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

doi:10.1017/S1743921307001974

Star formation In Bright-Rimmed Clouds: a comparison of wind-driven triggering with millimeter observations

Christopher H. De Vries[1], **G. Narayanan**[2] **and R. L. Snell**[2]

[1]Physics and Geology Department, CSU Stanislaus,
Turlock, CA 95382, USA
email: chris@physics.csustan.edu

[2]Department of Astronomy, University of Massachusetts Amherst,
Amherst, MA 01003, USA
email: gopal@astro.umass.edu, snell@astro.umass.edu

Bright-rimmed clouds (BRCs) are logical laboratories in which to study triggered star formation, however it is difficult in any single cloud to definitively show that star formation was triggered. In this study we compare the hydrodynamic models produced by Vanhala & Cameron (1998) that treat the problems of star-formation triggered by wind-driven implosion to millimeter and submillimeter molecular line observations of BRCs with embedded IRAS sources. These latter sources are derived from a catalog by Sugitani, Fukui, & Ogura (1991). In order to make an accurate comparison we implement a radiative transfer model based on the Sobolev or LVG approximation, and generate molecular line maps which can be directly compared to our observations. We observed several millimeter and submillimeter transitions of CO, $C^{18}O$, HCO^+, and $H^{13}CO^+$ using the FCRAO, SMT, CSO, and SMA observatories (De Vries, Narayanan, & Snell 2002). We compare these observations with 3 hydrodynamic models of wind-driven shock fronts interacting with pre-existing, but unbound cloud cores. In two cases these model cores are triggered to collapse under the influence of the external wind.

We find that the LVG radiative transfer method provides similar line shapes compared to the Hogerheijde & van der Tak (2000) radiative transfer model. Further, the gross morphologies of the hydrodynamic models, when run through our radiative transfer analysis, match the BRC morphologies we observe. The models produce an excitation temperature which increases with distance from the core center. This eliminates the blue-asymmetric infall signature often found in collapsing cores, and is supported by the relative rarity of infall signatures in our observed BRC sample. Closer examination reveals critical differences, including the absence of high-velocity gas streaming from the cores predicted by the hydrodynamic models. We conclude that while the wind-driven hydrodynamic model is not sufficient to explain all the features we observe, it does sufficiently explain both the overall morphology of BRCs, and the generally symmetric, broad line shapes observed within these clouds. The similarity between the hydrodynamic predictions and observations suggest that shock fronts may trigger collapse and the formation of stars within BRCs.

References

De Vries, C.H., Narayanan, G. & Snell, R.L. 2002, *ApJ* 577, 798
Hogerheijde, M.R. & van der Tak, F.F.S. 2000, *A&A* 362, 697
Sugitani, K., Fukui, Y. & Ogura, K. 1991, *ApJ* 77, 59
Vanhala, H.A.T. & Cameron, A.G.W. 1998, *ApJ* 508, 291