Triggered Star Formation in a Turbulent ISM
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Turbulence in the G333 molecular cloud

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We are studying the molecular clouds in the region around G333.6-0.2 in a number of 3-mm transitions from different molecular species, to probe, among other things, the turbulent properties. The observations are being made by on-the-fly mapping with the 22-m diameter single-dish Mopra radio telescope. See Bains *et al.* (2006) and Cunningham *et al.* (2006 in these proceedings) for more details. During 2004 and 2005 we obtained ^{13}CO (1 - 0), C^{18}O, CS (2 - 1) and C^{34}S data. Using the different molecular tracers gives complementary information about the gas density structure, due to the different critical densities, and different isotopomers allows correction for optical depth effects.

One of the simplest, and most commonly used, statistical analysis techniques is the spatial power spectrum (SPS). This is the power obtained by the Fourier Transform of the image, as a function of spatial frequency, and typically fits quite well to a power law. The slope of this power law (for C^{18}O in one sub-area) is shown in Fig. 1, as a function of velocity. We note that the slope varies between -3 and -4 across the spectral line (and the slope is -1 for "red" noise away from the line emission, due to the correlated noise in the on-the-fly mapping process.)

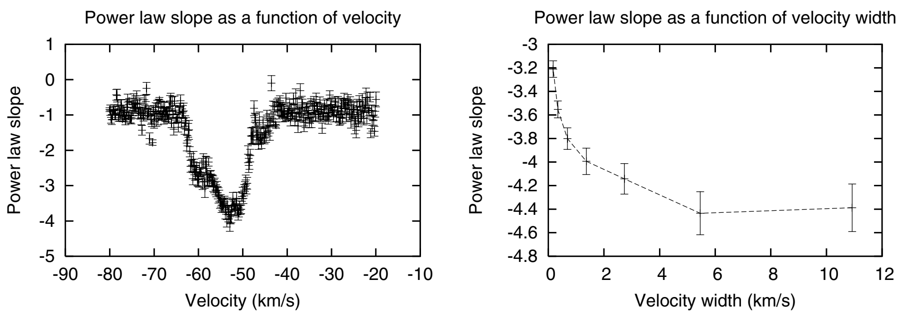

Figure 1. (a) Spatial power spectrum (SPS) of C^{18}O, and (b) The VCA power spectrum slope (for the 64 channels centred on the line emission) as a function of velocity width for C^{18}O.

For each small element of volume in the molecular cloud, the turbulence leads to a different density and velocity. Although we have only a 3-dimensional data cube (2-D column density as a function of velocity), rather than the full 6 dimensions of density and velocity, we can statistically determine the turbulent properties using the expectation that the 3 directions are equivalent. The slope of the SPS is expected to change as we go from "thin" velocity channels, where part of the structure seen is due to velocity structure, to "thick" velocity channels (Lazarian & Pogosyan 2000). In Fig 1 we show the velocity component analysis (VCA), where we can see the change in slope of the SPS as we aggregate the channels into groups of different velocity width.

References

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