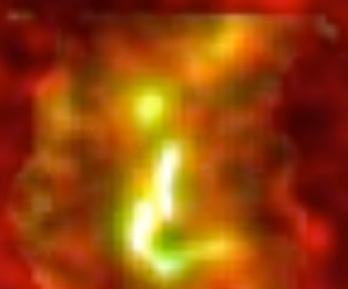
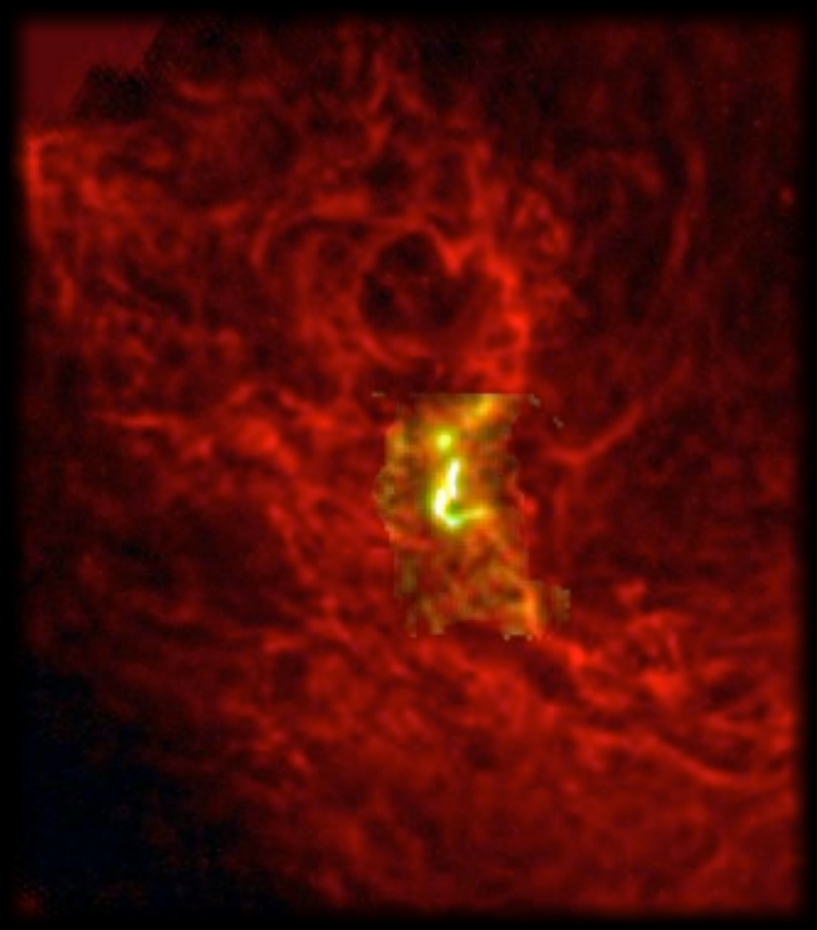
DO FILAMENTS CROSS "CORE" BOUNDARIES?



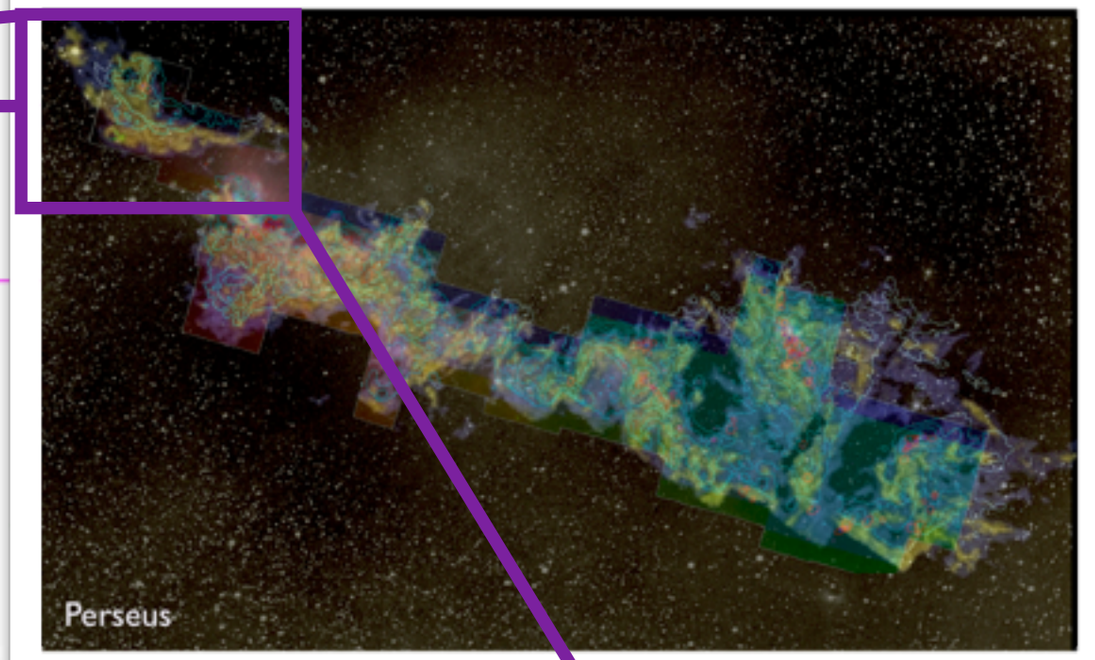
Alyssa Goodman & Hope Chen,
Harvard-Smithsonian Center for Astrophysics
+
Jaime Pineda, ETH Zurich & MPE
Stella Offner, UMASS

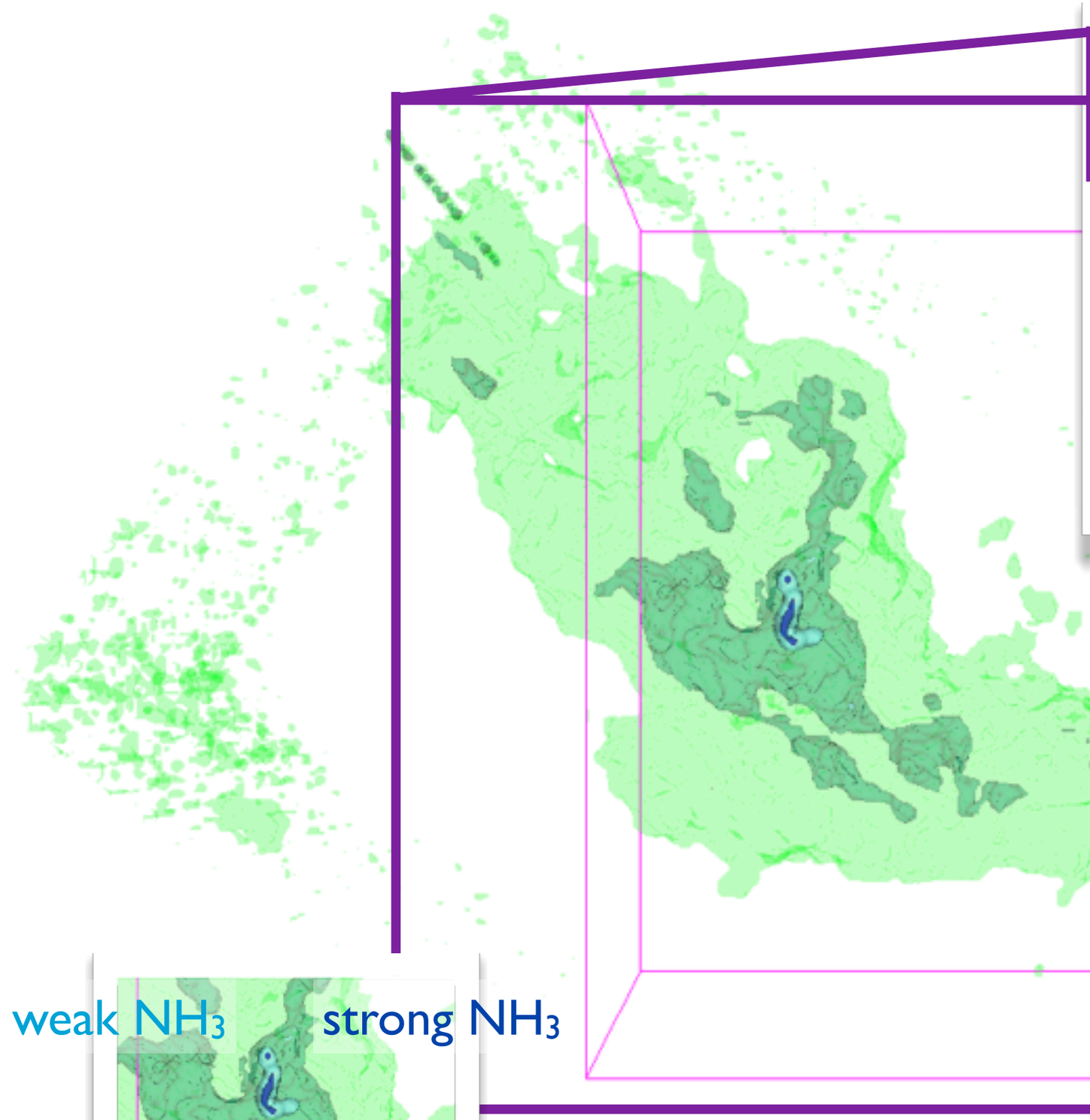
COHERENT CORES
ISLANDS OF CALM IN TURBULENT SEAS(?)

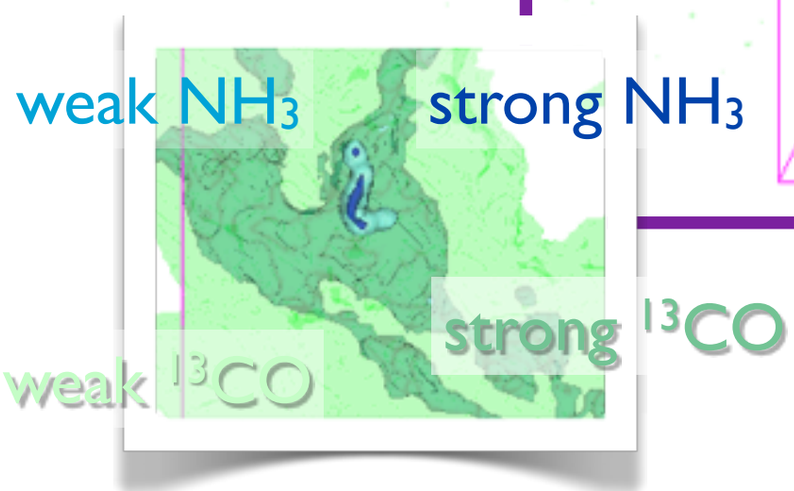


30-year story: Myers & Benson 1983, Goodman et al. 1998, Pineda et al. 2010, 2011, 2014

THE B5 REGION, IN PERSEUS

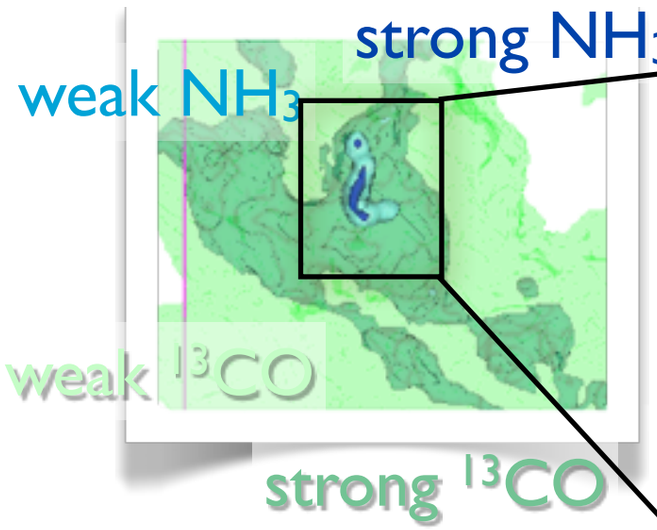




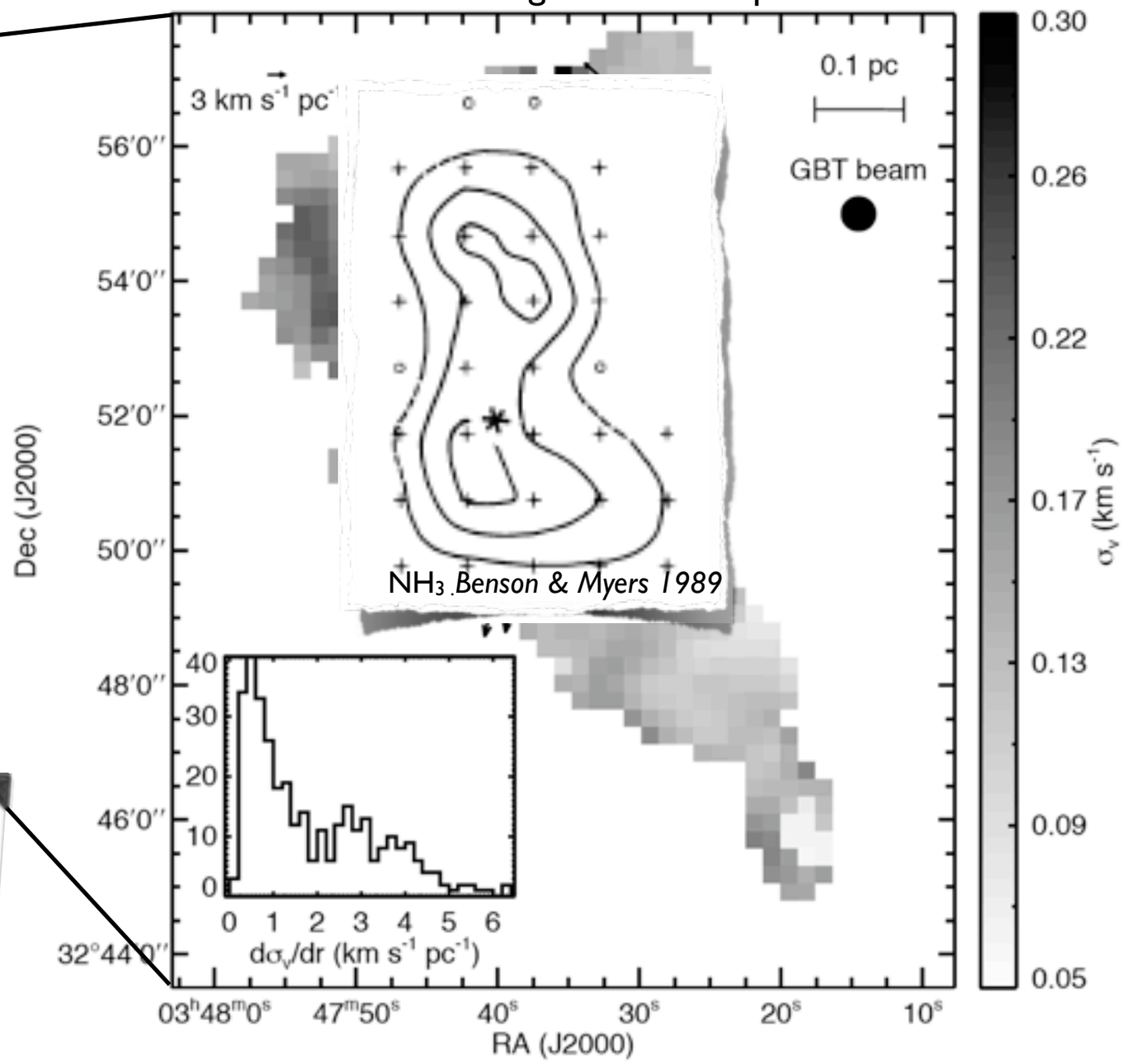


many thanks to Jaime Pineda & Jens Kauffmann for this figure
COMPLETE data: ^{13}CO from Ridge et al. 2006; NH_3 from Pineda et al. 2010

STRONG EVIDENCE FOR "VELOCITY COHERENCE" IN DENSE CORES

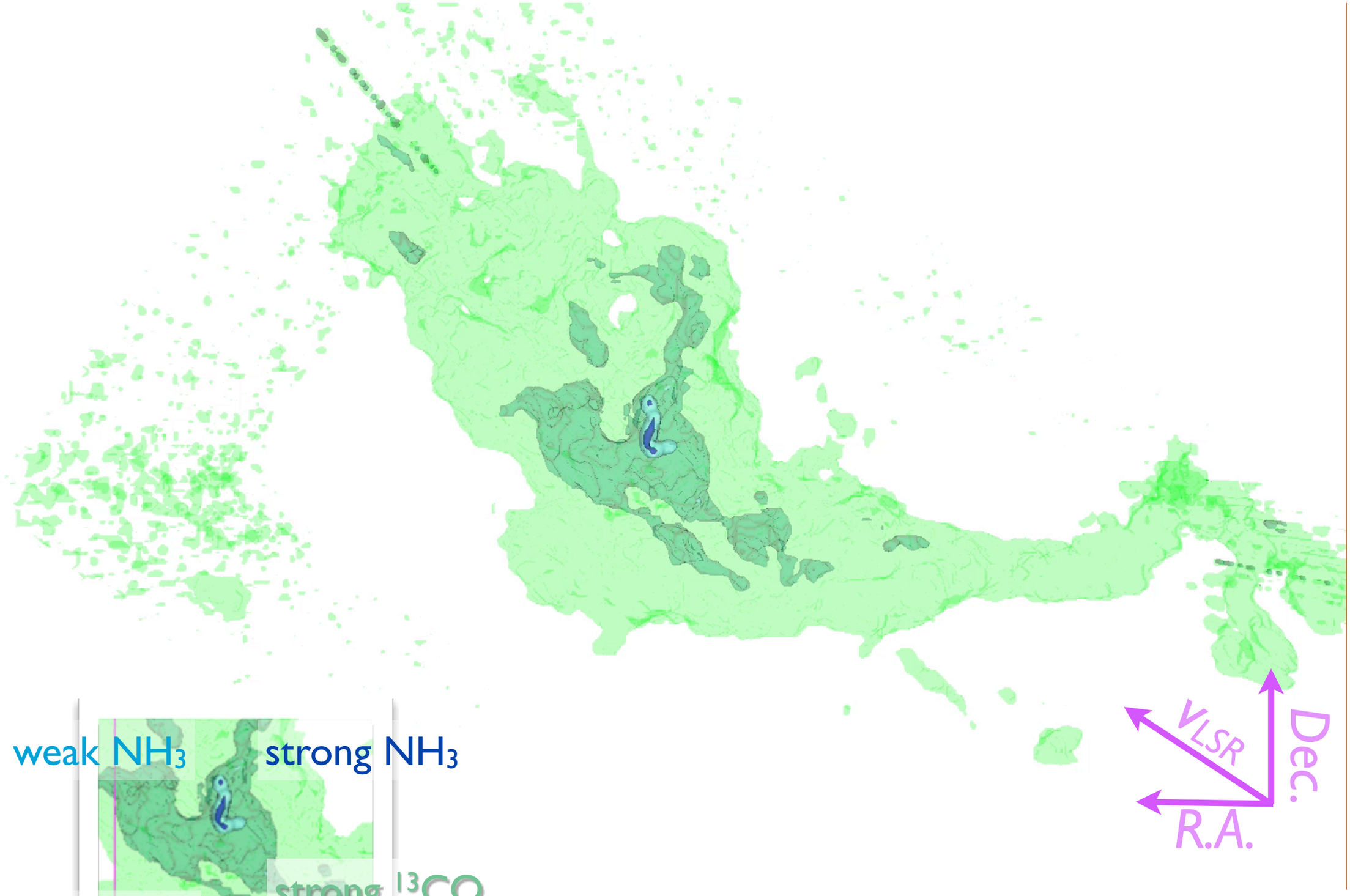


greyscale shows NH_3 velocity dispersion, arrows show gradient in dispersion



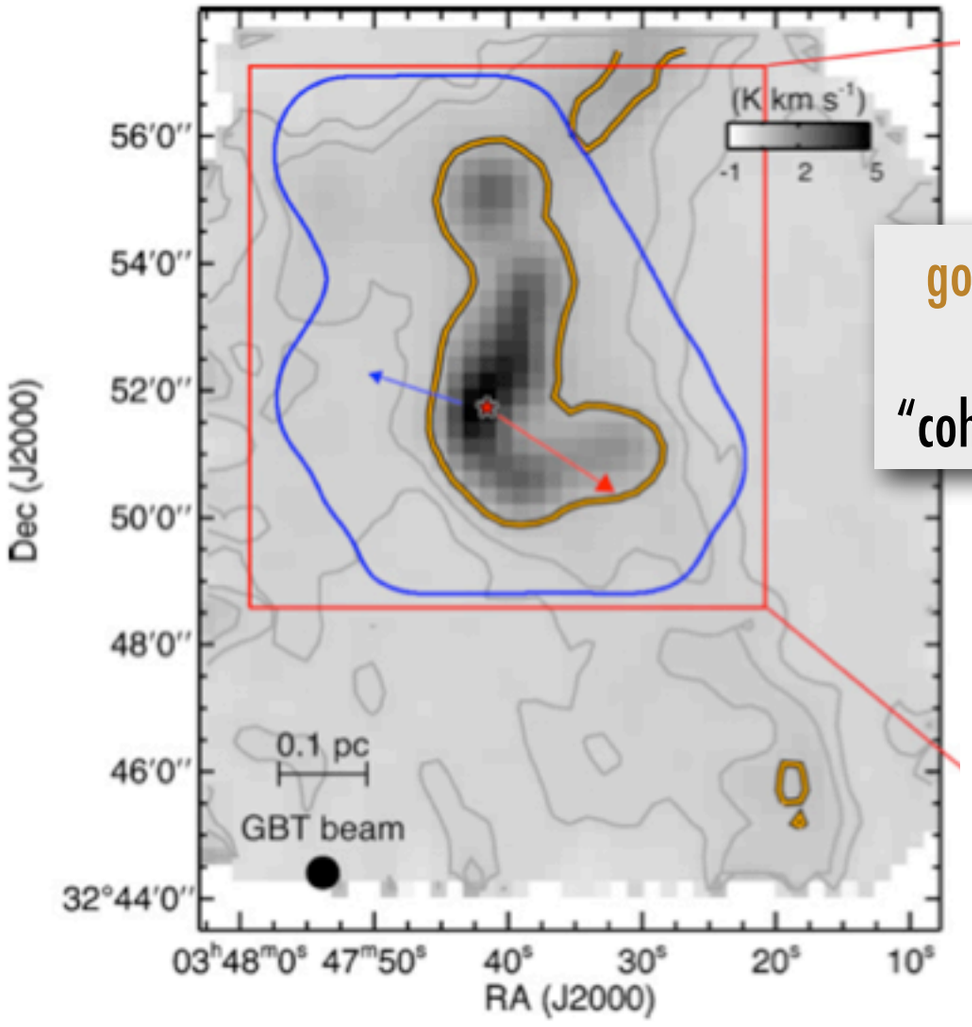
GBT NH_3 observations of the B5 core (Pineda et al. 2010)

POSITION-VELOCITY STRUCTURE OF THE B5 REGION IN PERSEUS



*many thanks to Jaime **Pineda** & Jens Kauffmann for this figure*
COMPLETE data: ^{13}CO from Ridge et al. 2006; NH_3 from Pineda et al. 2010

BUT THEN... VLA (JAIME) FOUND SUB-STRUCTURE

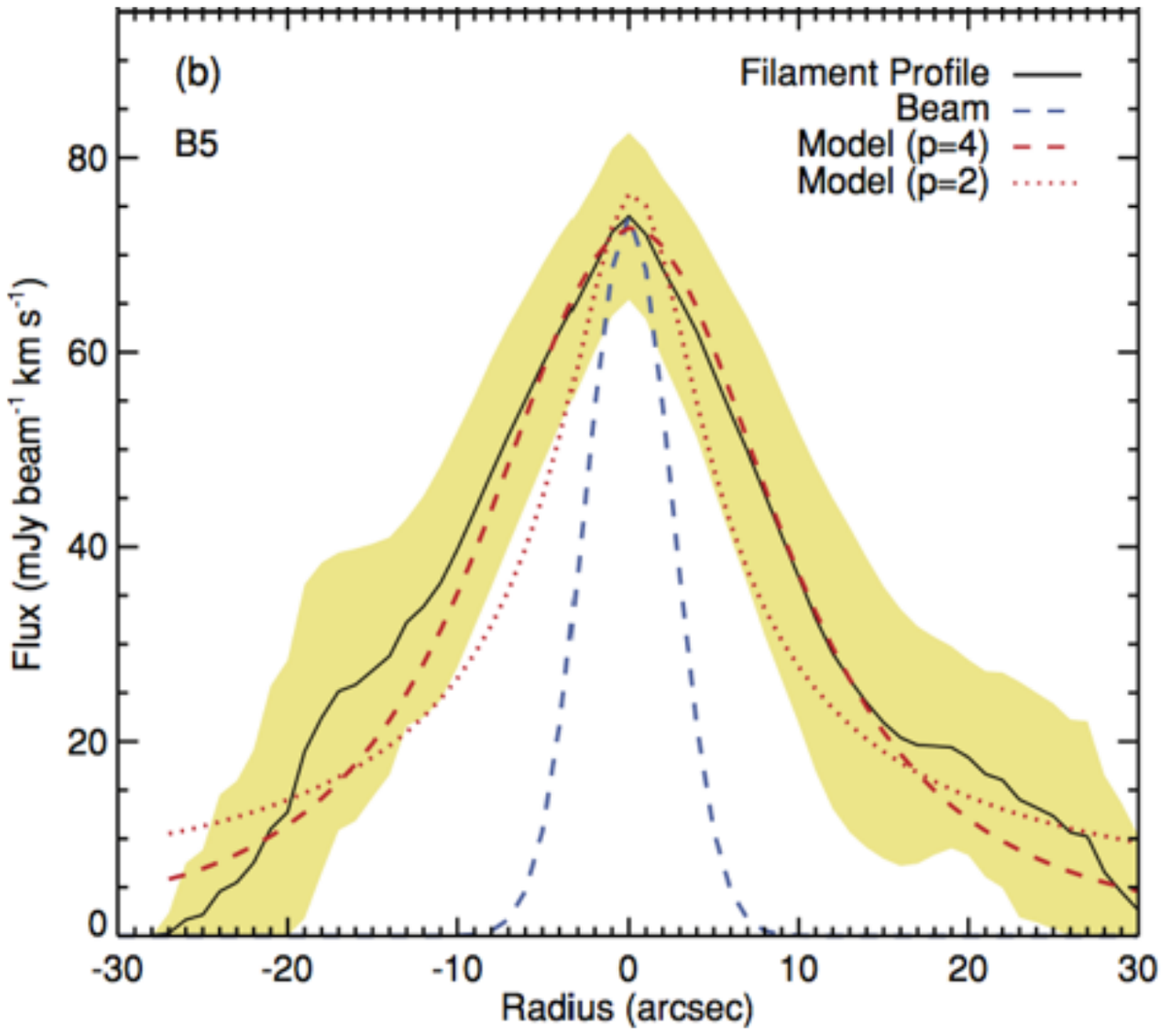


gold contour shows "coherent" core

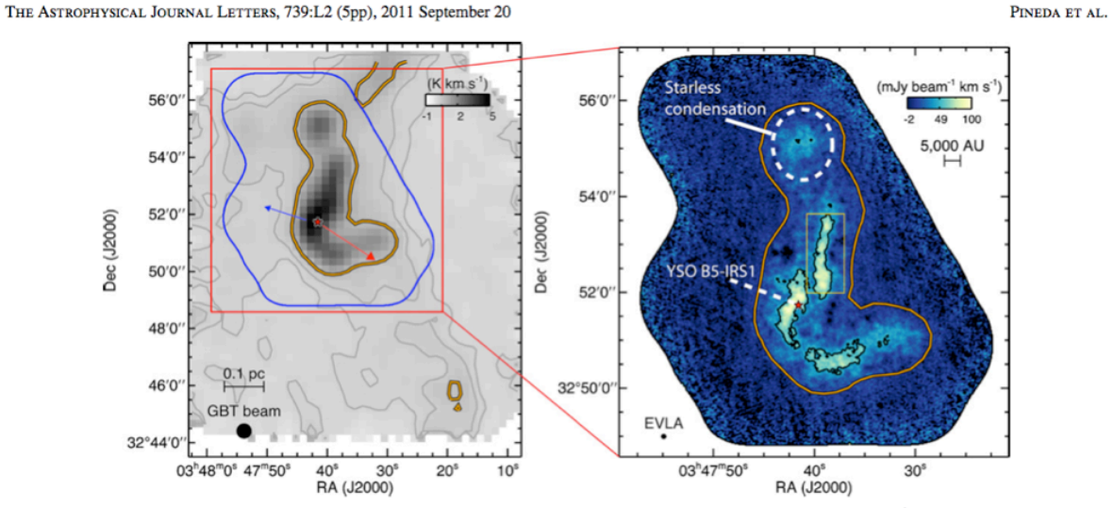
Figure 1. Left panel: integrated intensity map of B5 in NH_3 (1,1) obtained with GBT. Gray contours show the 0.15 and 0.3 K km s^{-1} level in NH_3 (1,1) integrated intensity. The orange contours show the region in the GBT data where the non-thermal velocity dispersion is subsonic. The young star, B5–IRS1, is shown by the star in both panels. The outflow direction is shown by the arrows. The blue contour shows the area observed with the EVLA and the red box shows the area shown in the right panel. Right panel: integrated intensity map of B5 in NH_3 (1,1) obtained combining the EVLA and GBT data. Black contour shows the 50 mJy beam^{-1} km s^{-1} level in NH_3 (1,1) integrated intensity. The yellow box shows the region used in Figure 4. The northern starless condensation is shown by the dashed circle.

Pineda et al. 2011

BUT MAYBE IT'S DIFFERENT?



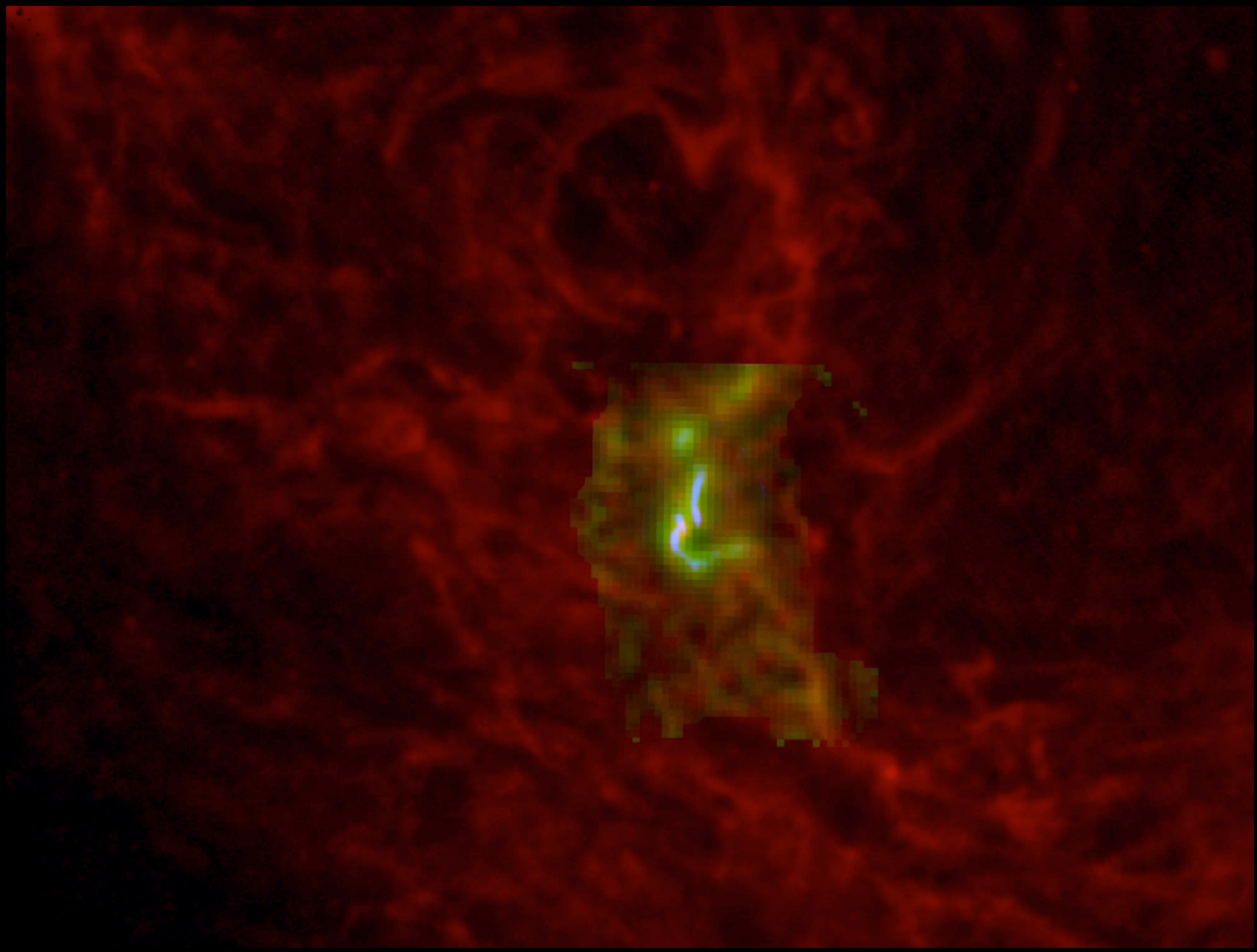
isothermal,
hydrostatic filaments,
not turbulent ones?



Pineda et al. 2011

BUT WHAT IF FILAMENTS CONTINUE ACROSS "CORE" BOUNDARIES?!

blue =VLA ammonia (high-density gas); green=GBT ammonia (lower-res high-density gas); red=Herschel 250 micron continuum (dust)



Goodman, Chen, Offner & Pineda 2014 in prep.

Herschel data from Gould Belt Survey

SHHH...

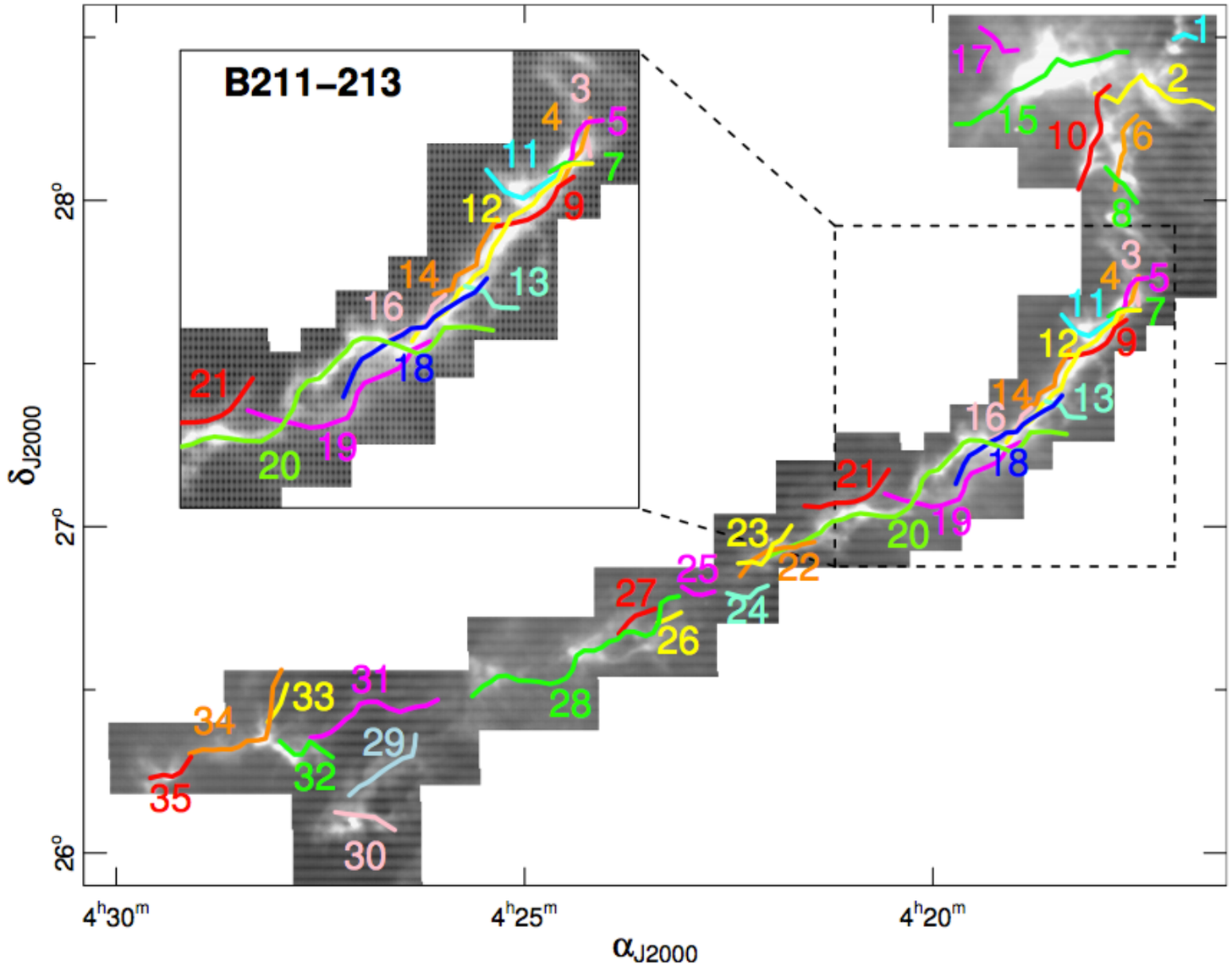
"filament fragmentation on scales of ~5,000 AU offers a viable pathway to the formation of multiple systems"

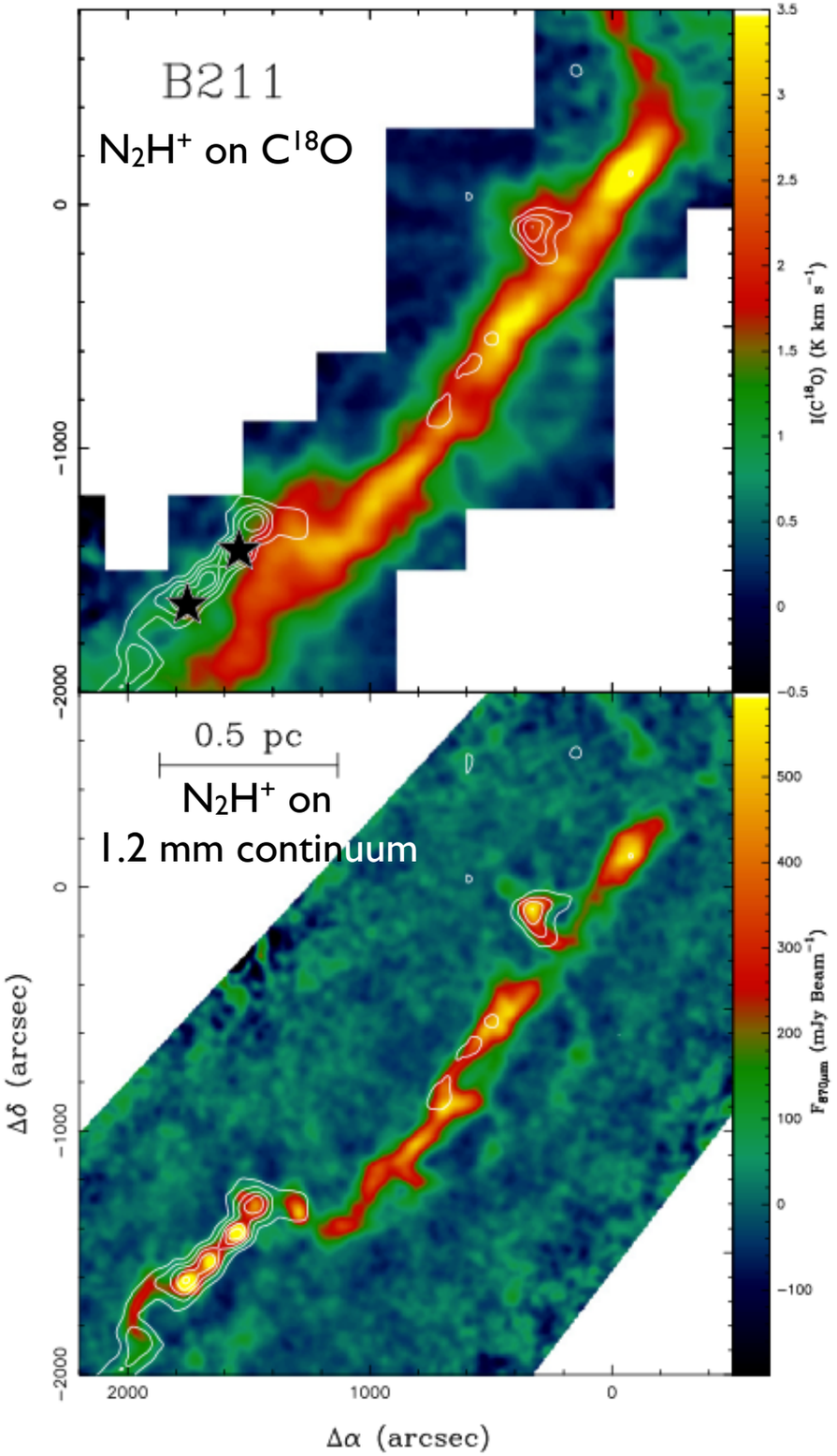
Pineda, Offner, Parker, Arce, Goodman, Caselli, Fuller, Bourke & Corder 2015, to appear in Nature (do not reproduce without permission)

Filaments offer pre-existing density enhancement.

Collapse is rapid enough that aboriginal filament is not erased, even within a "coherent core."

In B5, small bound cluster will form c. 40K years from now.





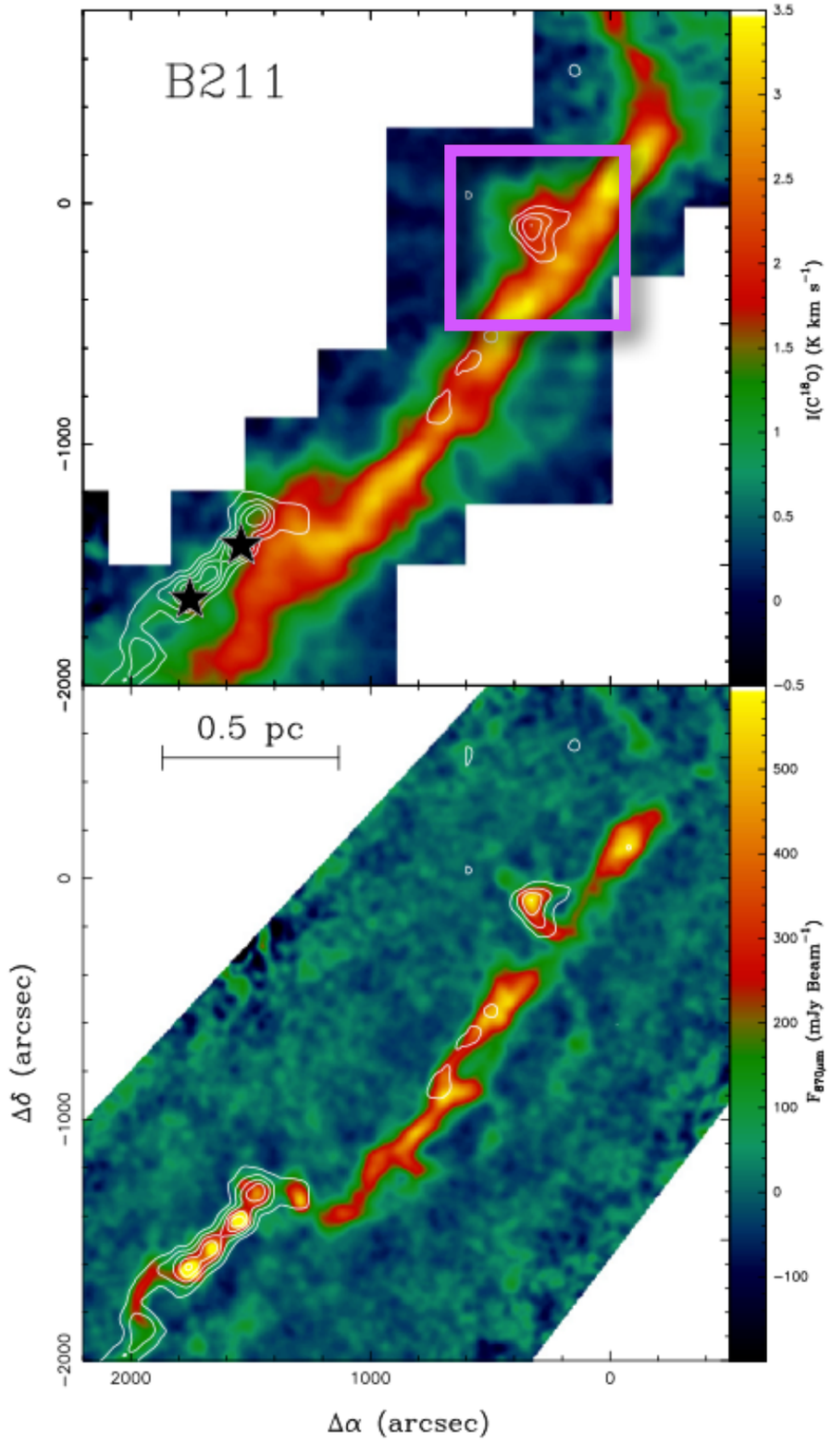
Now, we (all!) need to try FIVe, from Hacar et al. 2013, to study "coherent" core-filament relation.

Filaments offer pre-existing density enhancement.

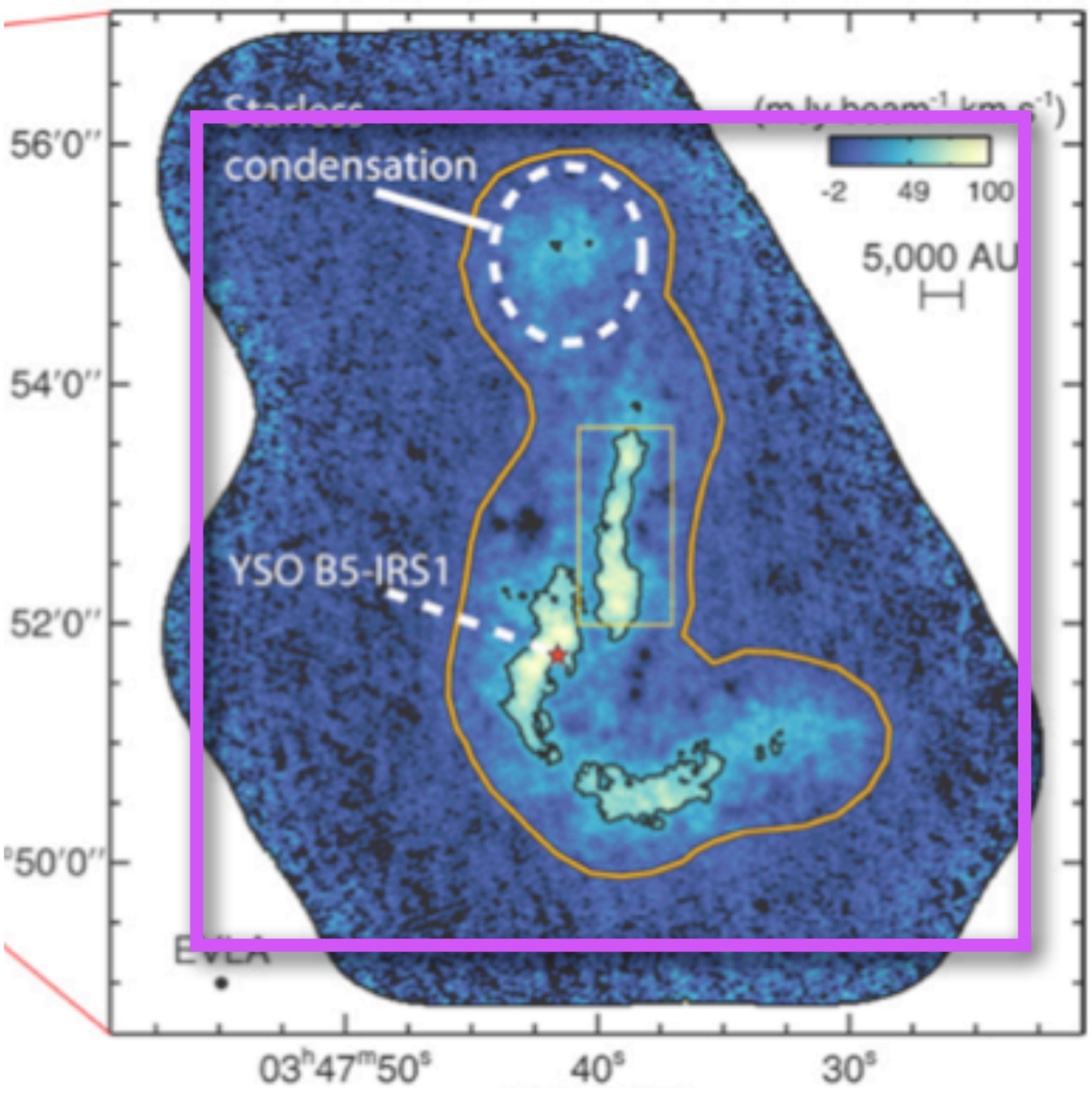
Collapse is rapid enough that aboriginal filament is not erased, even within a "coherent core."

In B5, small bound cluster will form c. 40K years from now.

COMPARING SCALES

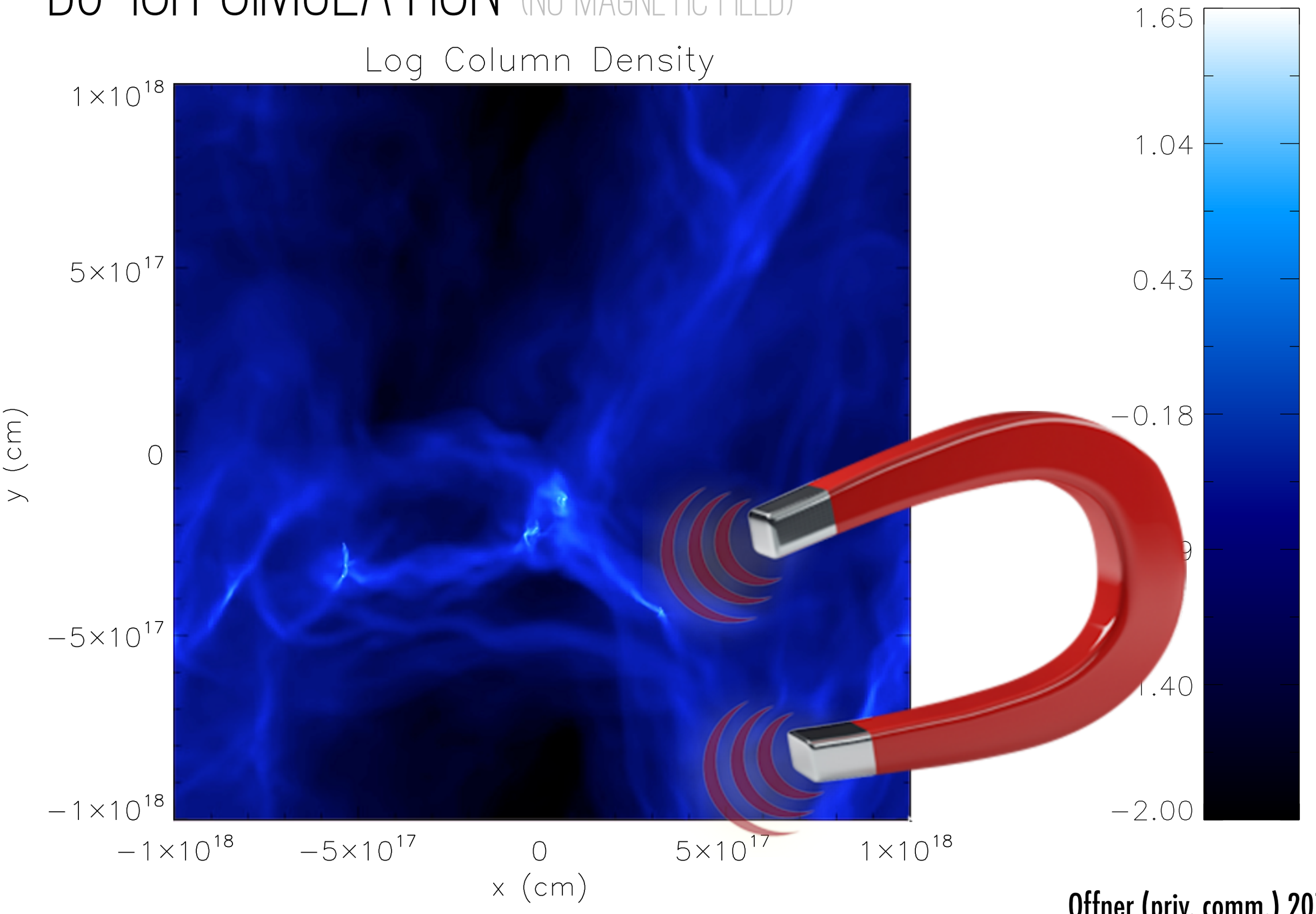


Taurus (Hacar et al.)



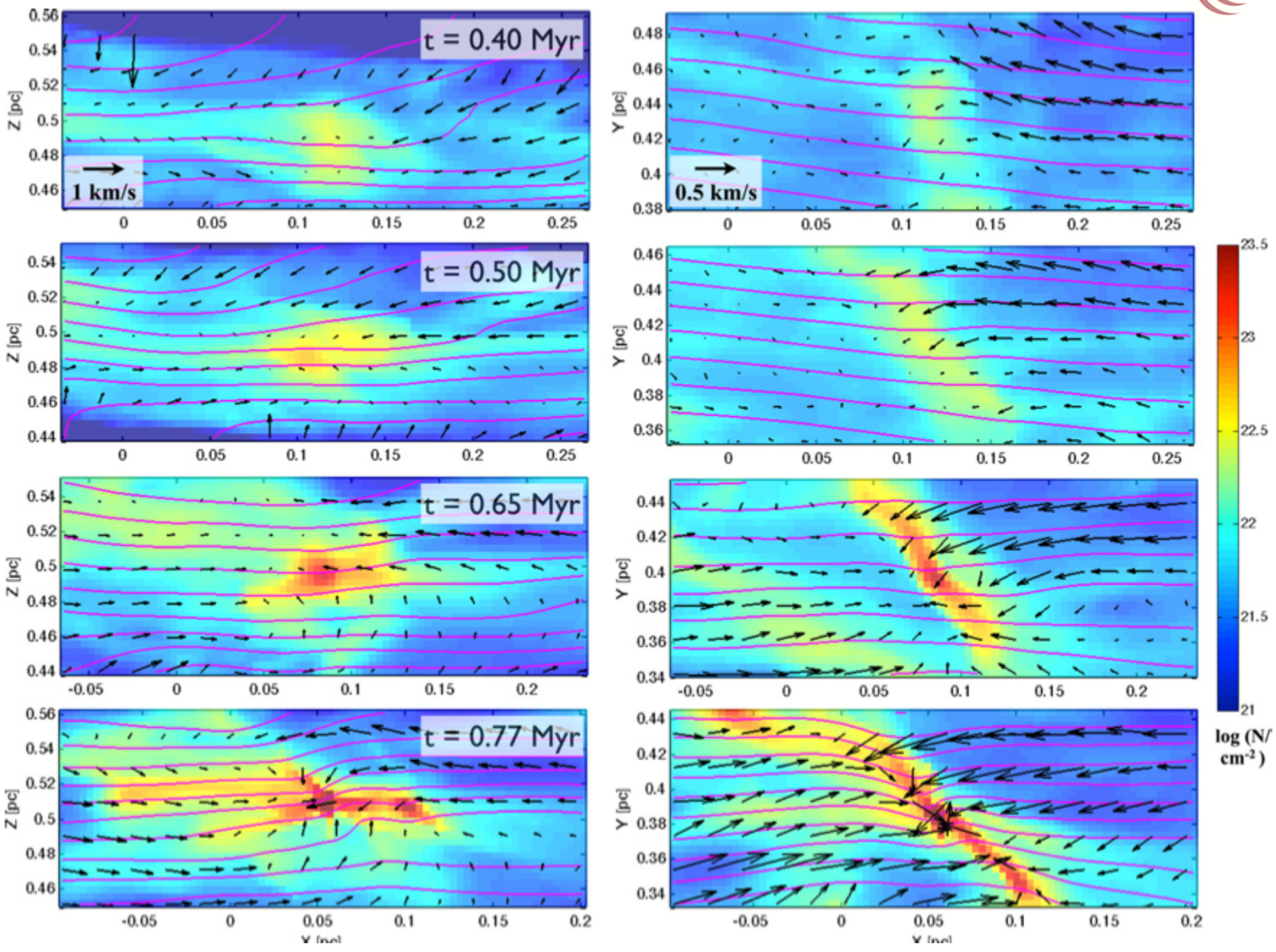
B5 (Pineda et al.)

B5-ISH SIMULATION (NO MAGNETIC FIELD)



Offner (priv. comm.) 2014

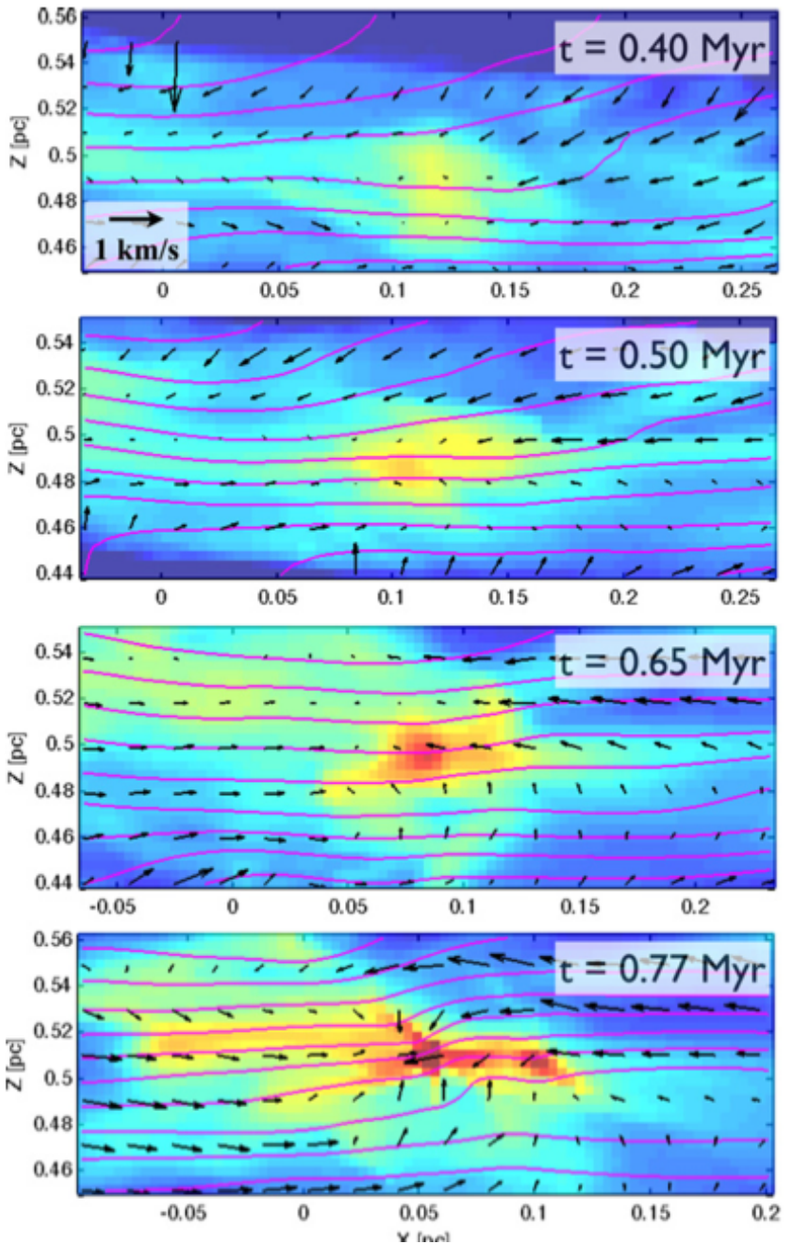
B5-ISH? SIMULATION (WITH MAGNETIC FIELD)

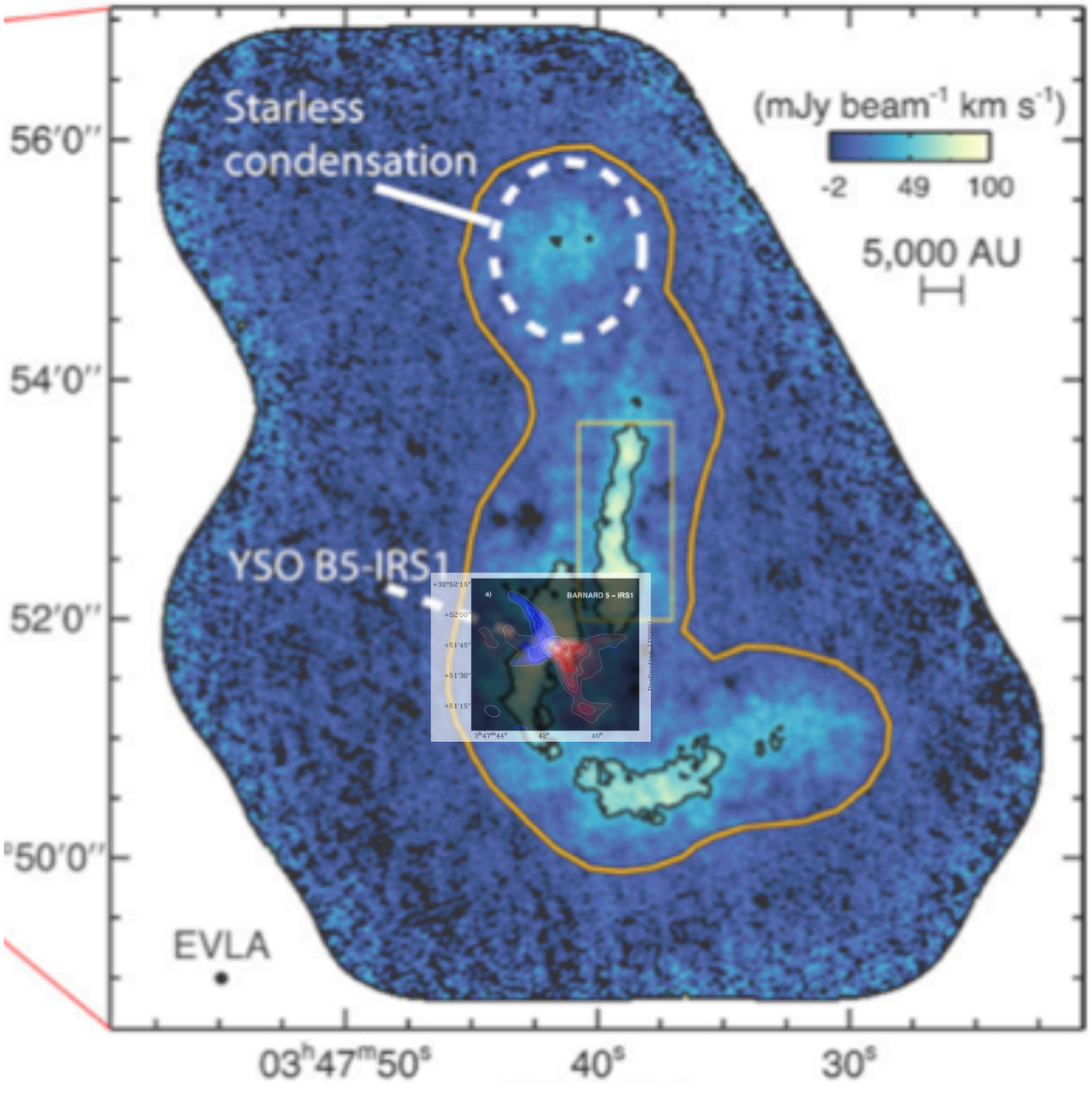


Chen & Ostriker 2014

TO THE SAME SCALE...

The Astrophysical Journal, 785:69 (20pp), 2014 April 10





MHD (Chen & Ostriker 2014)

B5 (Pineda et al.)+Zapata et. al. 2013