Triggered Star Formation in a Turbulent ISM
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Large-scale CO observations of a far-infrared loop in Pegasus; detection of a large number of very small molecular clouds possibly formed via shocks

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Large-scale CO observations with the millimeter/submillimeter telescope NANTEN toward a whole FIR loop-like structure whose angular extent is $\sim 20^\circ \times 20^\circ$ around $(l, b) \sim (109^\circ, -45^\circ)$ in Pegasus have been carried out in the ^{12}CO (J=1–0) at $4' - 8'$ grid spacing and the ^{12}CO emitting region in the ^{13}CO (J=1–0) at $2'$ grid spacing. The diameter corresponds to ∼25 pc at a distance of 100 pc, adopted from that of the star HD886(B2IV) near the center of the loop.

The 78 ^{12}CO small clumpy clouds we detected have mass 0.04–11 $M_\odot$, of which ∼83% have very small masses $\leqslant$ 1.0 Mo. ^{13}CO emission was detected in the region where the column density of H_2 derived from ^{12}CO is $\geqslant 5 \times 10^{20}$ cm^{-2}, corresponding to $A_V \sim 1$ mag, which takes into account that of HI. The ^{13}CO clouds are far from virial equilibrium, indicating that they are not gravitationally bound, but these clouds tend to be more virialized as the mass increases.

We find no indication of star formation in these clouds in the IRAS and 2MASS point source catalogs. The very low mass clouds, M $\leqslant$ 1 $M_\odot$, identified are unusual in that they have a very weak ^{12}CO peak temperature of 0.5–2.7 K and that they aggregate in a region of a few parsecs with no main massive clouds; in contrast, similar low-mass clouds $\leqslant$1 $M_\odot$ in other regions previously observed including those at high Galactic latitude are all associated with more massive main clouds of ∼100 $M_\odot$. The HI distribution in this area is looplike and shown in the expanding motion in the L-V diagram. The molecular clouds are distributed nearly along the HI loop but the expanding motion in CO can not be seen. Comparison with a theoretical work on molecular cloud formation suggests that the very low mass clouds may have been formed in the shocked layer through thermal instability. HD 886 may be the source of the mechanical luminosity via stellar winds to create shocks, forming the loop-like structure where the very low mass clouds are embedded.

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