

The Dialogue with Observation: New Tools and Data Sets to Study Molecular Cloud Evolution

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Collaborators

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The Taste Testing Project

Star Formation Taste Tests > Overview

https://iic.grouphub.com/projects/700257/project/log

star formation taste tests

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Project overview

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IMPORTANT ANNOUNCEMENT for NSF Reviewers: The NSF requested that we edit the "Supplemental Materials" section of our proposal, so as to make it fully compliant with NSF format regulations. The **original version of the Supplemental Materials** is still included in the copy of the [NSF proposal](#) available for download in the Files section of this Basecamp.

Welcome to the Tasting Room



This is the collaborative space for those who do simulations of star forming regions, and those who observe them. It was inspired, in the Fall of 2006, by the NSF proposal entitled "Star Formation Taste Tests," by A. Goodman & E. Rosolowsky. Today, it is used to host conversations about and short descriptions of simulations, along with links to longer descriptions (e.g. Journal articles & web sites). In the future, we are planning to connect more enhanced descriptions of those simulations directly to online code bases and sample outputs (likely with help from our friends at NCSA). So, stay tuned.

What's fresh?

Today

No activity today

Yesterday

No activity yesterday

Before Yesterday

TO-DO Done : list
in [Send postdoc notice](#)

MESSAGE [Rahul Shetty will be the Taste Testing Postdoc, starting 10/07](#)
by Alyssa G. in [Full Group Communications](#), 18 Mar

MILESTONE Done : AG request new letters of commitment

iic

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Michelle Borkin
Last login about 1 hour ago
Felice Frankel
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Domains in Astronomy

Reality



Simulations

Physics &
Telescopes



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Observations

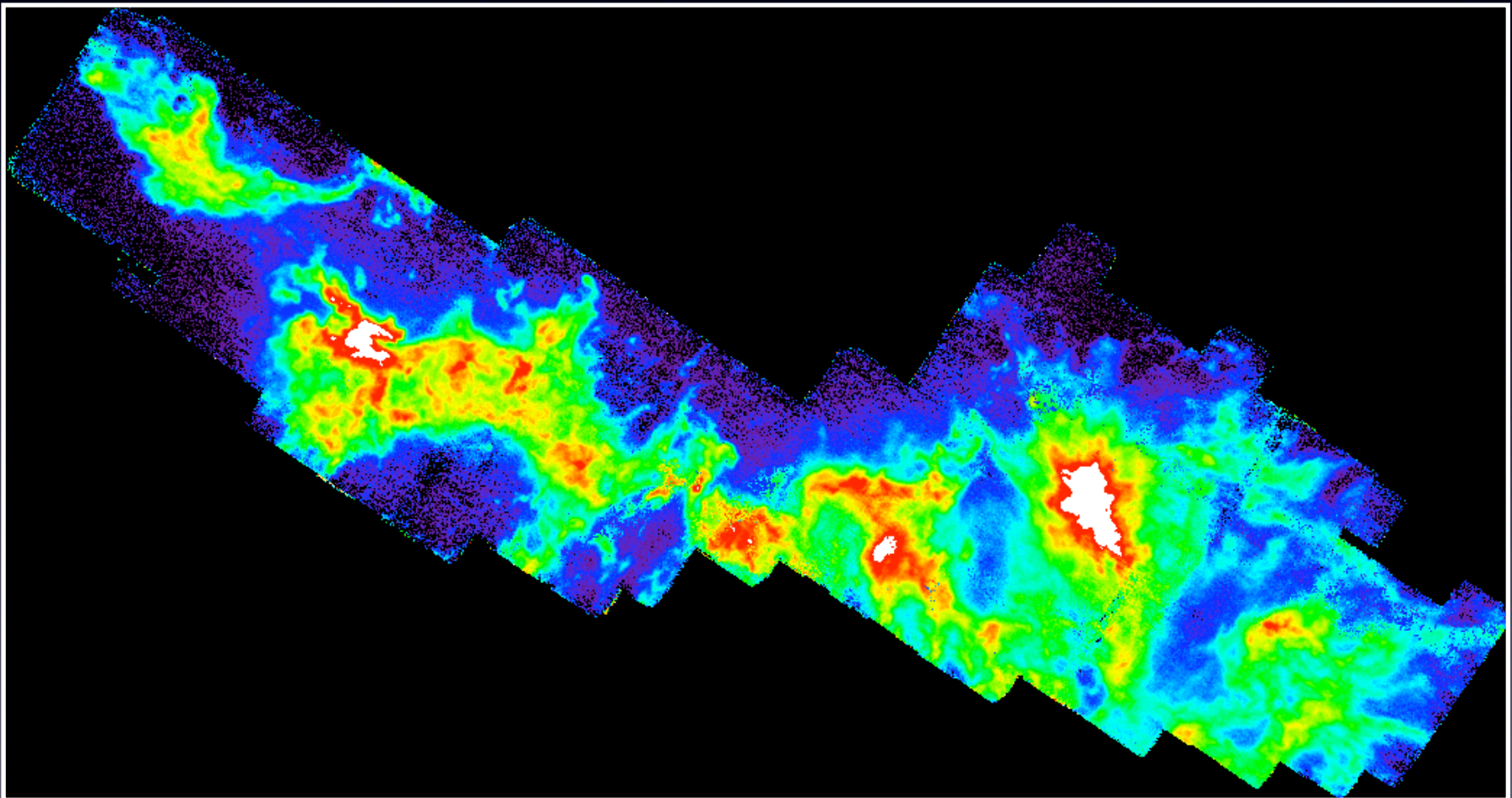


Observed
Simulations

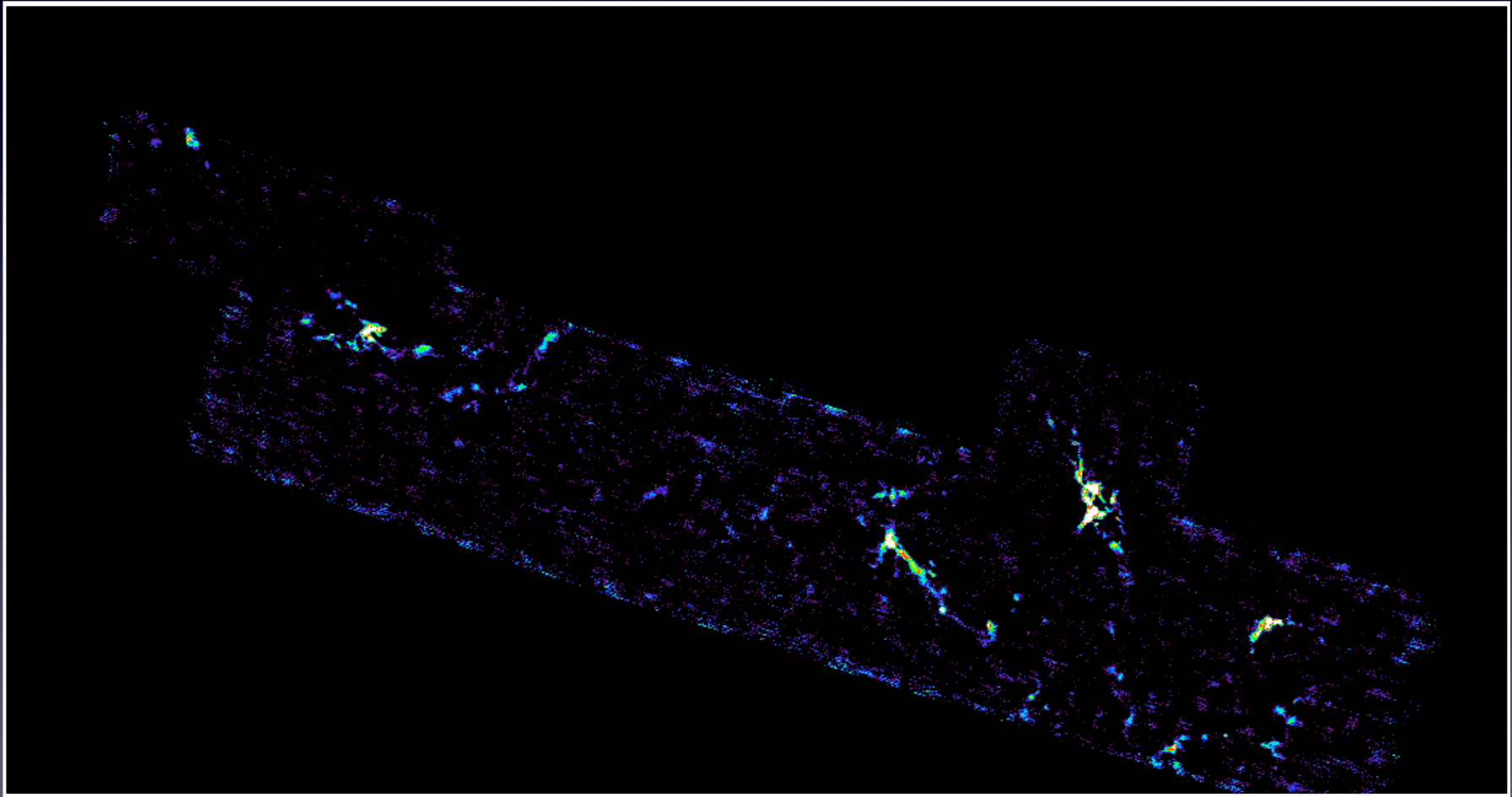
Talk Outline

- Dense Core Ensemble Properties
- Hierarchical Structure in Molecular Emission
- Conclusions & Solicitations

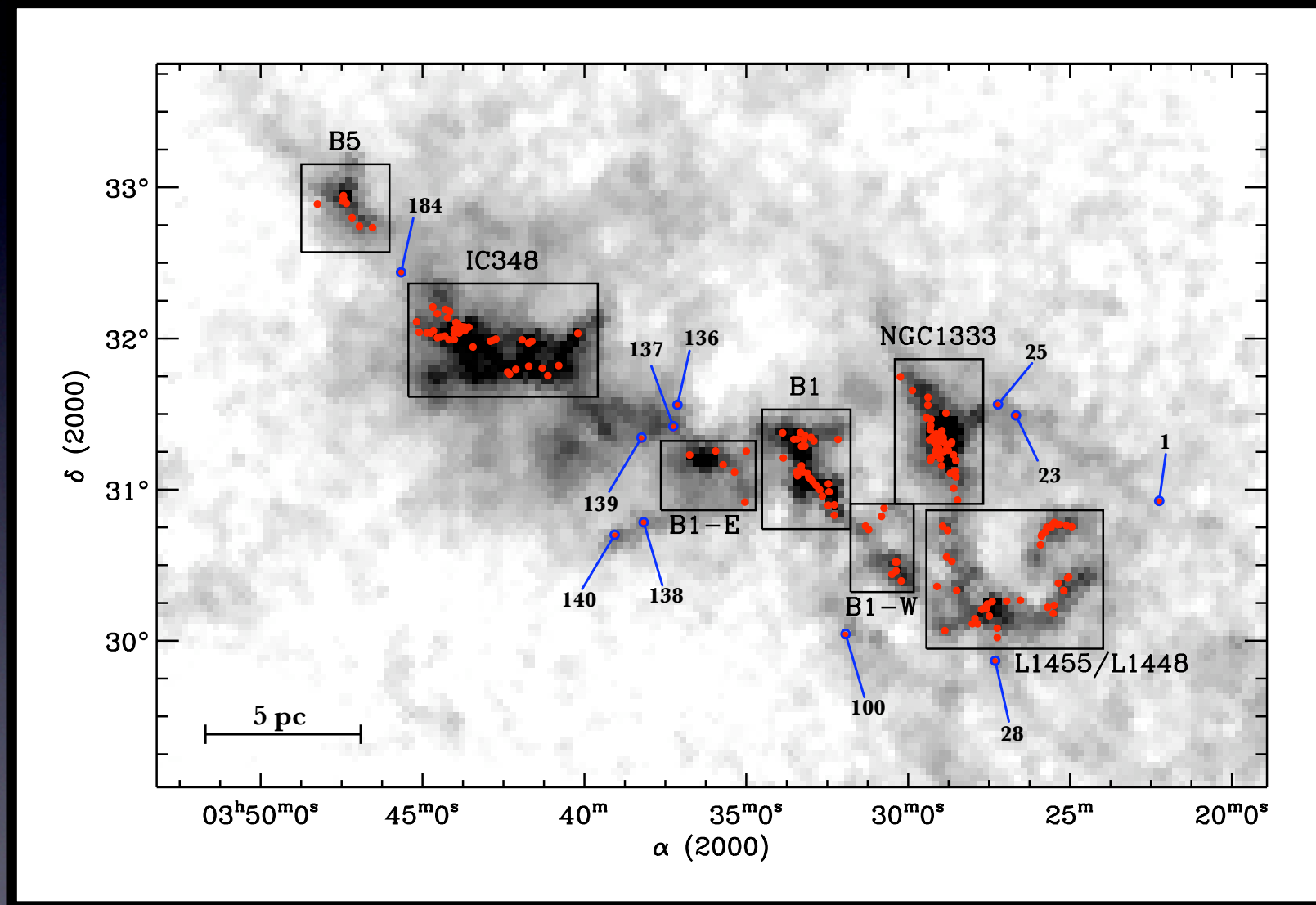
Dense Cores in Perseus



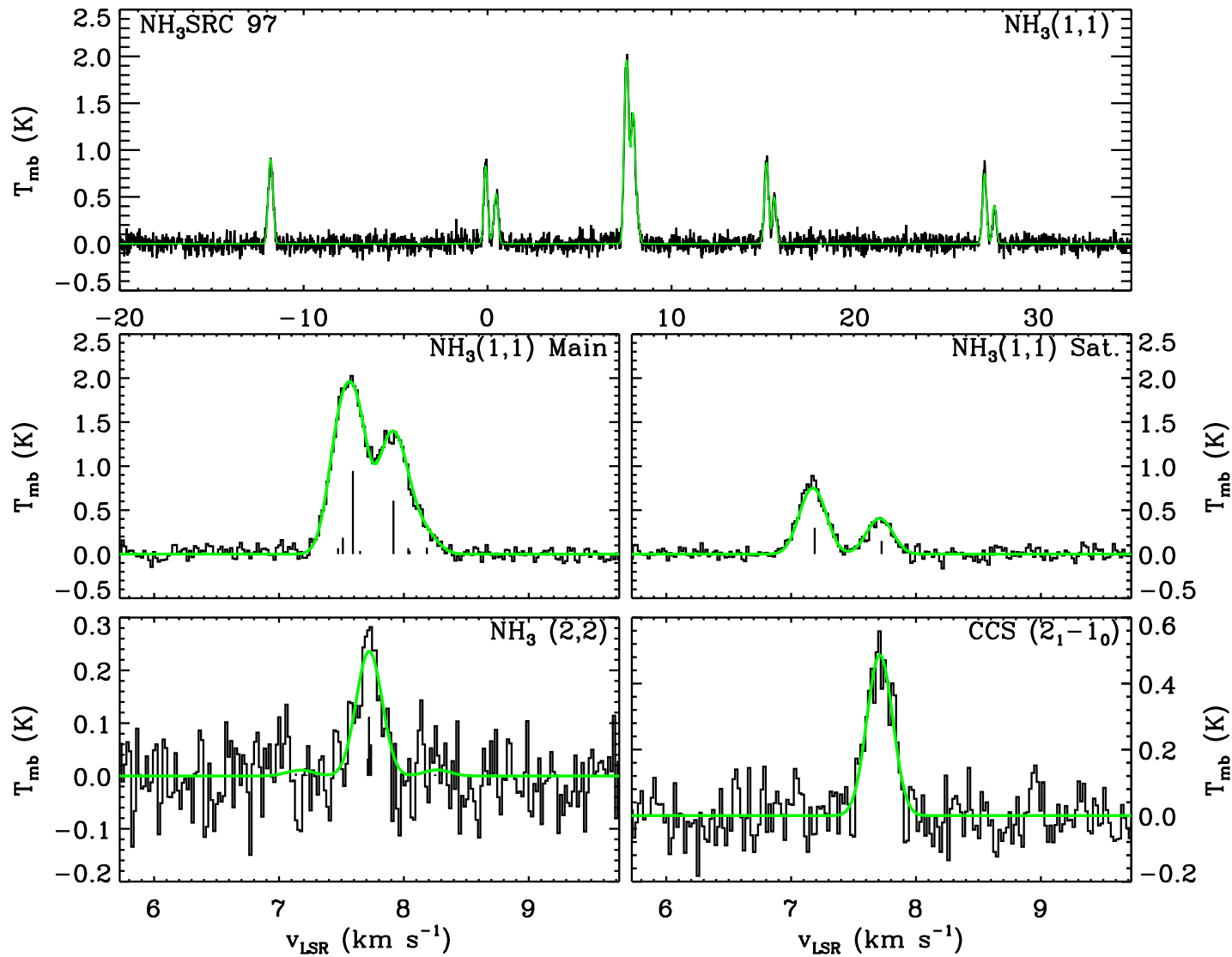
Dense Cores in Perseus



Dense Cores in Perseus



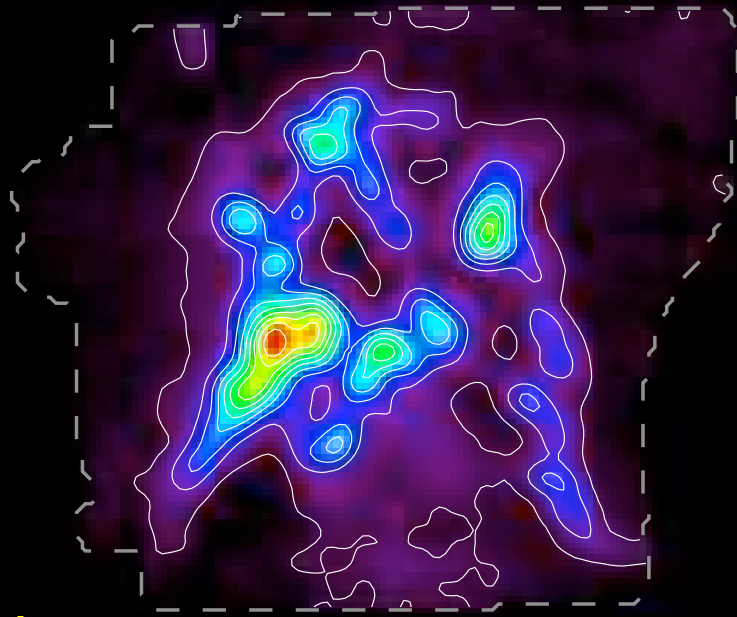
- 193 Dense cores
- Drawn from (sub)mm emission, FIR features.
- Close to complete survey of dense core properties in a molecular cloud.
- Observations in $\text{NH}_3(1,1)$, $\text{NH}_3(2,2)$ and C_2S .
- C_2S traces early time vs. NH_3 traces late time.
- Starless vs. Protostellar information from c2d.



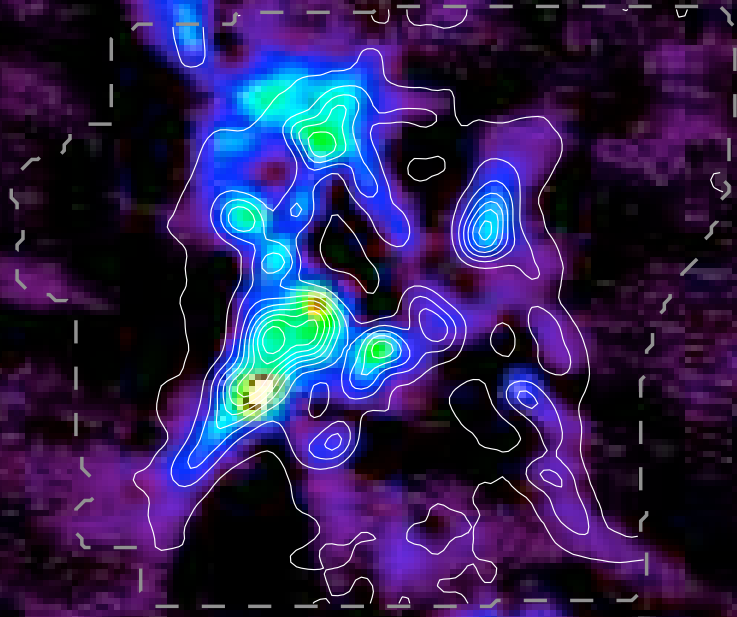
Fit for T_{k} , σ_{v} , v_{LSR} , τ , T_{ex} , $N(\text{NH}_3)$, $N(\text{C}_2\text{S})$
 (plus R , M from dust continuum)

Dust continuum vs. NH_3

NH_3 (1,1) contours on NH_3 (1,1)



NH_3 (1,1) contours on BOLOCAM

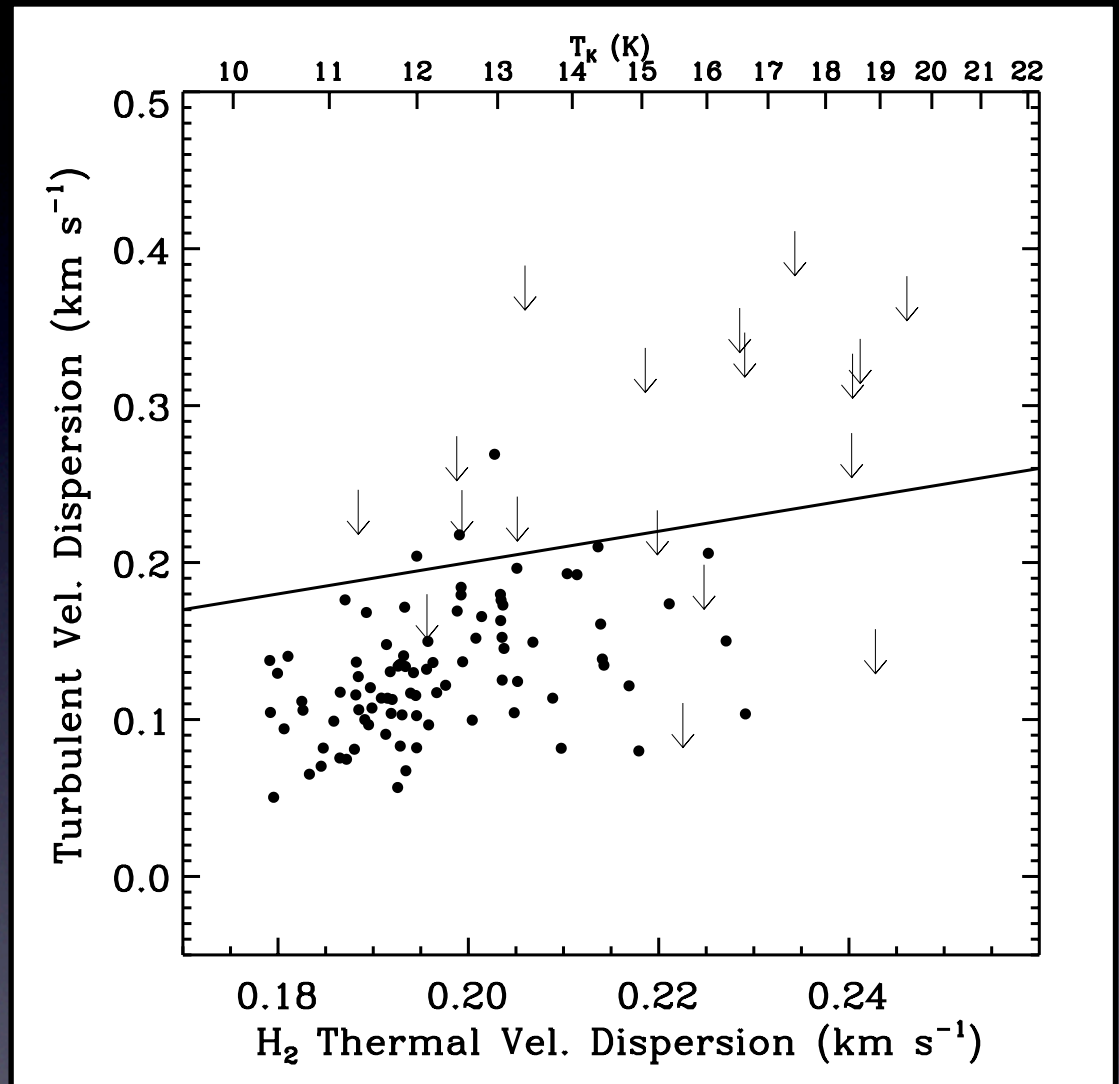


NGC 1333

Core Line Width

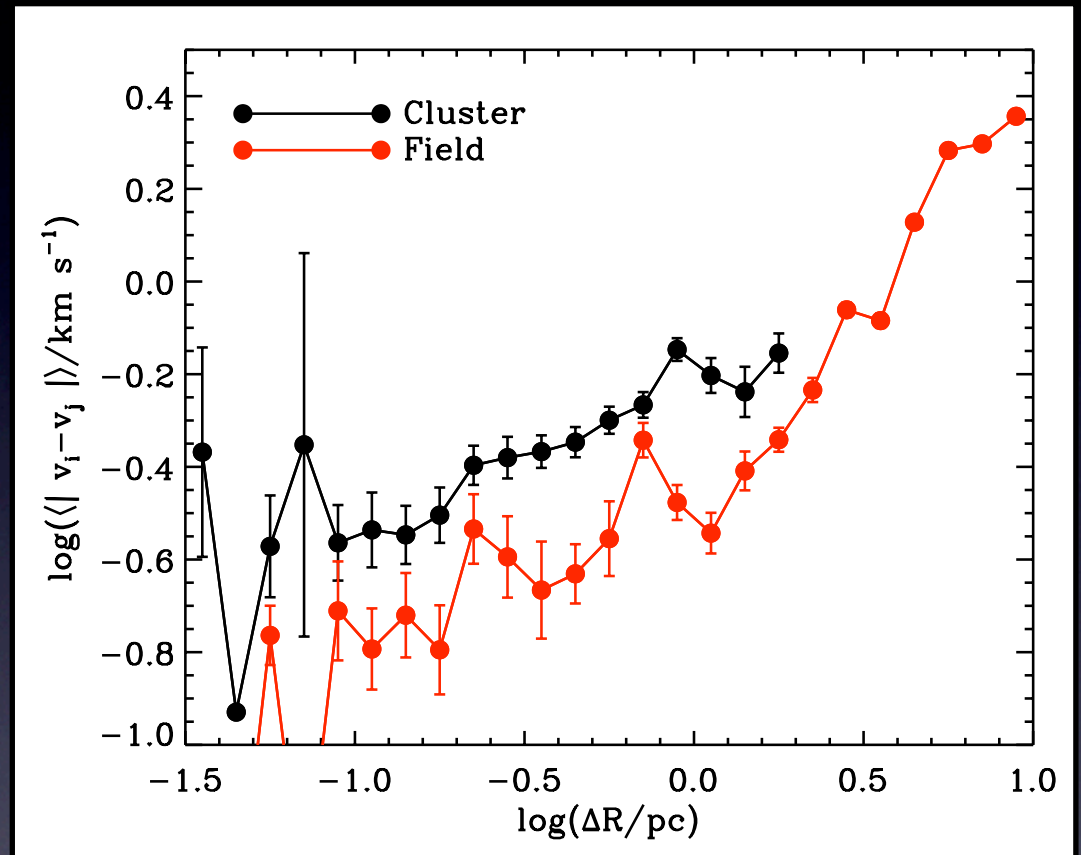
Comparisons of thermal and non-thermal contributions to the line width.

Most cores have subsonic nonthermal motions.



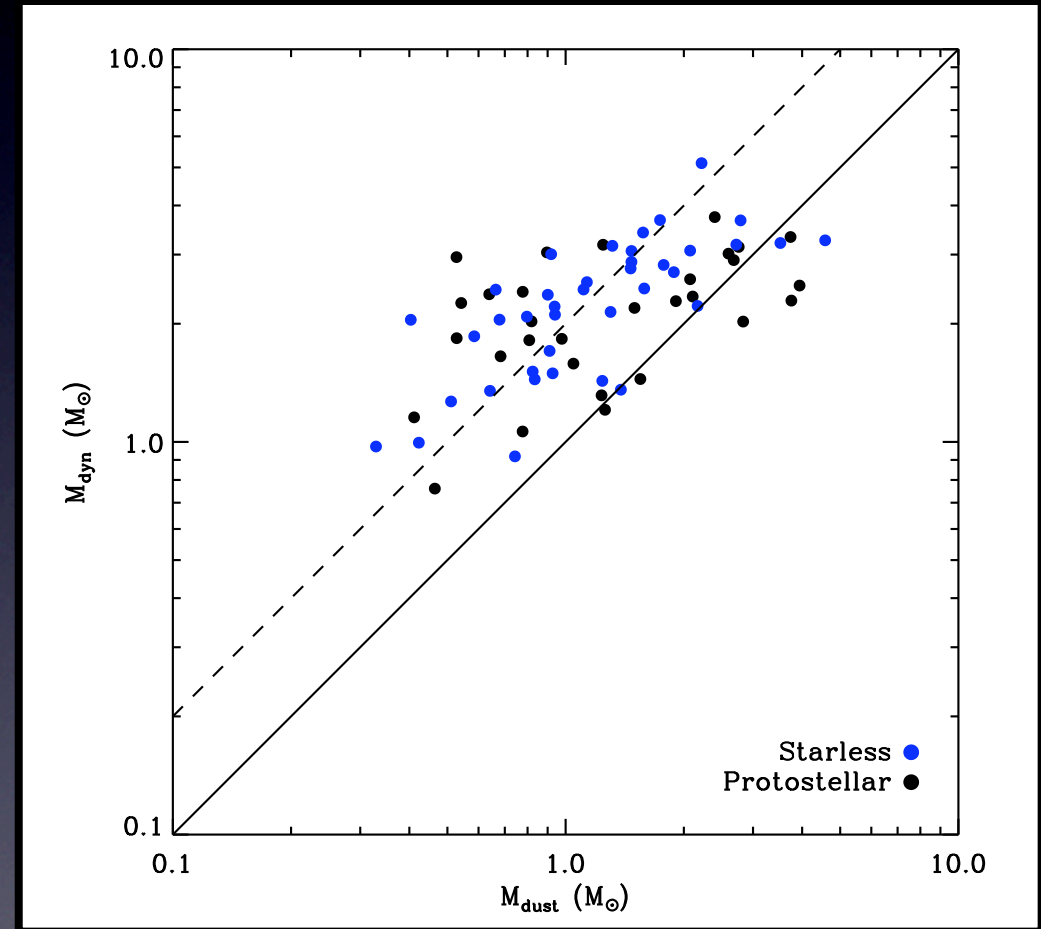
Velocity Structure Functions

Measure the relative motions of dense cores relative to each other.



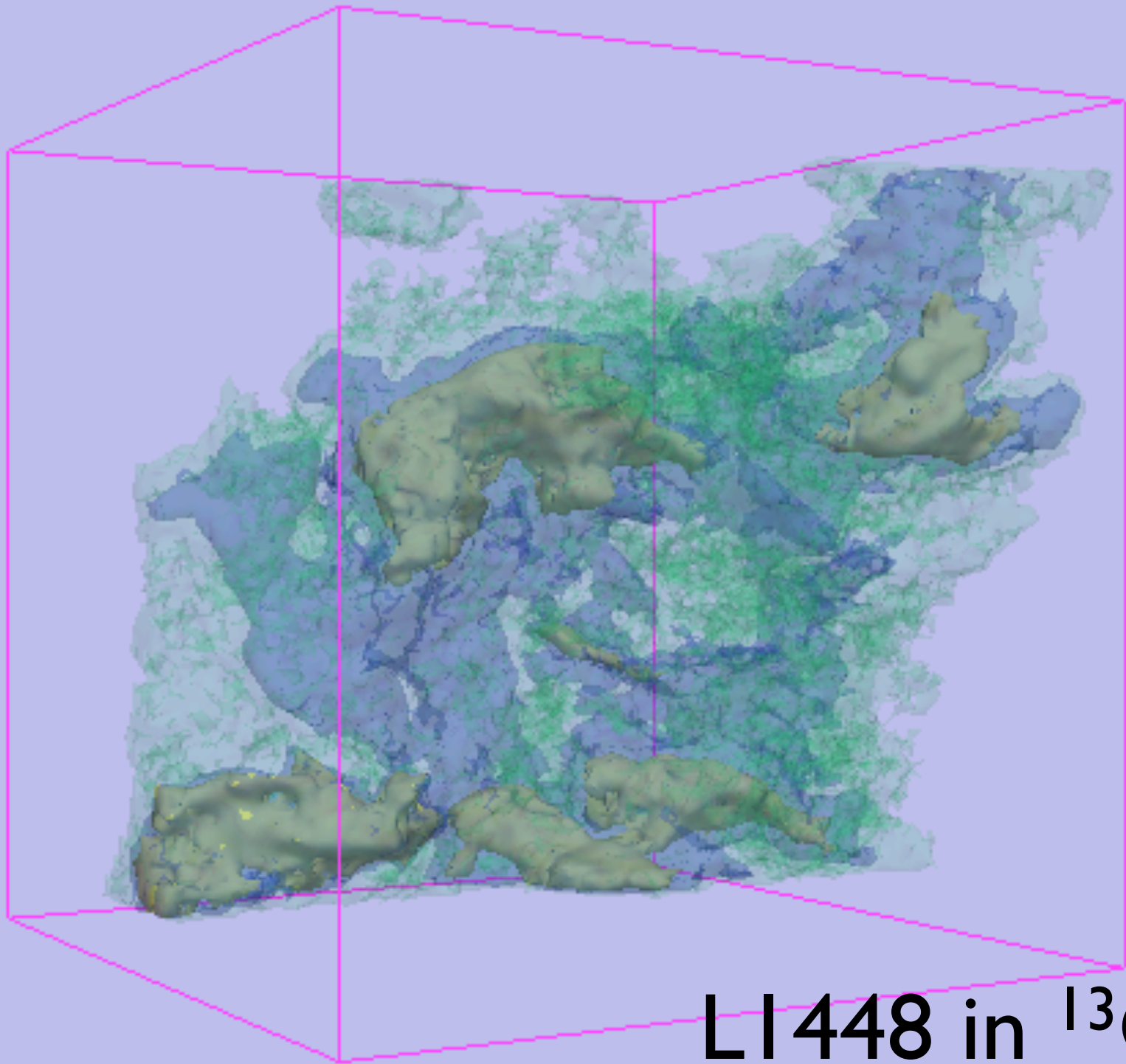
Dynamical State of Dense Cores

- Compare dynamical and luminous mass values.
- Luminous mass and size from dust continuum
- Line width from NH_3 data
- Stellar content from c2d
- NO external pressure in mass est.

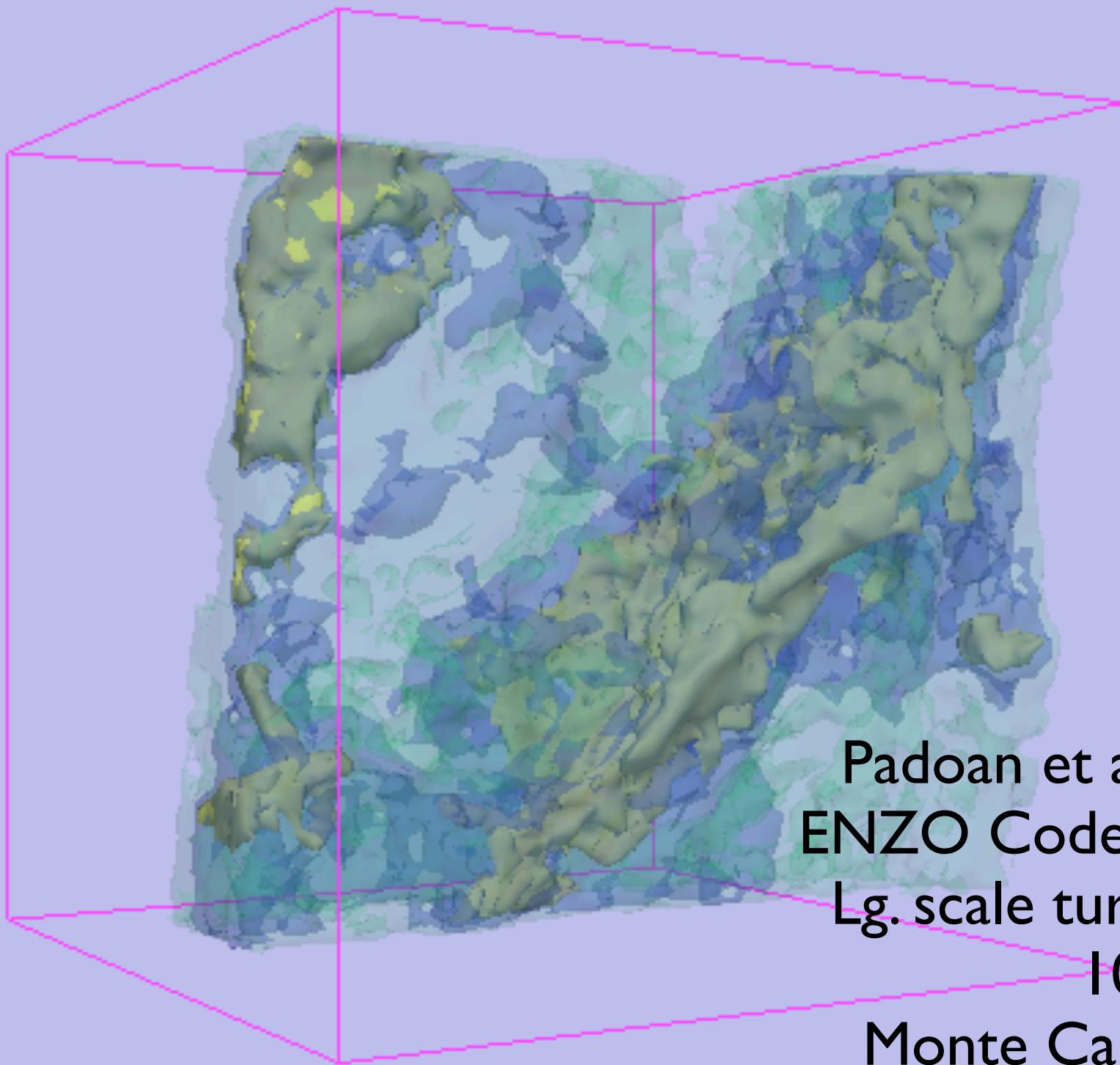




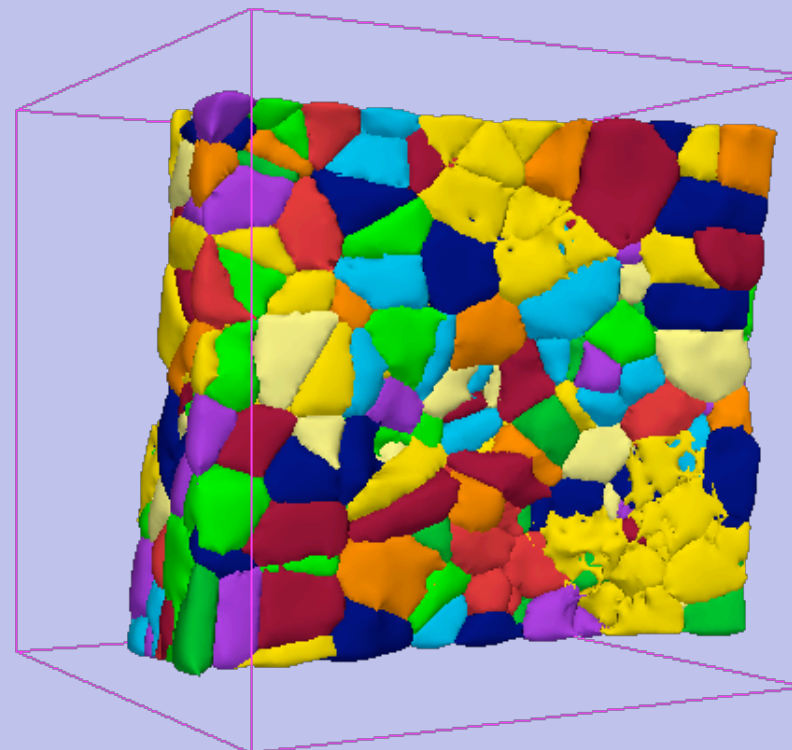
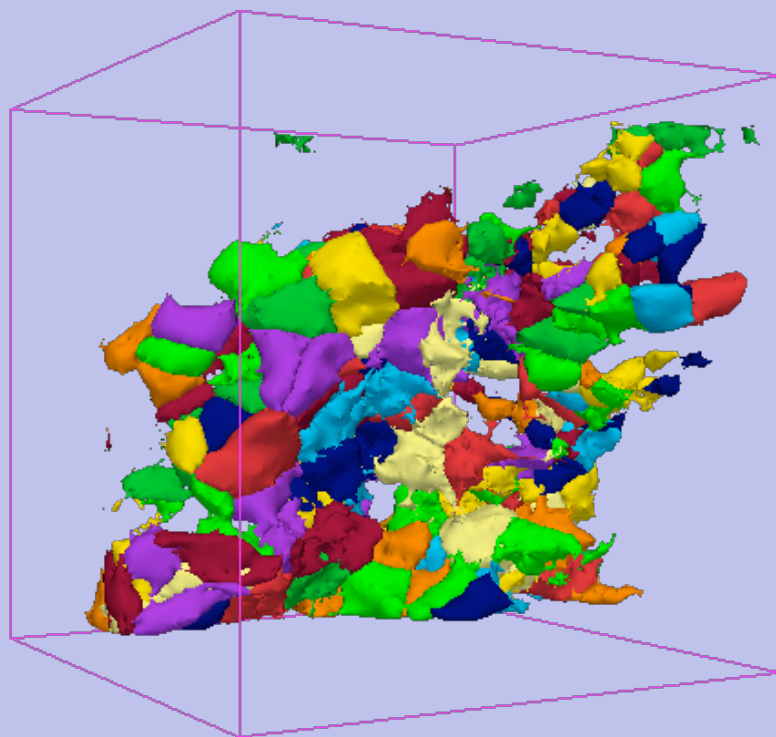
Characterizing Hierarchical Structure in Molecular Clouds



L1448 in ^{13}CO

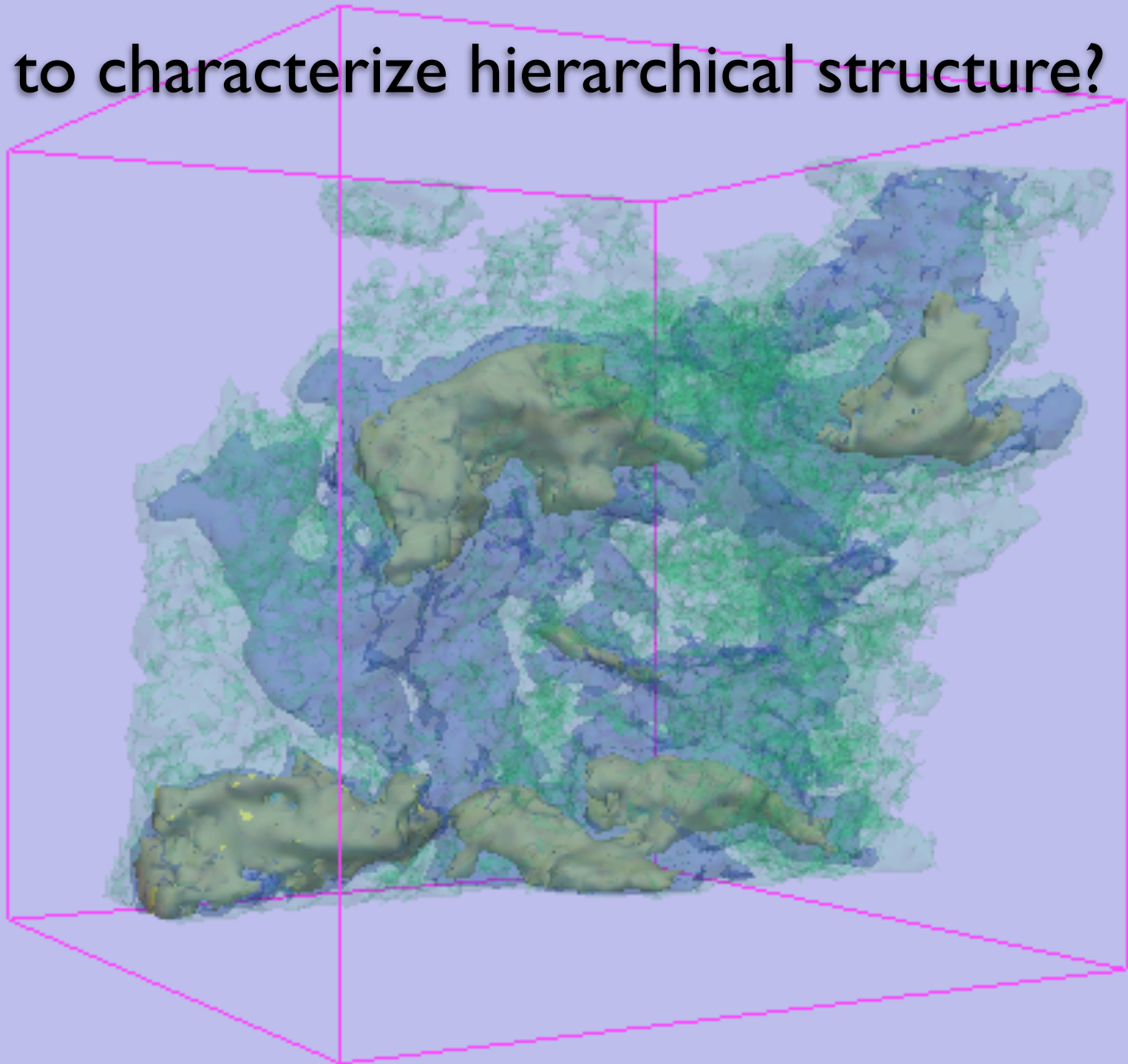


Padoan et al. simulations.
ENZO Code (Eulerian, HD)
Lg. scale turbulent driving
 1024^3
Monte Carlo Rad. Xfer



The industry standard CLUMPFIND segments the emission into small scale objects governed by structure (specifically, the local maxima) in the emission cube.

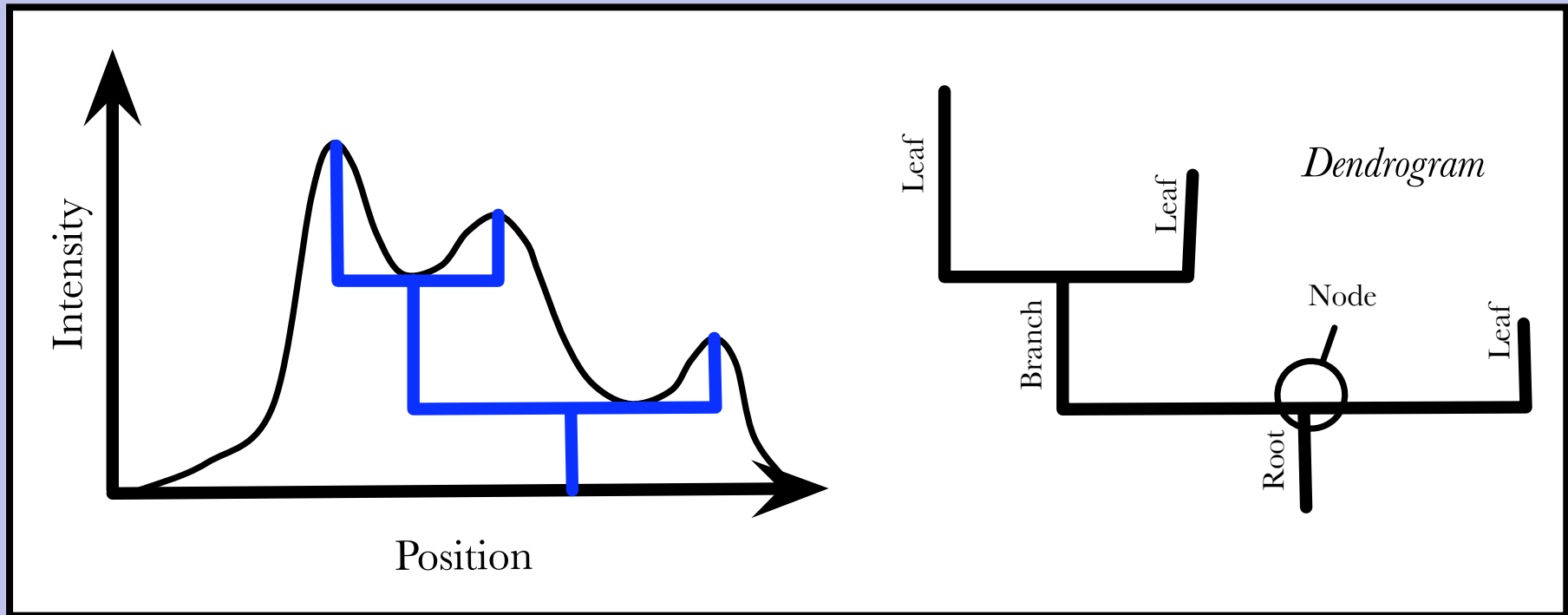
How to characterize hierarchical structure?



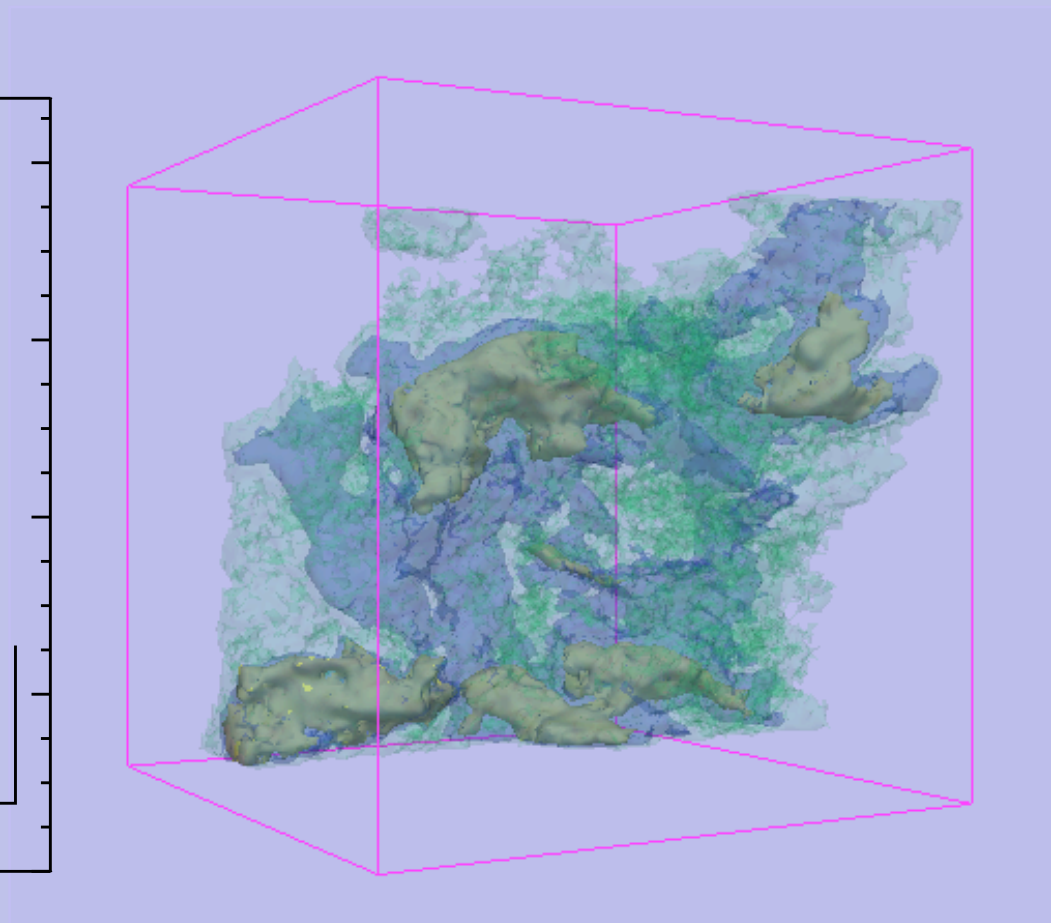
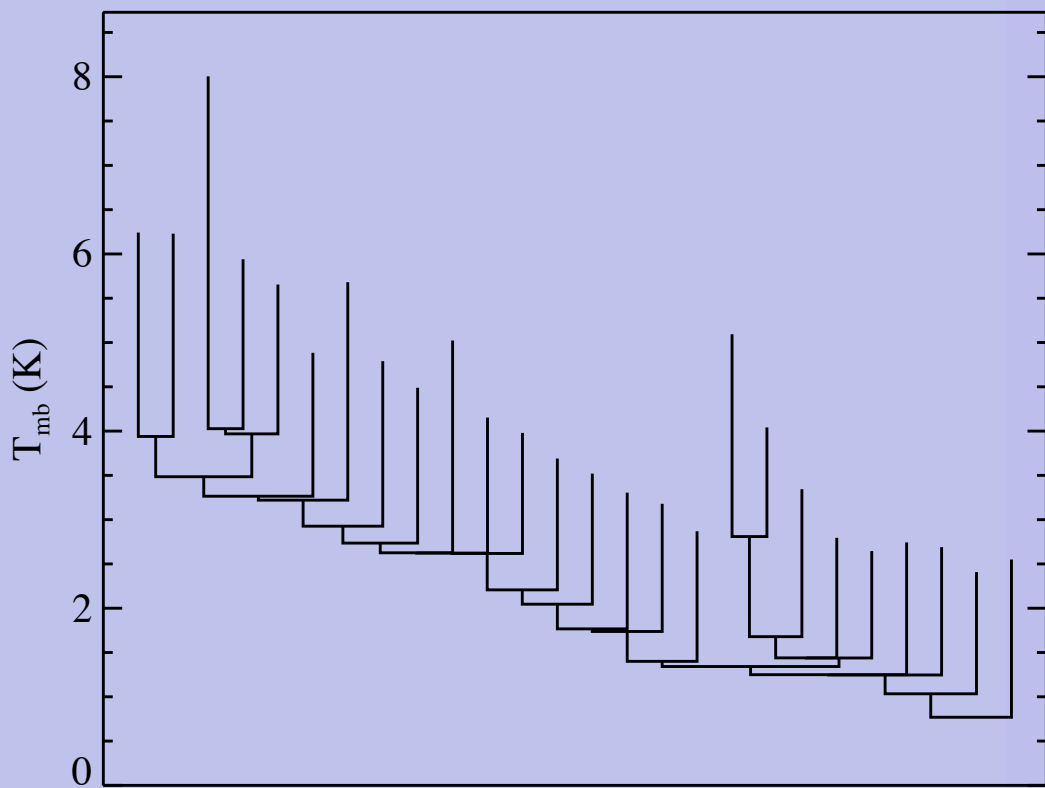
Dendrograms

- a hierarchy-preserving abstraction

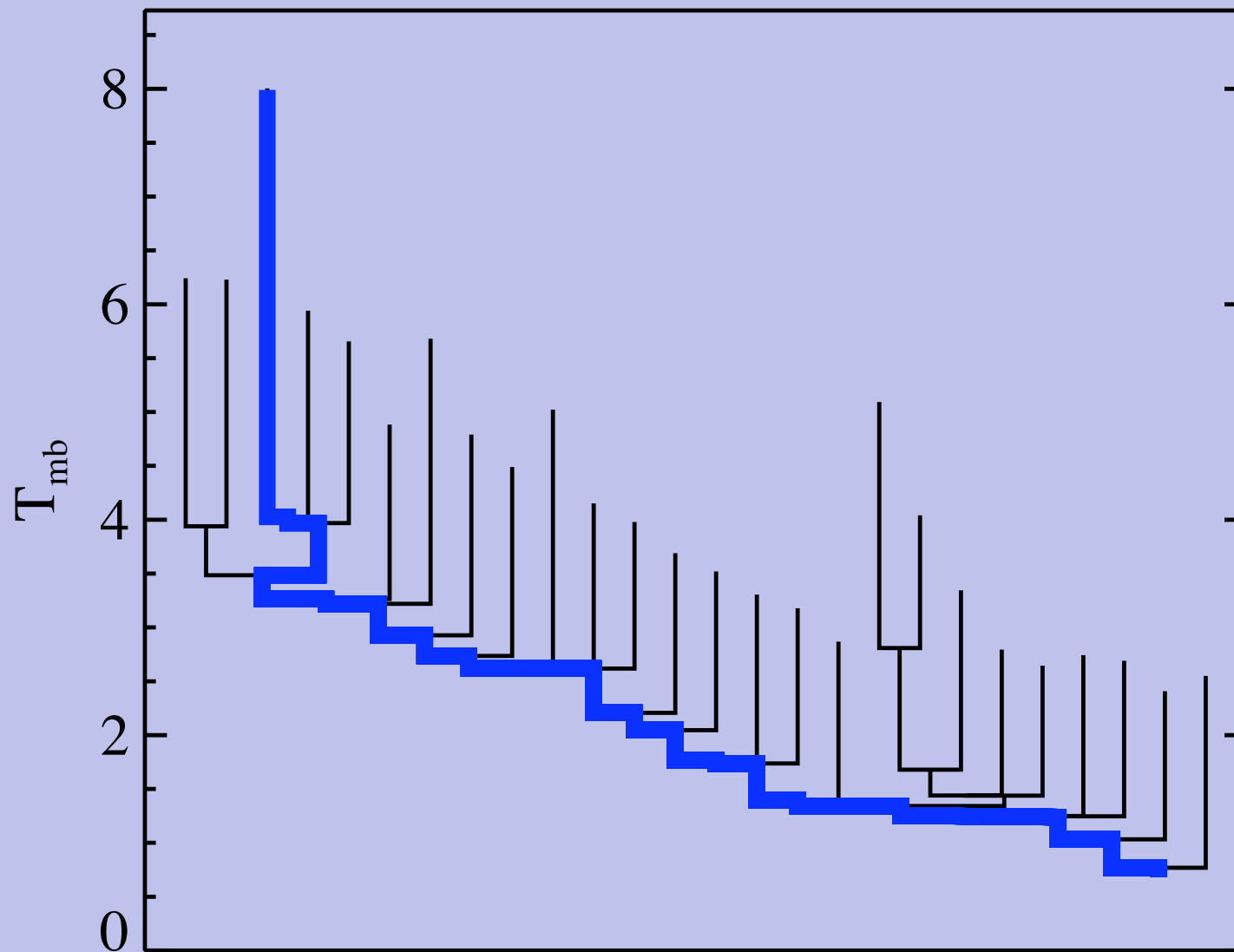
Heavily inspired by “structure trees” by Houllahan & Scalo (1993)



Dendrogram of LI 448

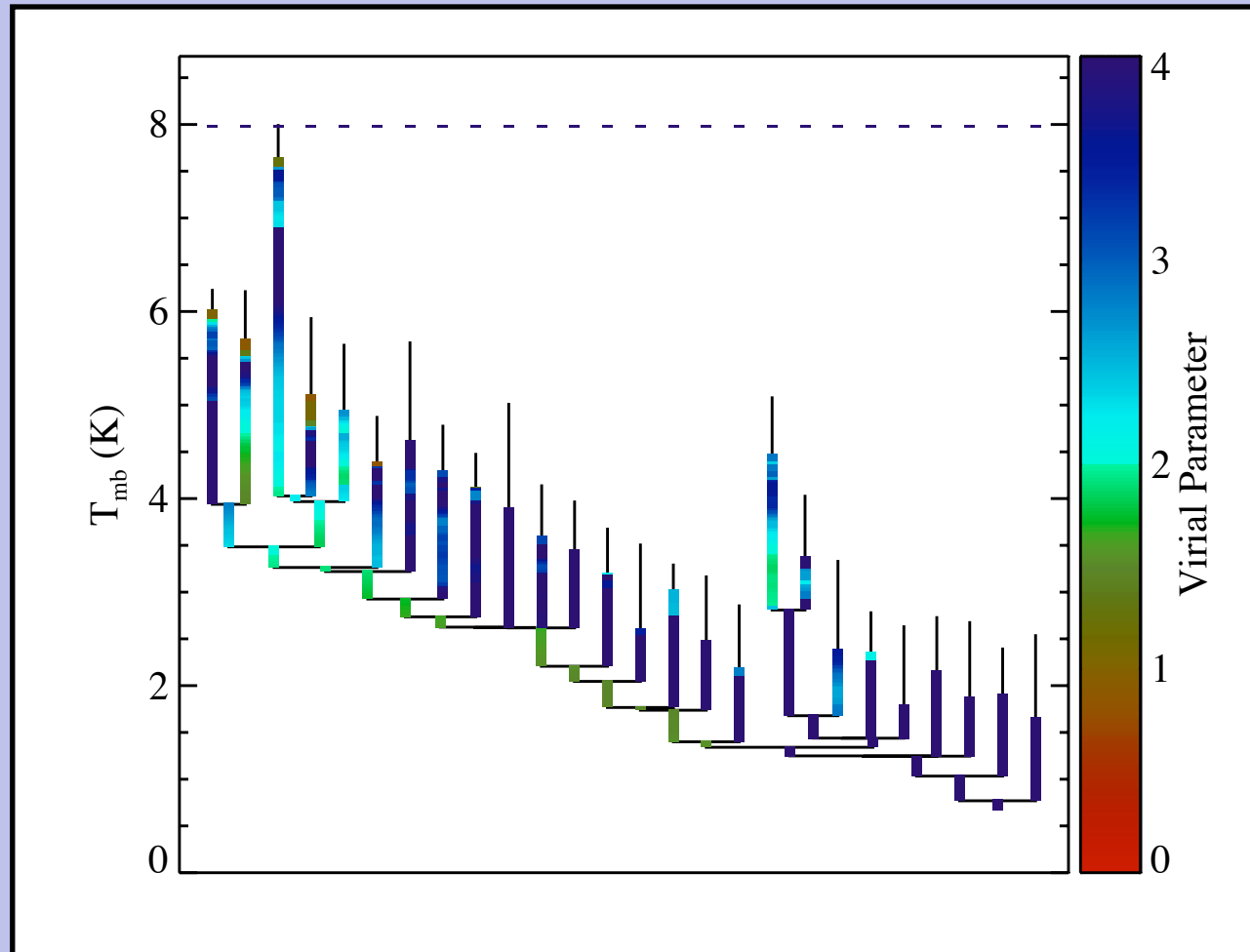


Determination of Branch Properties



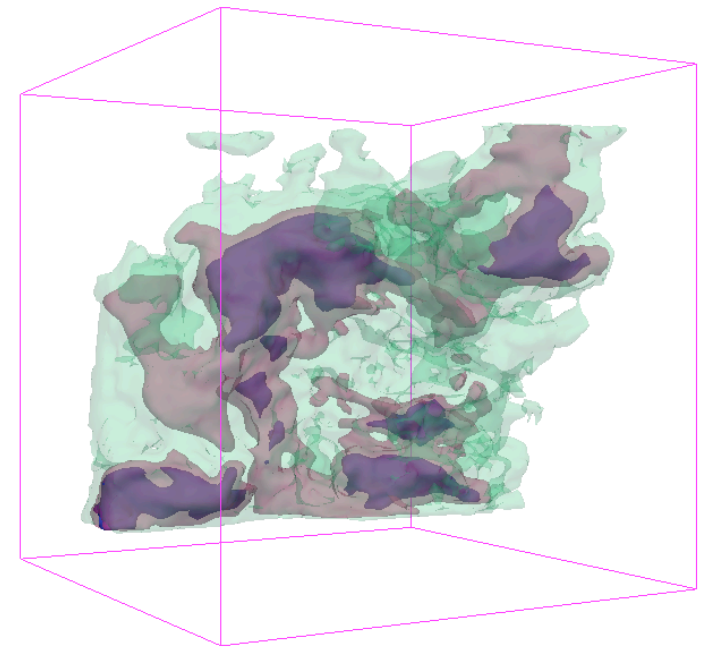
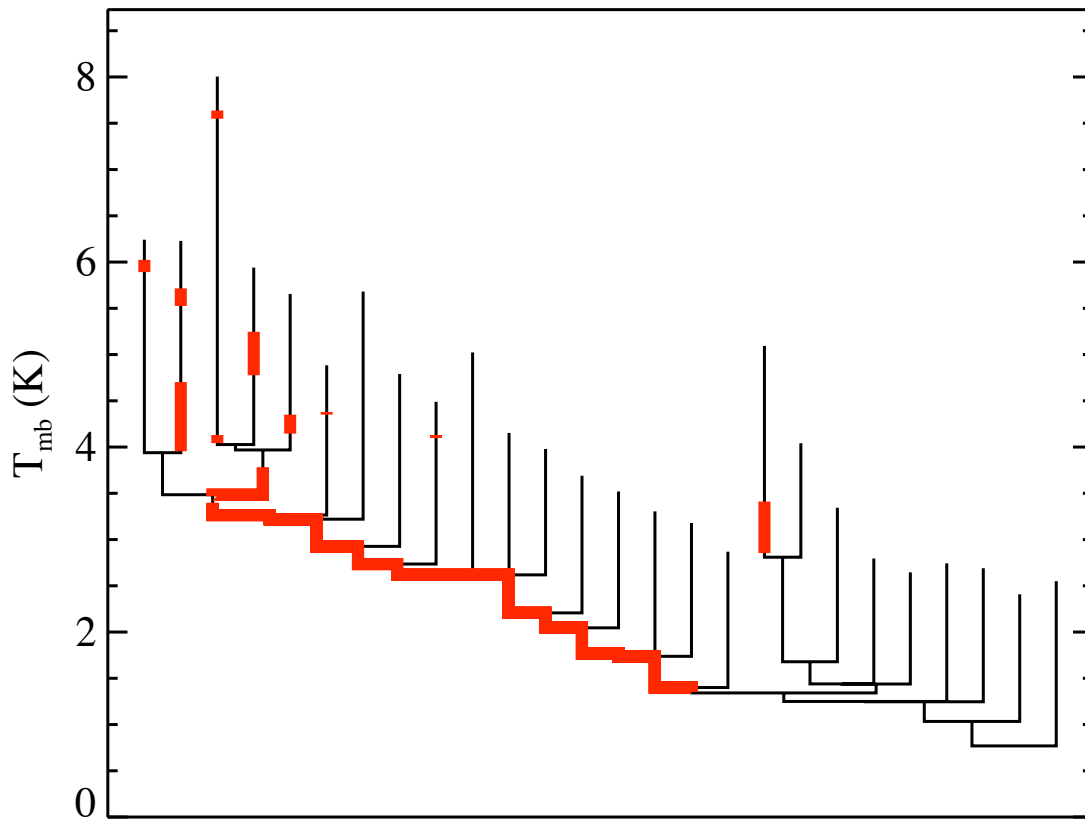
Determination of Branch Properties

$$\alpha_{\text{VIR}} \equiv \frac{5\sigma_v^2 R}{GM} = \frac{5\sigma_v^2 R}{GX L_{\text{CO}}}$$

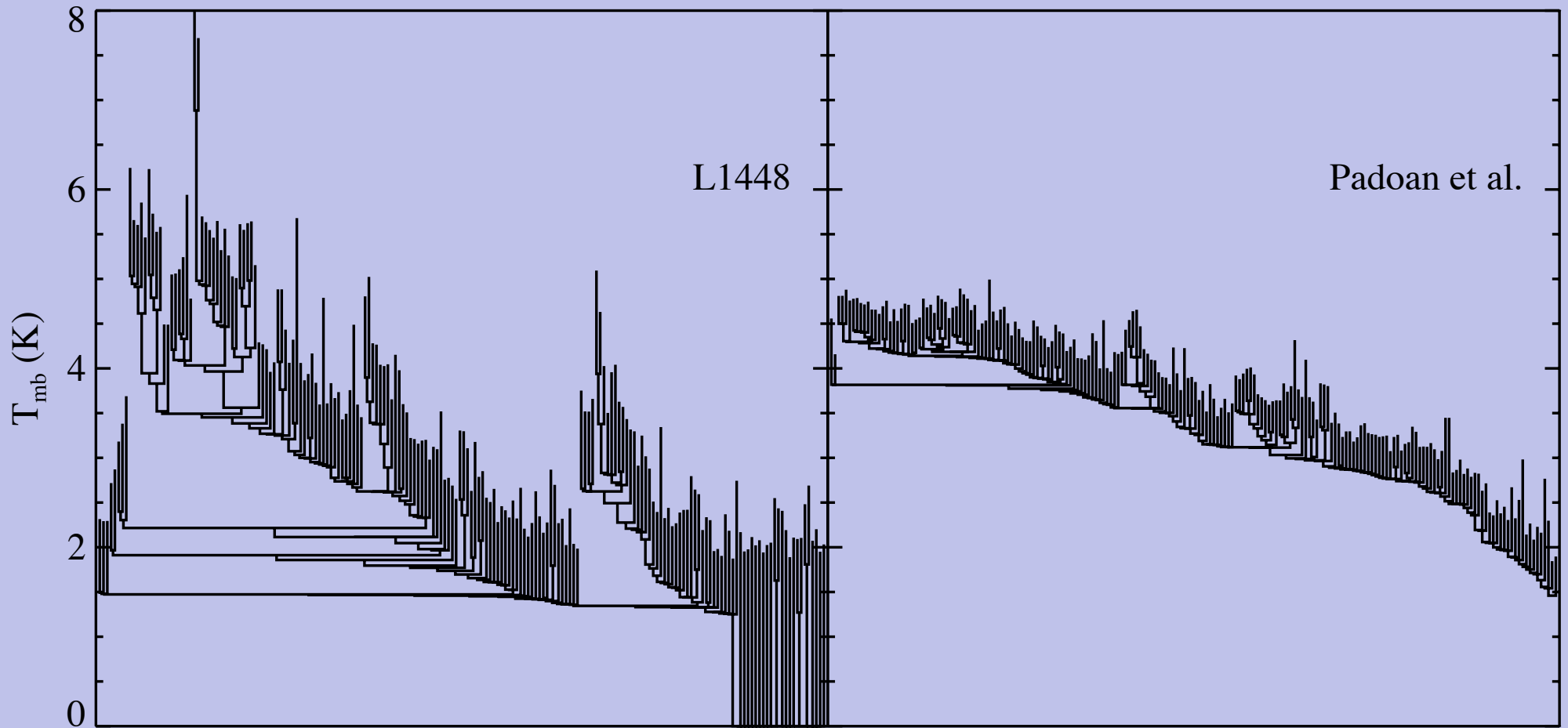


Determination of Branch Properties

$$\alpha_{\text{VIR}} \equiv \frac{5\sigma_v^2 R}{GM} = \frac{5\sigma_v^2 R}{GX L_{\text{CO}}}$$



Sensitivity to Noise

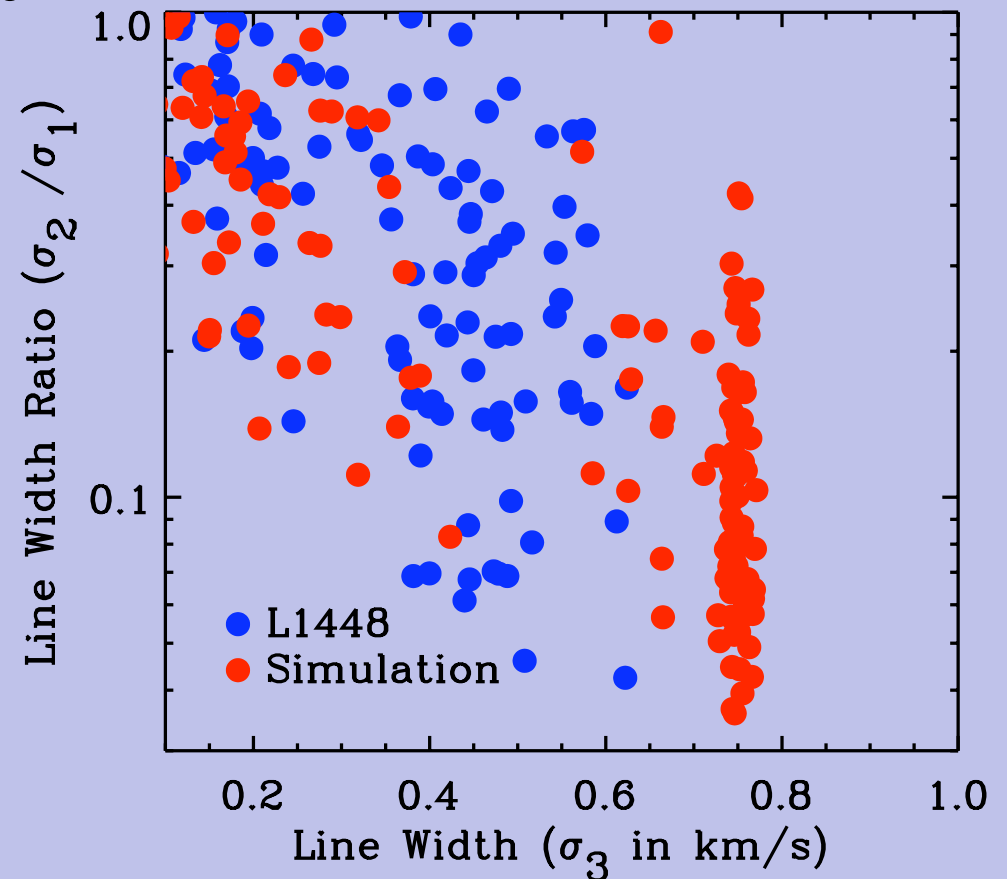
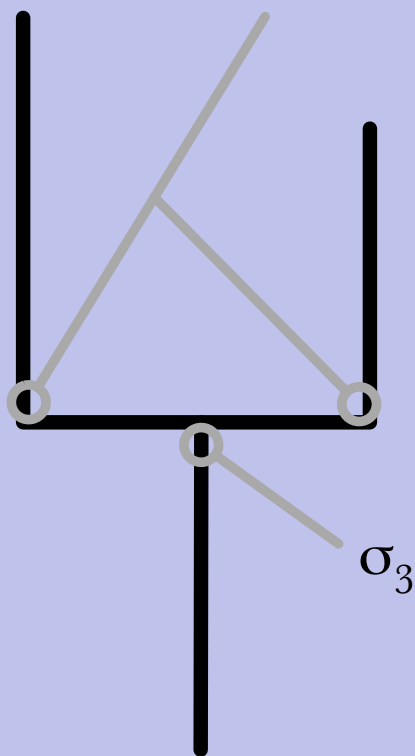


Developing New Statistics

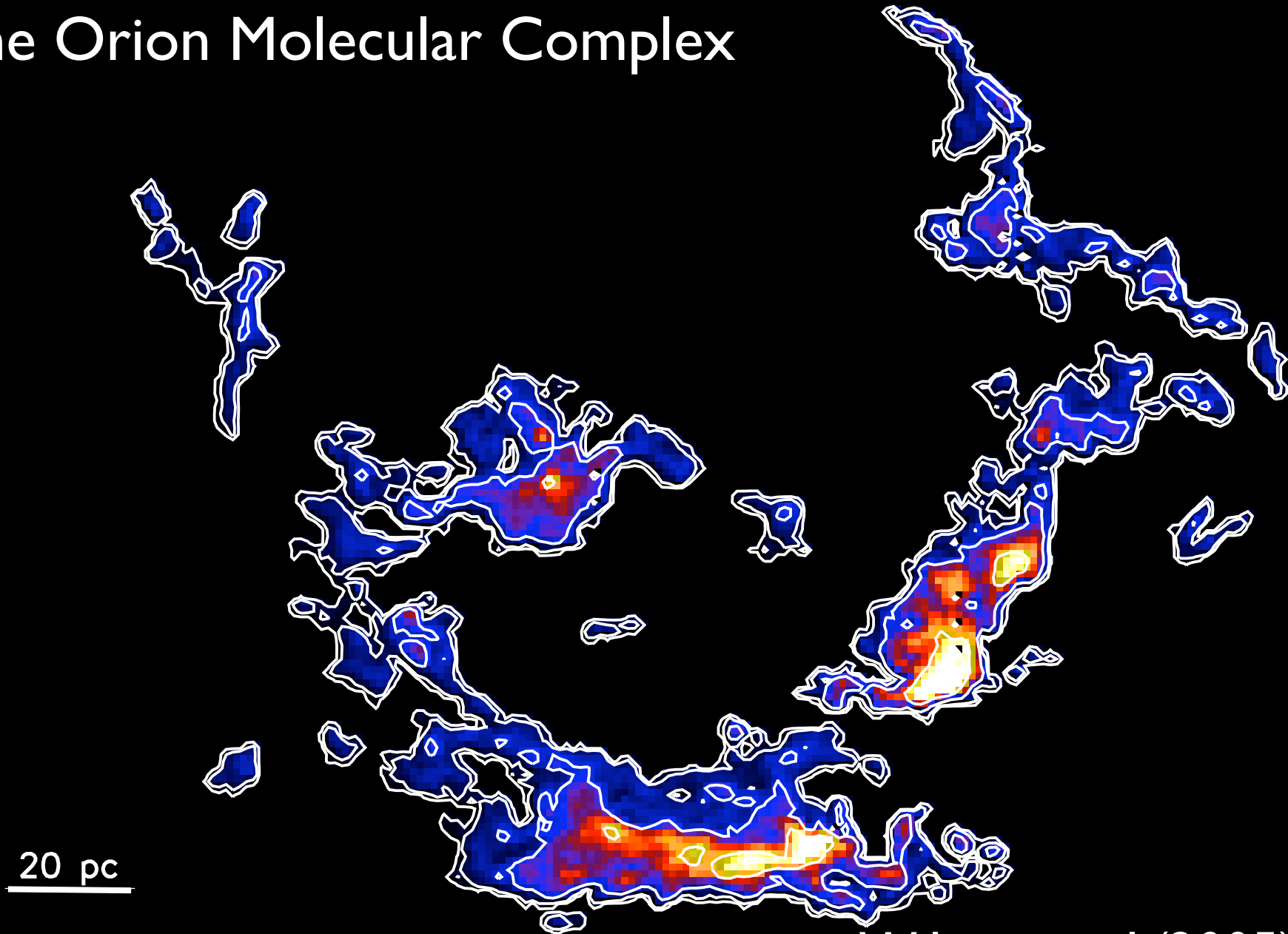
Measure line width above merger.

Define σ_1 as the larger of the two

and σ_2 as the smaller.

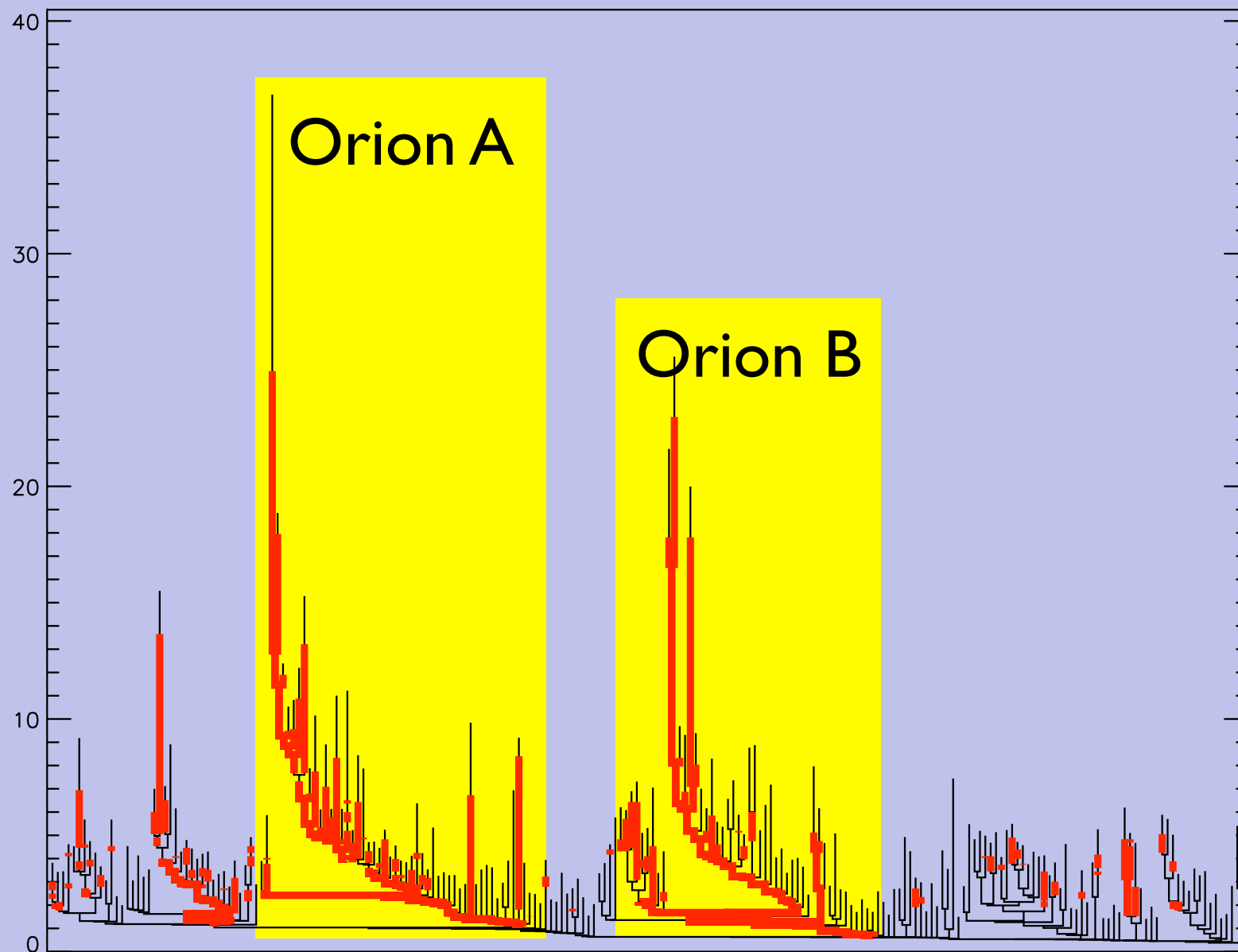


The Orion Molecular Complex



20 pc

Wilson, et al.(2005)



Summary

- Ensemble properties of dense cores
 - Most are thermally dominated, show velocity structure fcn.
- Hierarchical structure
 - Still half-baked. Suggestions welcome.