Triggered Star Formation in a Turbulent ISM
Proceedings IAU Symposium No. 237, 2006
B. G. Elmegreen & J. Palouš, eds.

doi:10.1017/S1743921307002141

ASTE Submillimeter observations of a YSO condensation in Cederblad 110

Masaaki Hiramatsu[1], Kazuhisa Kamegai[2], Takahiro Hayakawa[3], Ken'ichi Tatematsu[3], Toshikazu Onishi[4], Akira Mizuno[5] and Tetsuo Hasegawa[3]

[1]Department of Astronomy, University of Tokyo, Bunkyo, Tokyo 113-0033, Japan, email: hiramatsu.masaaki@nao.ac.jp

[2]Institute of Astronomy, The University of Tokyo, Mitaka, Tokyo 181-0015, Japan
[3]National Astronomical Observatory of Japan, Mitaka, Tokyo 181-8588, Japan

[4]Department of Astrophysics, Nagoya University, Chikusa, Nagoya 464-8602, Japan
[5]Solar-Terrestrial Environment Laboratory, Nagoya University, Toyokawa, Aichi, 442-8507, Japan

1. Observations of Cederblad 110 region

Outflow-cloud interaction is an important issue in discussions about star formation in clusters because it could generate turbulence and restrain star formation activities, as well as it causes outflow-triggered star formation.

Chamaeleon I molecular cloud complex is one of near (D = 160 pc) low-mass star formation regions in the southern sky. In the center of the cloud, a reflection nebula Cederblad 110 and a YSO condensation which contains 3 class I, 2 class II, 1 class III sources and a millimeter-continuum source.

We observed this YSO condensation in 2004 and 2005 with ASTE, a 10 m submillimeter telescope in Atacama. Observed lines are CO ($J = 3 - 2$), HCO^+ ($J = 4 - 3$) and $H^{13}CO^+$ ($J = 4 - 3$). The beamsize was $22''$ and the spectral resolution was 125 kHz, which corresponds 0.11 km s^{-1} in 345 GHz.

2. Results

Our HCO^+ ($J = 4 - 3$) map reveals a dense molecular clump with an extent of about 0.1 pc, which is a complex of three envelopes associated with class I sources Ced110 IRS4 and IRS11, and a millimeter-continuum source Cha-MMS1. The other two class I sources in this region, IRS6 and NIR89, are located outside the clump and have no conspicuous HCO^+ emission. $H^{13}CO^+$ ($J = 4 - 3$) observations toward IRS4 and MMS1 show the HCO^+ abundance are $X(HCO^+) = 3.3 \times 10^{-9}$ and 3.0×10^{-10}, respectively.

Bipolar outflows from IRS4 and IRS6 are detected in our CO ($J = 3 - 2$) observations. We could not detect any outflows from Cha-MMS1. This source could be a very young protostar which has no signs of outflow activity yet. The outflow from IRS4 seems to collide with Cha-MMS1. The outflow has momentum about 5 times larger than the momentum of gas in MMS1. This means the motion of the gas in MMS1 is easily affected when the outflow from IRS4 collides with the source. The time for the shock of collision to arrive at the center of MMS1 is about the same as the dynamical timescale of the IRS4 outflow, which shows induced star formation process has not triggered yet, or just triggered.