Triggered Star Formation in a Turbulent ISM
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Dense core evolutions induced by shock triggering and turbulent dissipation

Kengo Tachihara[1], A. Hayashi[2], T. Onishi[2], A. Mizuno[3] and Y. Fukui[2]

[1]Graduate School of Science and Technology, Kobe University, 1-1 Rokko-dai, Nada-ku, Kobe, 657-8501, Japan
email: tatihara@kobe-u.ac.jp

[2]Department of Astrophysics, Nagoya University, Furo-cho, Chikusa-ku, Nagoya, 464-8602, Japan

[3]Solar-Terrestrial Environment Laboratory, Nagoya University, Furo-cho, Chikusa-ku, Nagoya, 464-8602, Japan

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1. Introduction

External shock triggering and internal turbulence play major role for the condensation of the ISM and star formation. Some evidences of shock triggering by non-isotropic compression are seen in the cloud morphologies and associated active cluster formation such as the ρ Oph and Cha I clouds. Surveys for $C^{18}O$ dense cores have shown that internal turbulence dominates the core dynamics and regulates star formation activity (Tachihara *et al.* 2002).

2. Observations and results

Based on the precedent $C^{18}O$ core surveys by the NANTEN radio telescope (Tachihara *et al.* 2002 and the references therein), the Taurus, Ophiuchus North, Lupus, and Chamaeleon clouds were surveyed for denser and more compact cores in $H^{13}CO^+$ (J =1–0) by the 45m telescope at the Nobeyama Radio Observatory and the SEST 15m telescope at La Silla. The results obtained in Taurus were published by Onishi *et al.* (2002). For a comparison, $H^{13}CO^+$ survey with the 45m telescope in the ρ Oph cloud by Umemoto *et al.* (2002) are compiled.

In general, one $C^{18}O$ core (typical density is $\sim 10^4$ cm^{-3}) fragments into a few $H^{13}CO^+$ cores ($\sim 10^5$ cm^{-3}) in isolated star-forming regions (SFRs), in contrast to the typical triggered cluster-forming region of the ρ Oph cloud, which consists of 57 $H^{13}CO^+$ cores. The statistics show a remarkable trend that more evolved $C^{18}O$ cores associated with $H^{13}CO^+$ cores and young stars have larger masses and smaller line widths than those without $H^{13}CO^+$ cores. This suggests that the turbulent decay is required for the dynamical relaxation of the $C^{18}O$ cores to gain more mass and then contract to form denser $H^{13}CO^+$ cores spontaneously. On the other hand, no clear trend is seen in the physical properties between star-forming and prestellar $H^{13}CO^+$ cores. Among the nearby SFRs, the $H^{13}CO^+$ cores in Taurus are larger in number and mass than in other SFRs, while the ρ Oph and Cha I clouds have larger mass fractions of the total $C^{18}O$ cores to the parental ^{13}CO clouds. We suggest that the external shock compresses the low-density part of the clouds and the internal turbulent decay leads the dense core condensations.

References

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