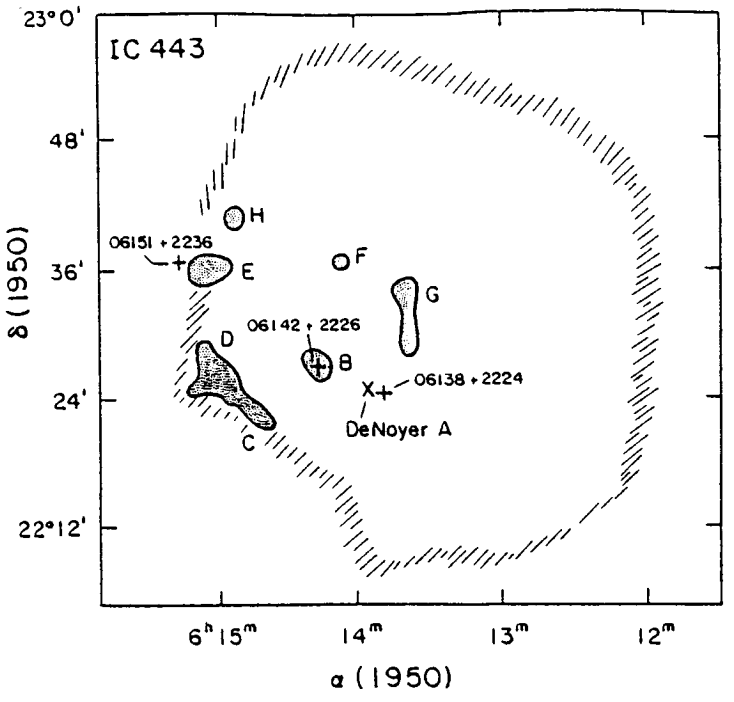

Figure 1: Schematic representation of the location of shocked clumps toward the SNR IC 443, as revealed by CO spectra obtained with the FCRAO 14 m telescope. The stippled region surrounding each clump corresponds to the area over which highly perturbed CO could be identified in our spectra. Also shown are the outline of the optical SNR and three bright IRAS point sources which may be associated with the clumps (Huang, Dickman, and Snell 1986).

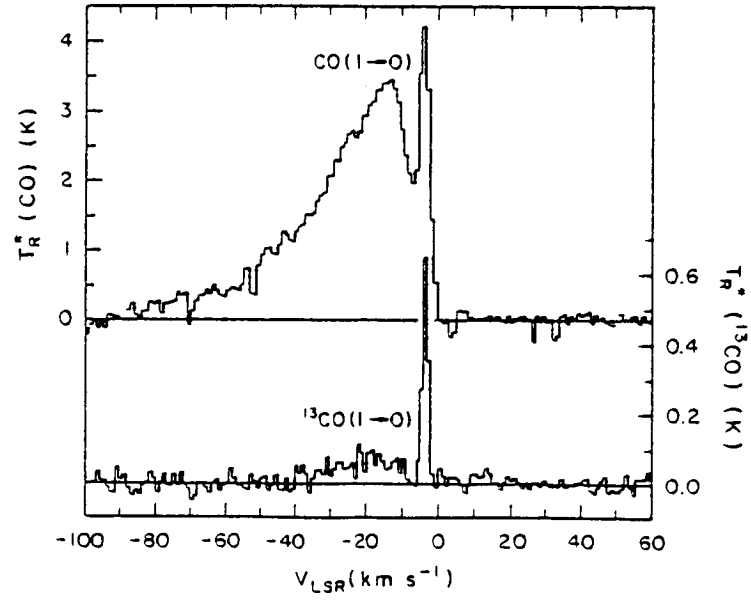

Figure 2: CO and ^{13}CO (J=1→0) spectra toward clump B ($\alpha = 6^h\ 14^m\ 15^s$, $\delta = 22°\ 27'\ 50''$; epoch 1950). For clarity, the ^{13}CO spectrum has been blown up five time.