Direct Observation of the Transition to Coherence in Dense Cores

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From Stars to Galaxies, April 7
Dense Cores

Goodman et al. (1998)

"Coherent Core"

From Stars to Galaxies, April 7
Dense Cores

• How are dense cores connected to their environment?
NH$_3$ GBT survey

![Image of the NH$_3$ GBT survey with marked regions B5, IC348, L1448, and L1451. The survey covers R.A. (J2000) ranging from 03h50m0s to 30m, Dec (J2000) from 33° to 31°, and includes an intensity scale for the $^{13}$CO integrated intensity (K km s$^{-1}$).]
The case of B5

Pineda et al. (2010)
The case of B5

Pineda et al. (2010)
The case of B5

Pineda et al. (2010)
Velocity Dispersion map

Pineda et al. (2010)
Velocity Dispersion map

Hyperfine component separation

Pineda et al. (2010)
Velocity Dispersion map

Pineda et al. (2010)
Transition to Coherence

\[ 0.5 \bar{c}_{s, \text{ave}} = \sigma_{NT} \]

\[ \bar{c}_{s, \text{ave}} = \sigma_{NT} \]

\[ B5 \]
Coherence Transition

$\sigma_v$ (km s$^{-1}$)

Coherent Core

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Transition to Coherence
Transition to Coherence
How does this compare with simulations?
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Starless Core
(Offner et al 2008)
How does this compare with simulations?
Summary

- “Transition to Coherence” is observed for the first time in a **single tracer**
- It is very sharp: in ~0.06pc the $\sigma_v$ changes by a factor of 2x
- Robust definition of a dense core

- Is there also a sharp transition in other quantities?
- how dependent on the environment is the transition?