NEW TECHNOLOGY FOSTERED BY RADIO ASTRONOMY

Compiled by the Staff
of the
National Radio Astronomy Observatory

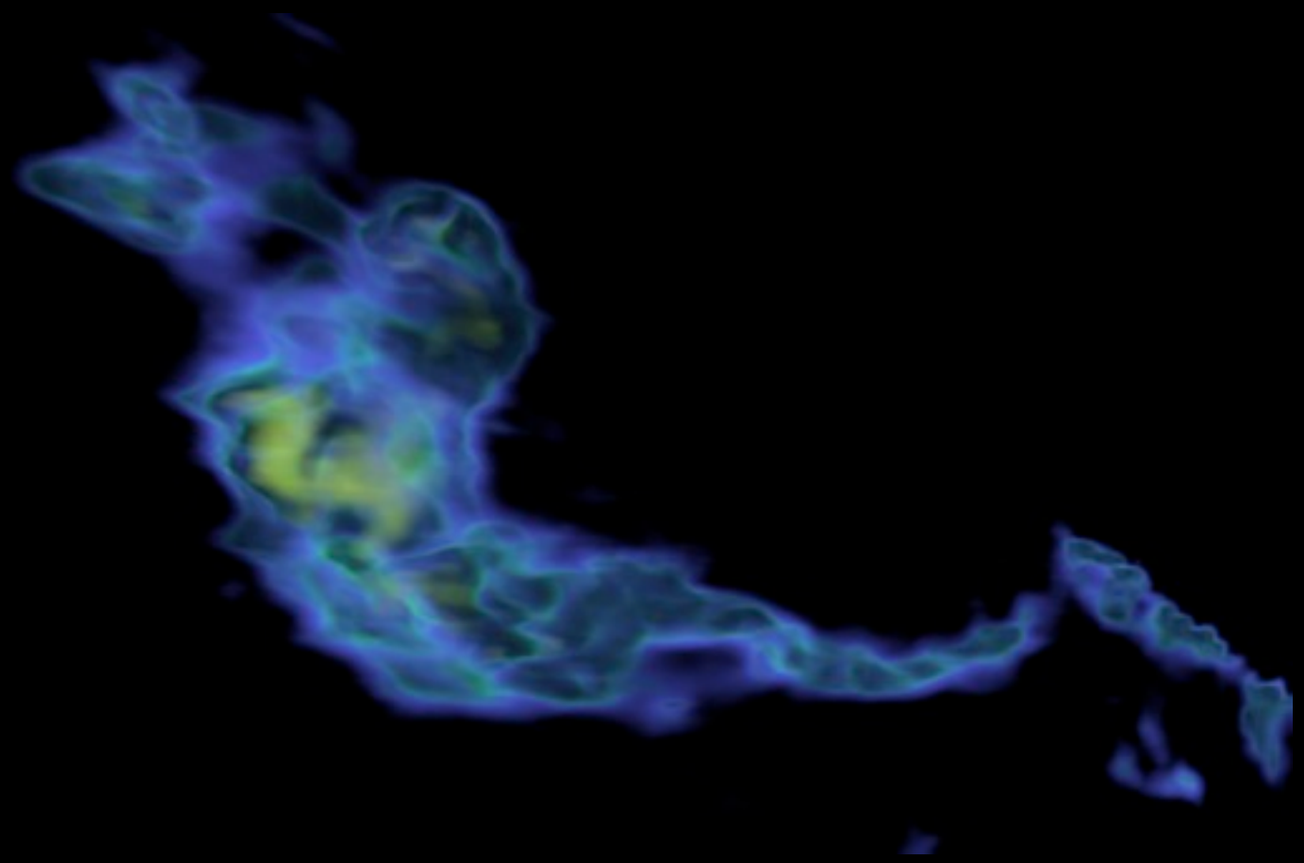
July 1990

“Astronomical Medicine”

IIC Team: Douglas Alan, Michelle Borkin, Alyssa Goodman, Michael Halle, Jens Kauffman

A-M Collaborators: Jonathan Foster, Nick Holliman, Jaime Pineda, Erik Rosolowsky

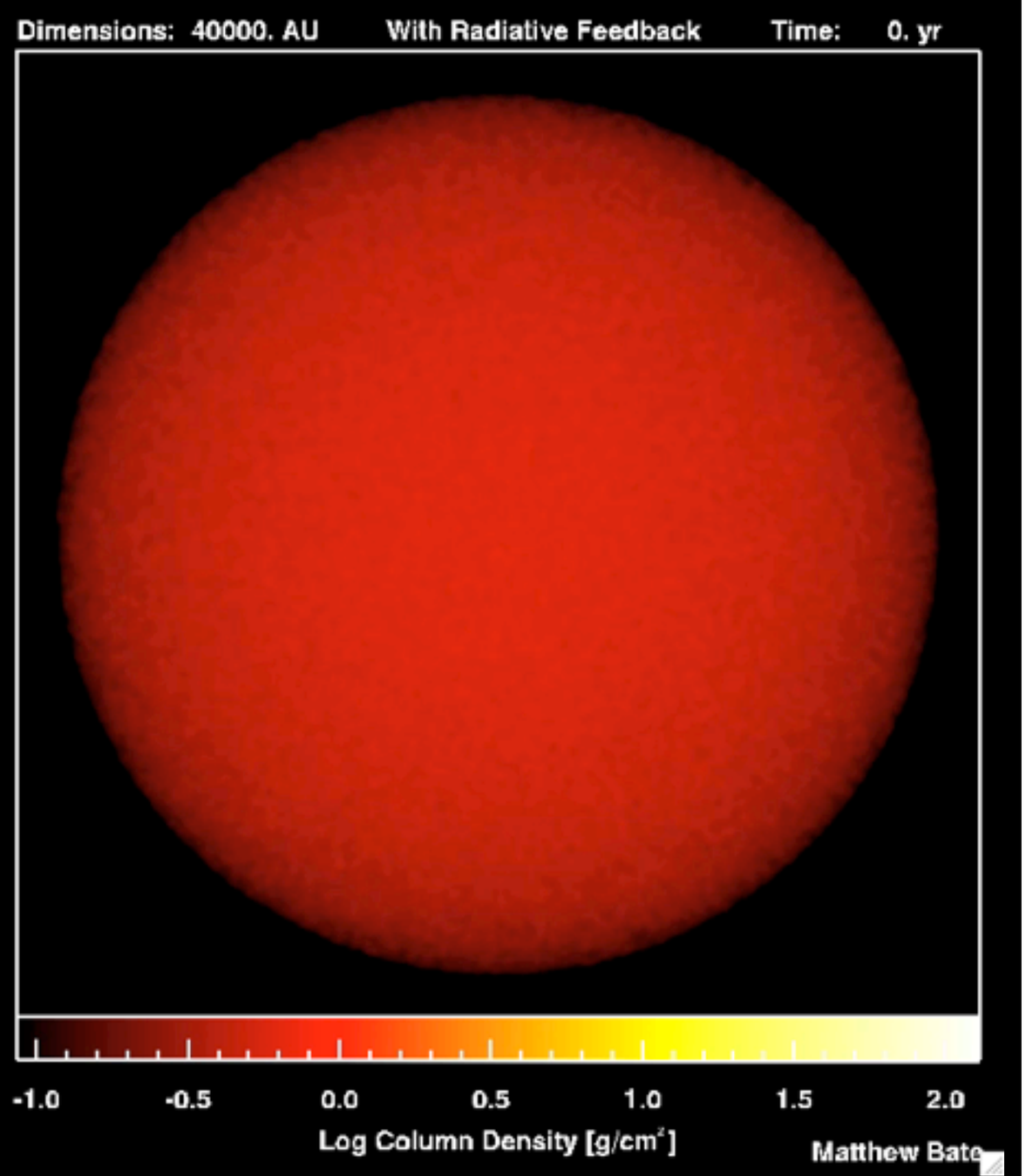
Astronomy + Medicine = Understanding



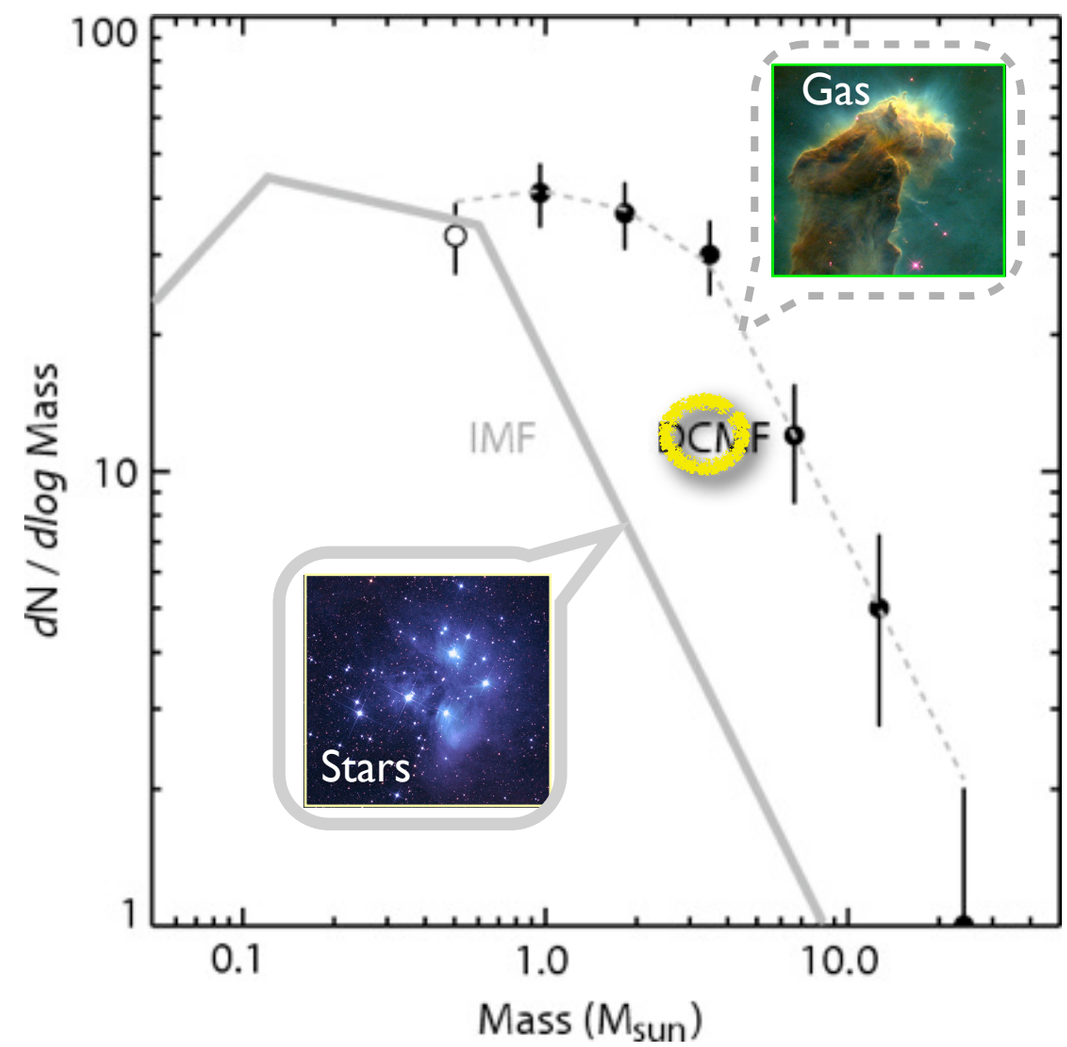
Initiative in Innovative Computing @ Harvard
and
Harvard-Smithsonian Center for Astrophysics

Left: 13CO in B5 in VolView, N. Holliman **Right**: Visualization of a DTI measurement of a human brain. Depicted are reconstructed fiber tracts that run through the mid-sagittal plane. Especially prominent are the U-shaped fibers that connect the two hemispheres through the corp. Rendering is own work, using a modified version of the BioTensor application developed at the University of Utah. The dataset is courtesy of Gordon Kindlmann at the Scientific Computing and Imaging Institute, University of Utah, and Andrew Alexander, W.M. Keck Laboratory for Functional Brain Imaging and Behaviour, University of Wisconsin, Madison. It is publicly available from [1]

From this ...to this?

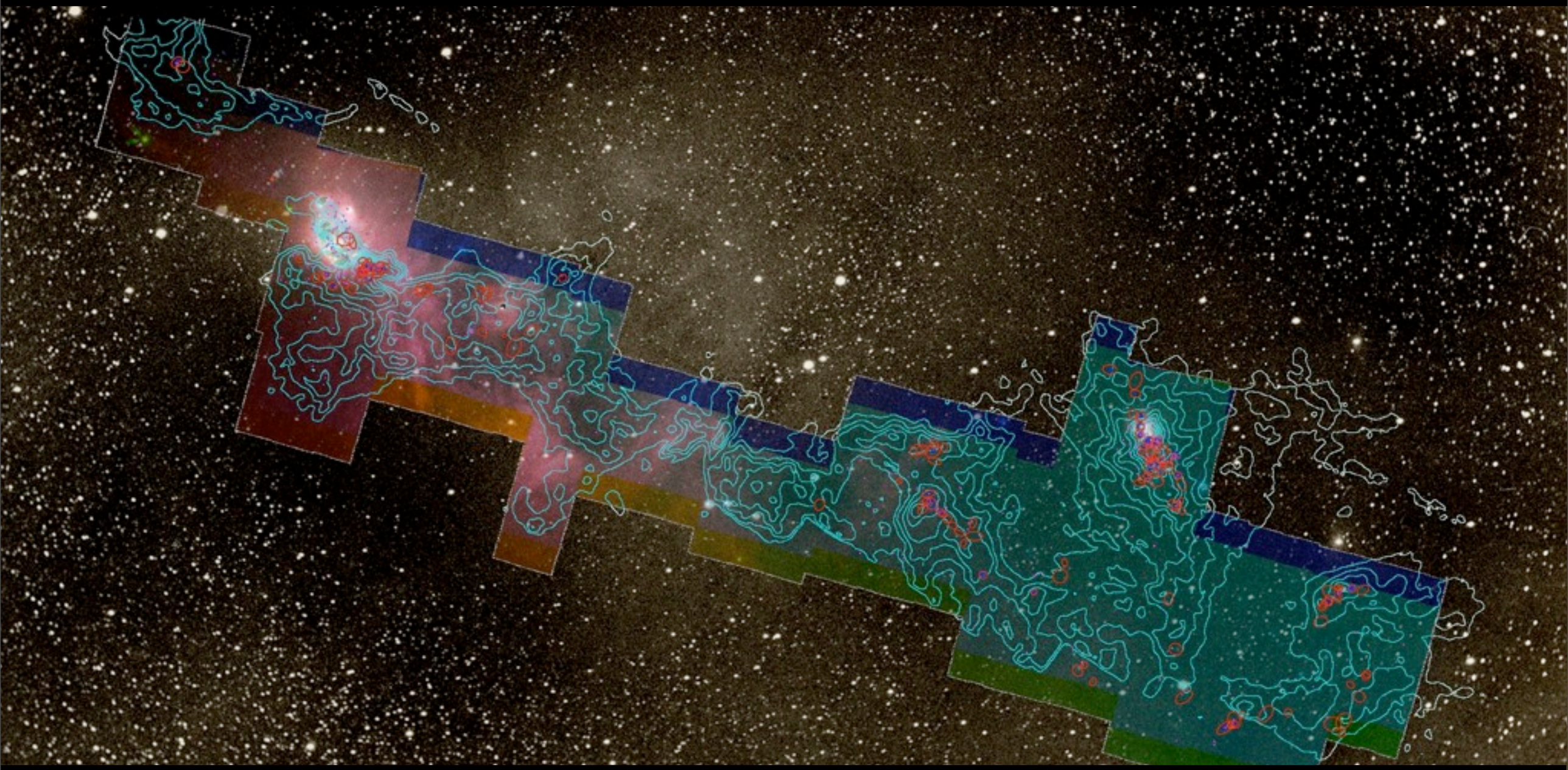


Bate 2009; cf. Padoan & Nordlund 2002



Alves, Lombardi & Lada 2007

COMPLETE = **CO**ordinated **M**olecular **P**robe **L**ine **E**xtinction **T**hermal **E**mission Survey of Star-Forming Regions



COMPLETE Collaborators, 2009:

Alyssa A. Goodman (CfA/IIC)

João Alves (Calar Alto, Spain)

Héctor Arce (Yale)

Michelle Borkin (Harvard SEAS/IIC)

Paola Caselli (Leeds, UK)

James DiFrancesco (HIA, Canada)

Jonathan Foster (B.U.)

Mark Heyer (UMASS/FCRAO)

Doug Johnstone (HIA, Canada)

Jens Kauffmann (JPL/Caltech)

Helen Kirk (CfA)

Di Li (JPL/Caltech)

Stella Offner (CfA)

Jaime Pineda (CfA, PhD Student)

Thomas Robitaille (CfA)

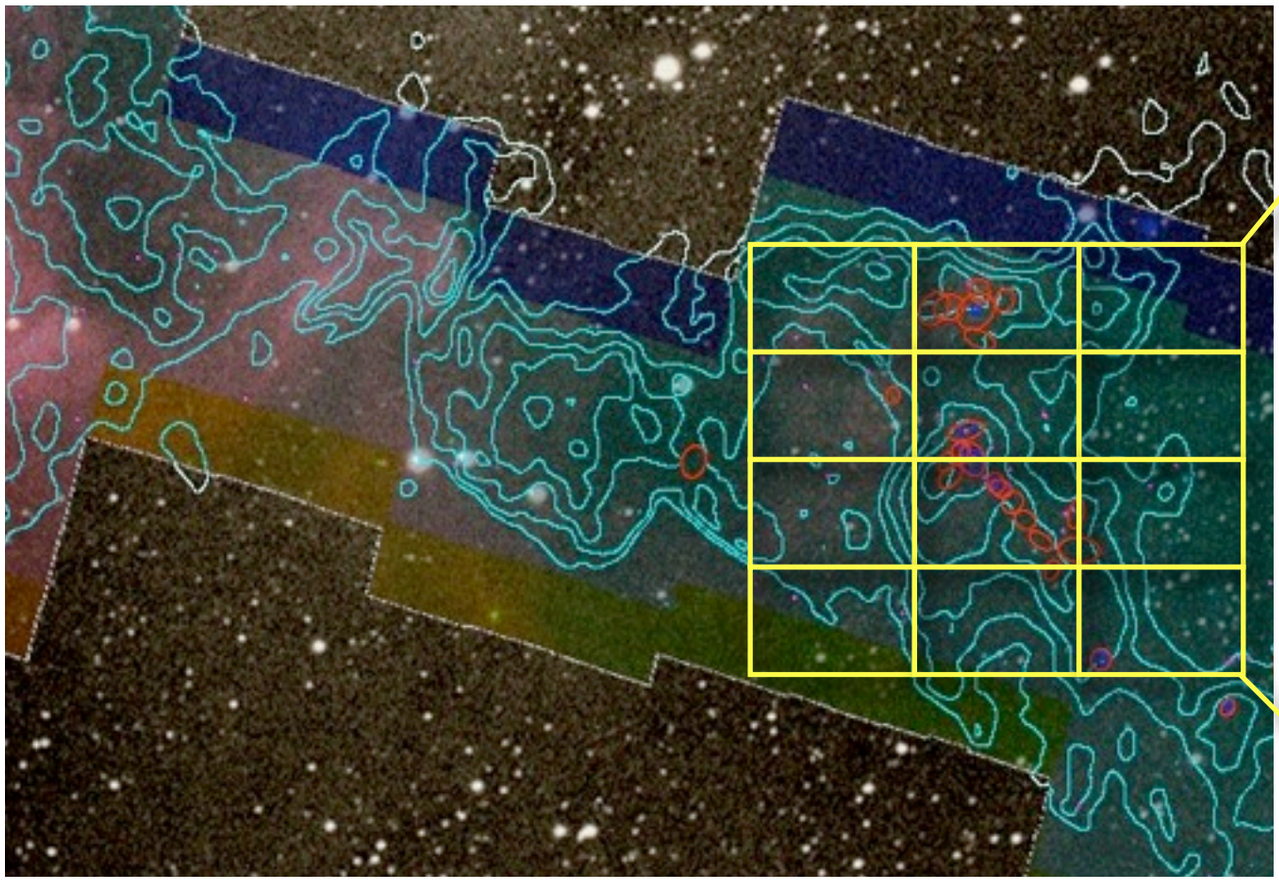
Erik Rosolowsky (UBC Okanagan)

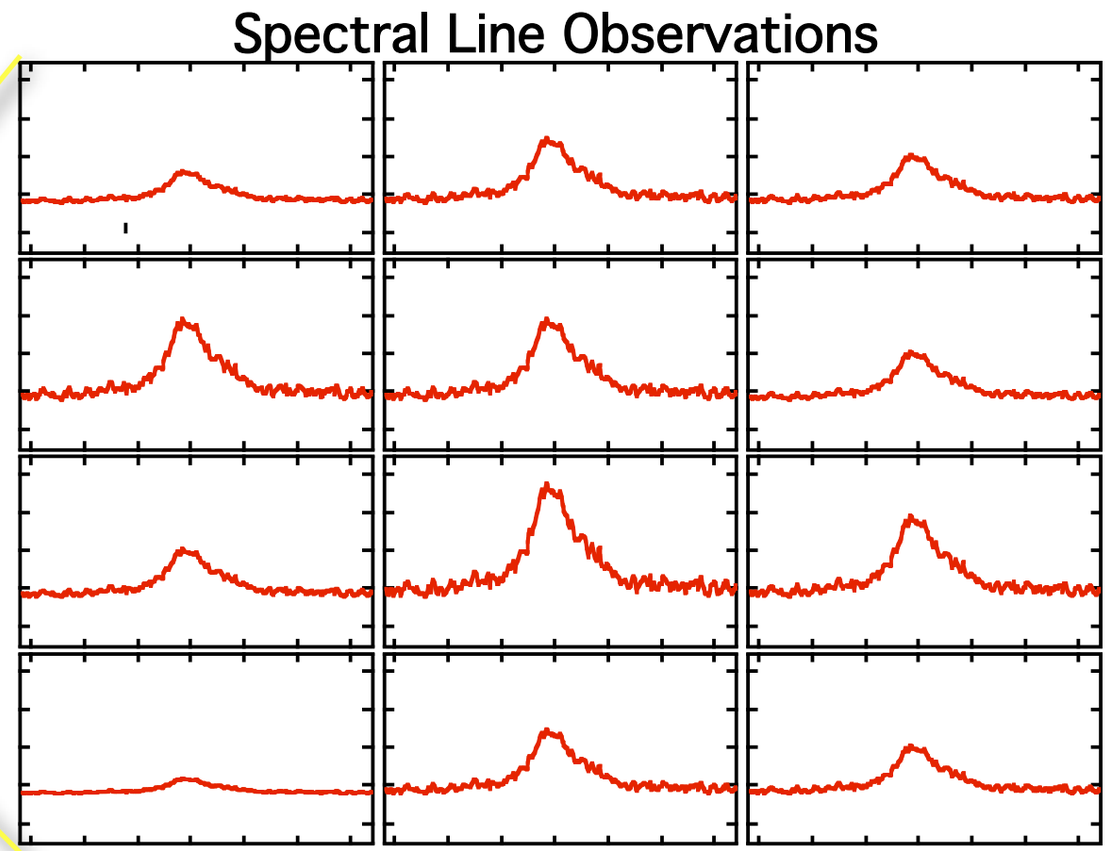
Rahul Shetty (ITA Heidelberg)

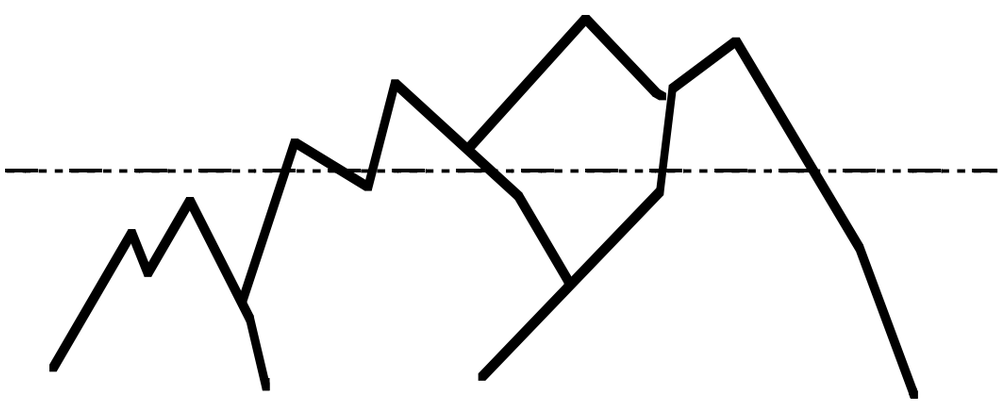
Scott Schnee (HIA Victoria)

Mario Tafalla (OAN, Spain)

There's much more to life than "integrated intensity"

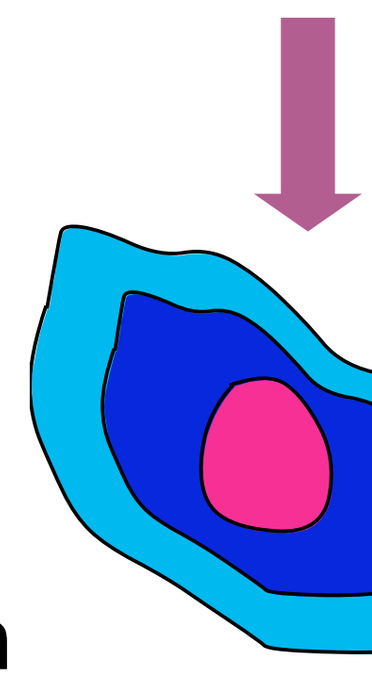






Mountain Range

No loss of information



Loss of 1 dimension

Astronomical Visualization Tools are Traditionally 2D

IDL

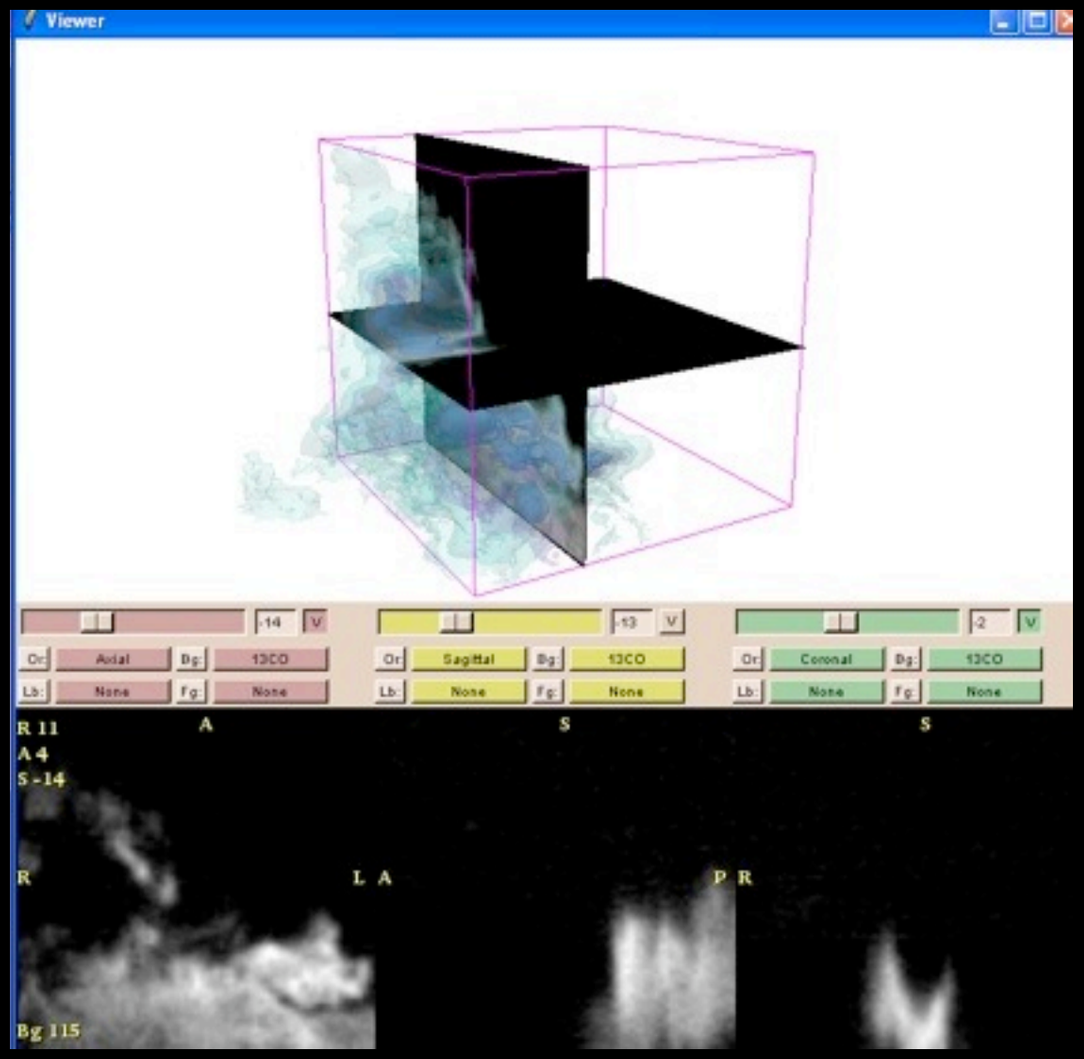
DS9

Karma*

GAIA

Aipsview

3D Slicer



"3D"=movies (i.e. stepping through velocity)

Monday, November 16, 2009

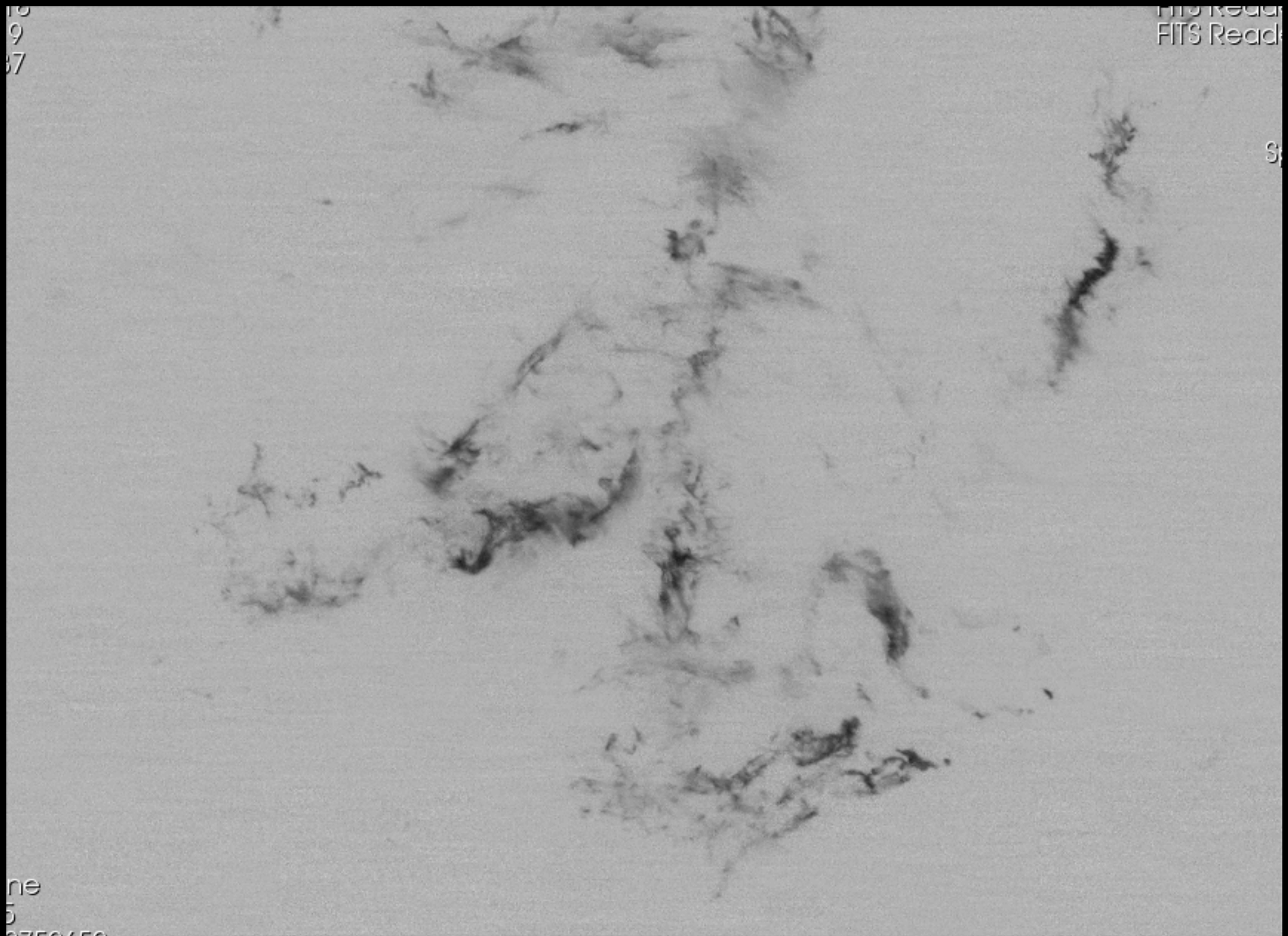
Challenge in displaying spectral line data cubes.

Hard to address all three dimensions at once, but made compact with 3D Slicer.

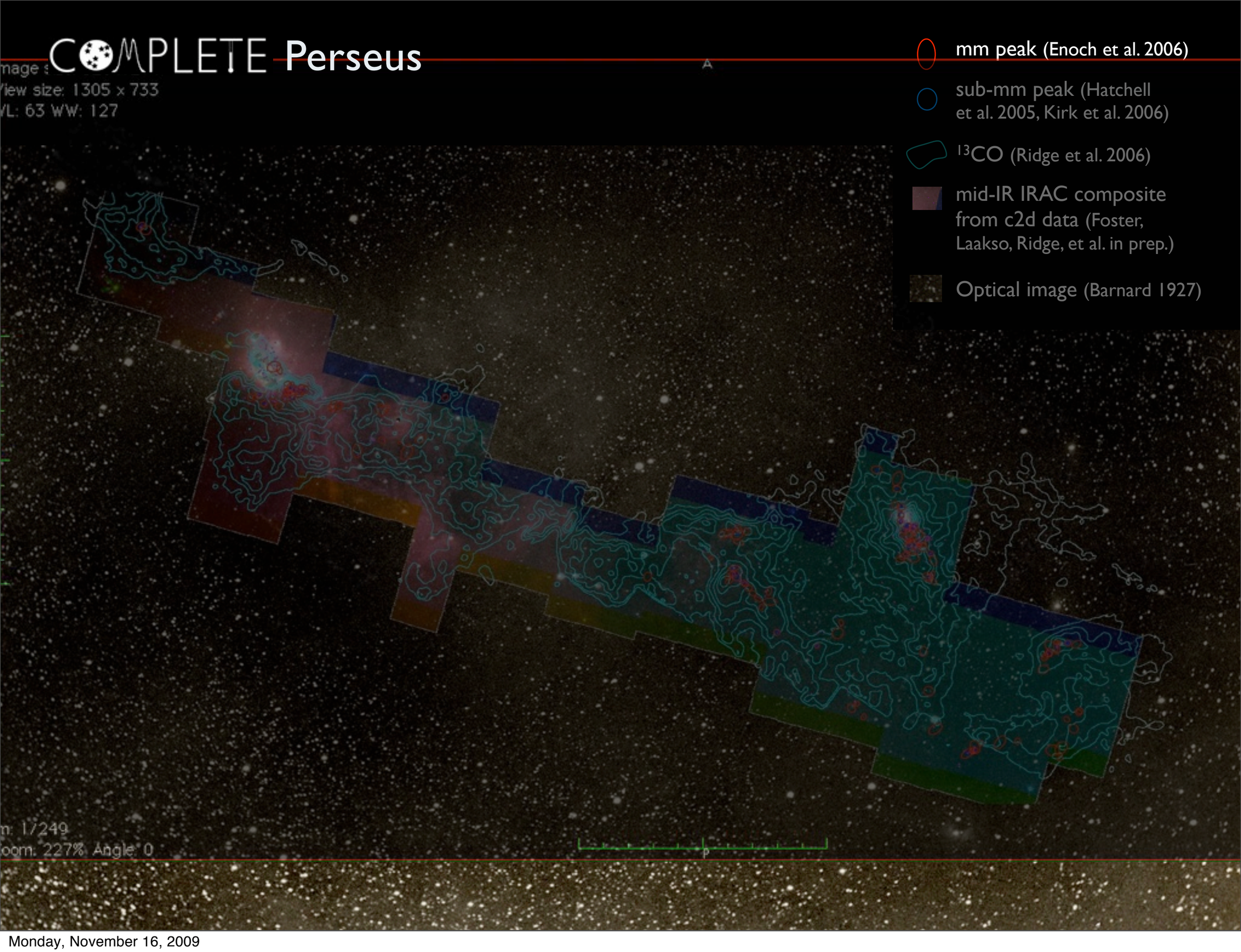
3D Slicer is a visualization tool taking fundamentally different approach.

3D Slicer built and designed for 3D viewing; others come from 2D approach.

Quiz (and Demo)



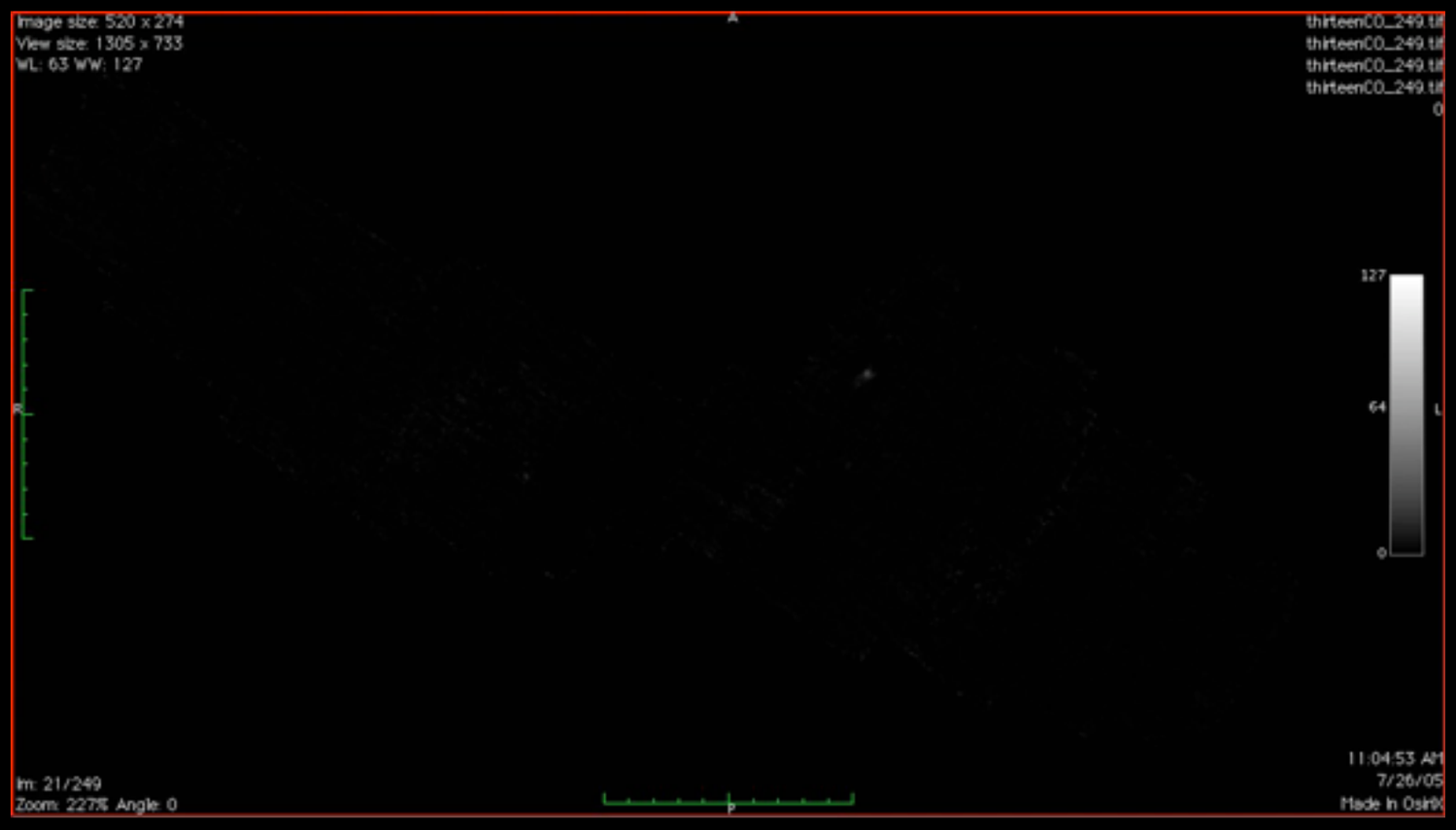
COMPLETE Perseus



“Astronomical Medicine”

“KEITH”

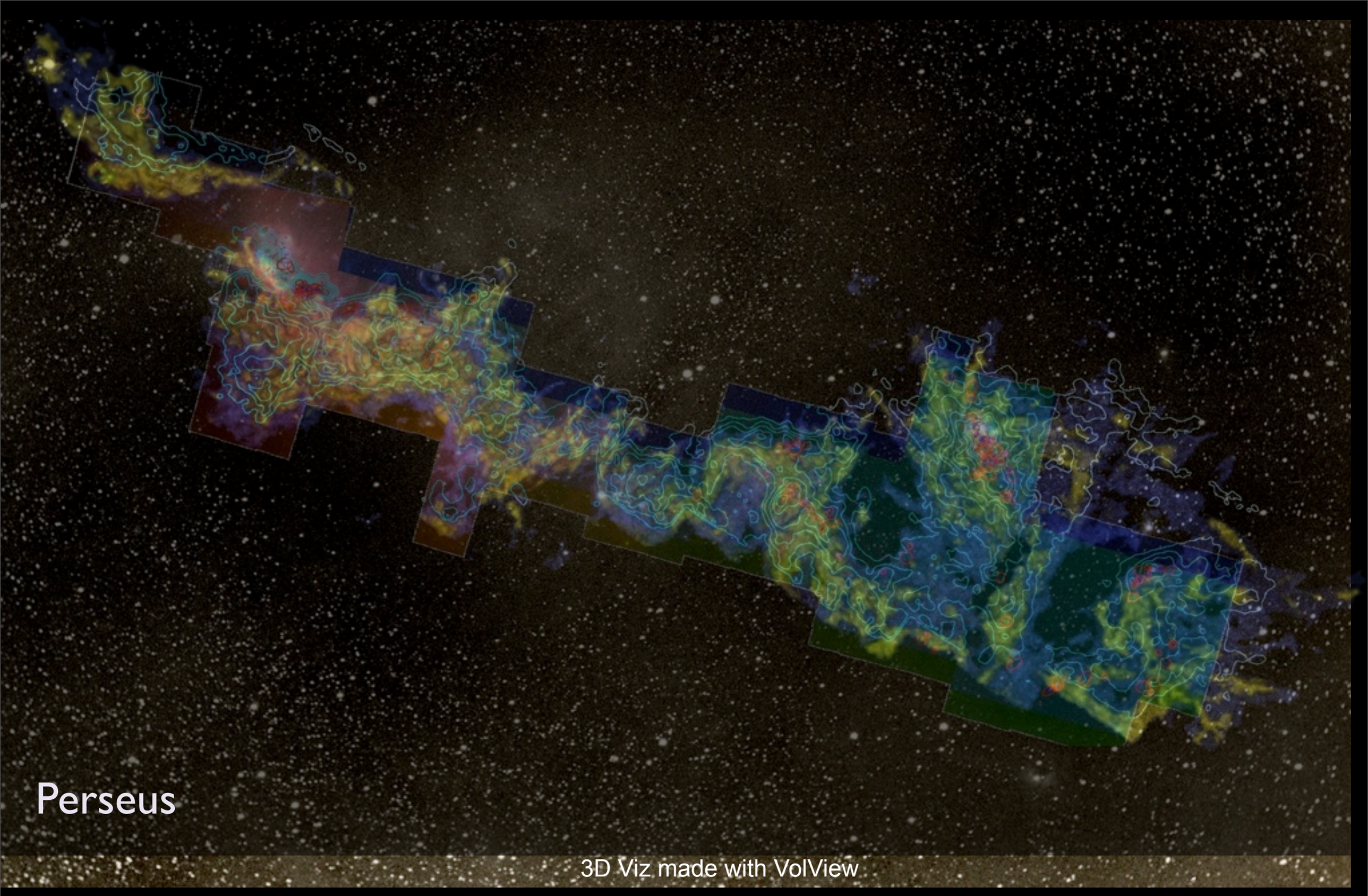
“PERSEUS”



“z” is depth into head

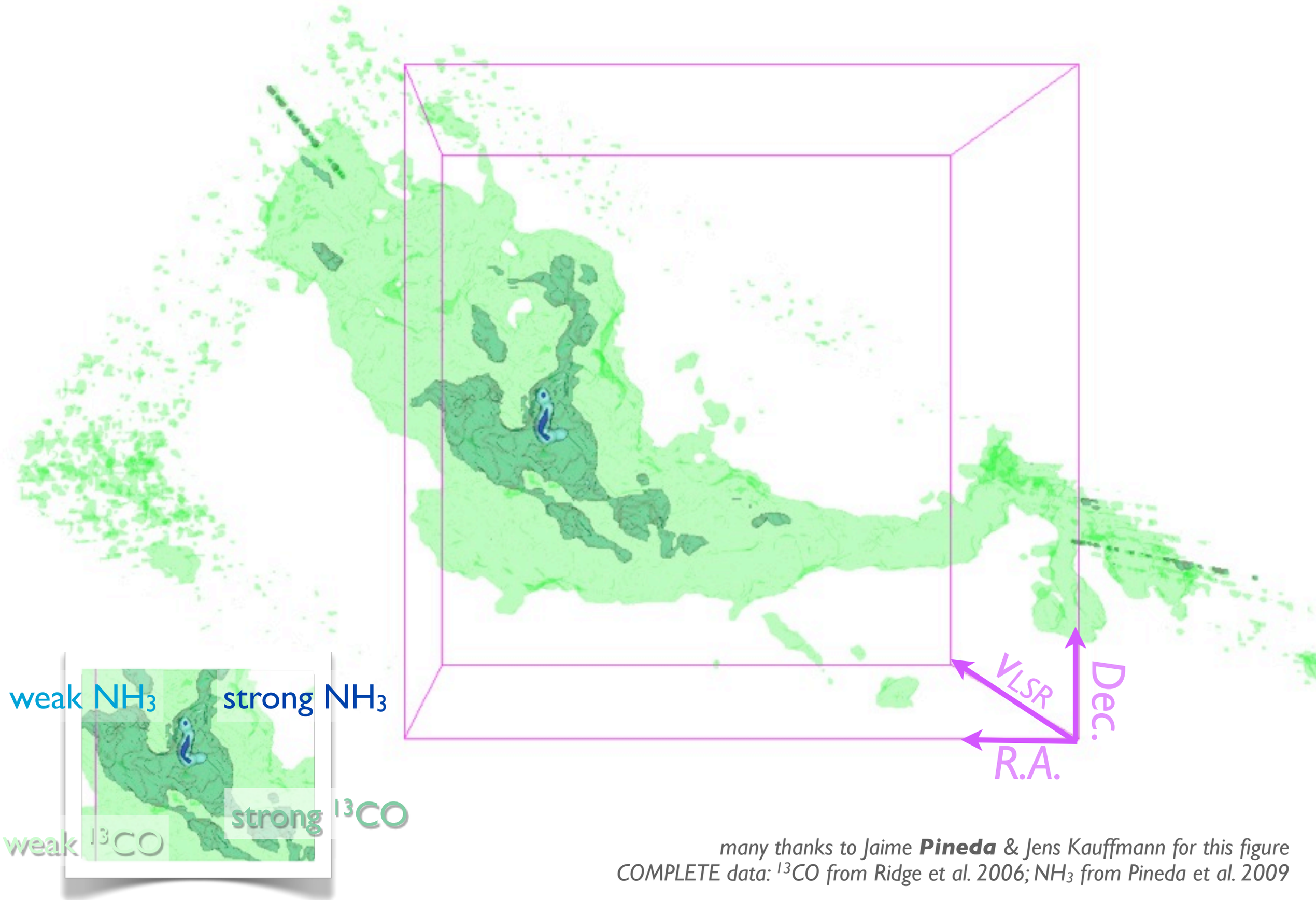
“z” is line-of-sight velocity

(This kind of “series of 2D slices view” is known in the Viz as “the grand tour”)



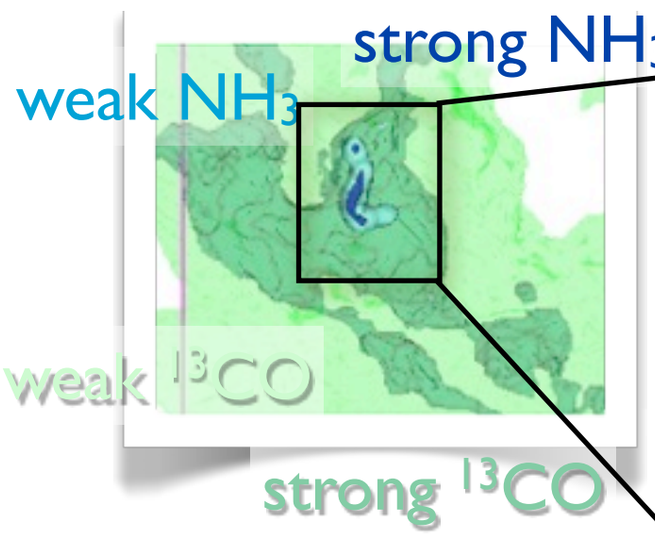
AstronomicalMedicine@ COMPLETE

p-p-v structure of the B5 region in Perseus

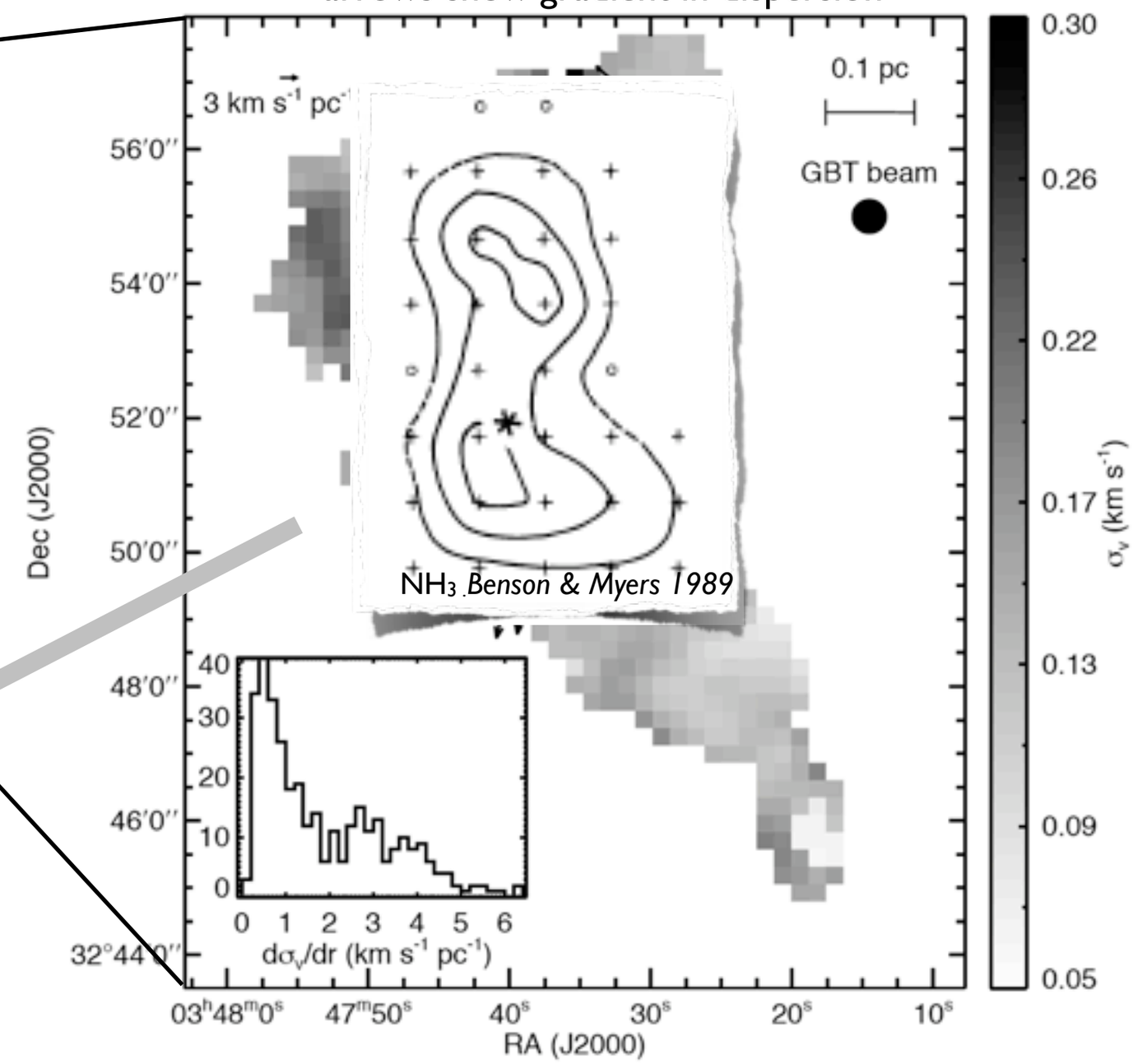


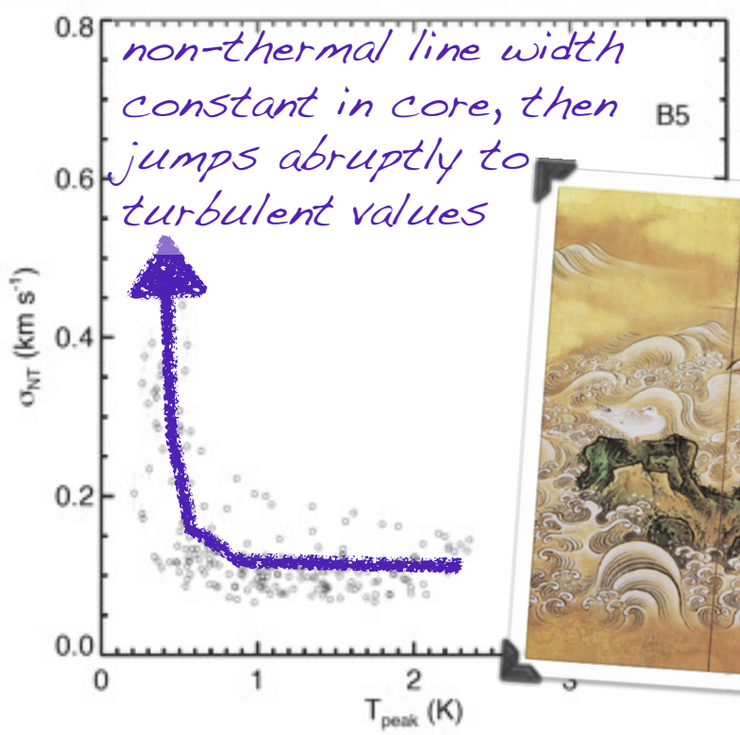
*many thanks to Jaime **Pineda** & Jens Kauffmann for this figure*
COMPLETE data: ^{13}CO from Ridge et al. 2006; NH_3 from Pineda et al. 2009

A Rapid Transition to Coherence in Dense Cores



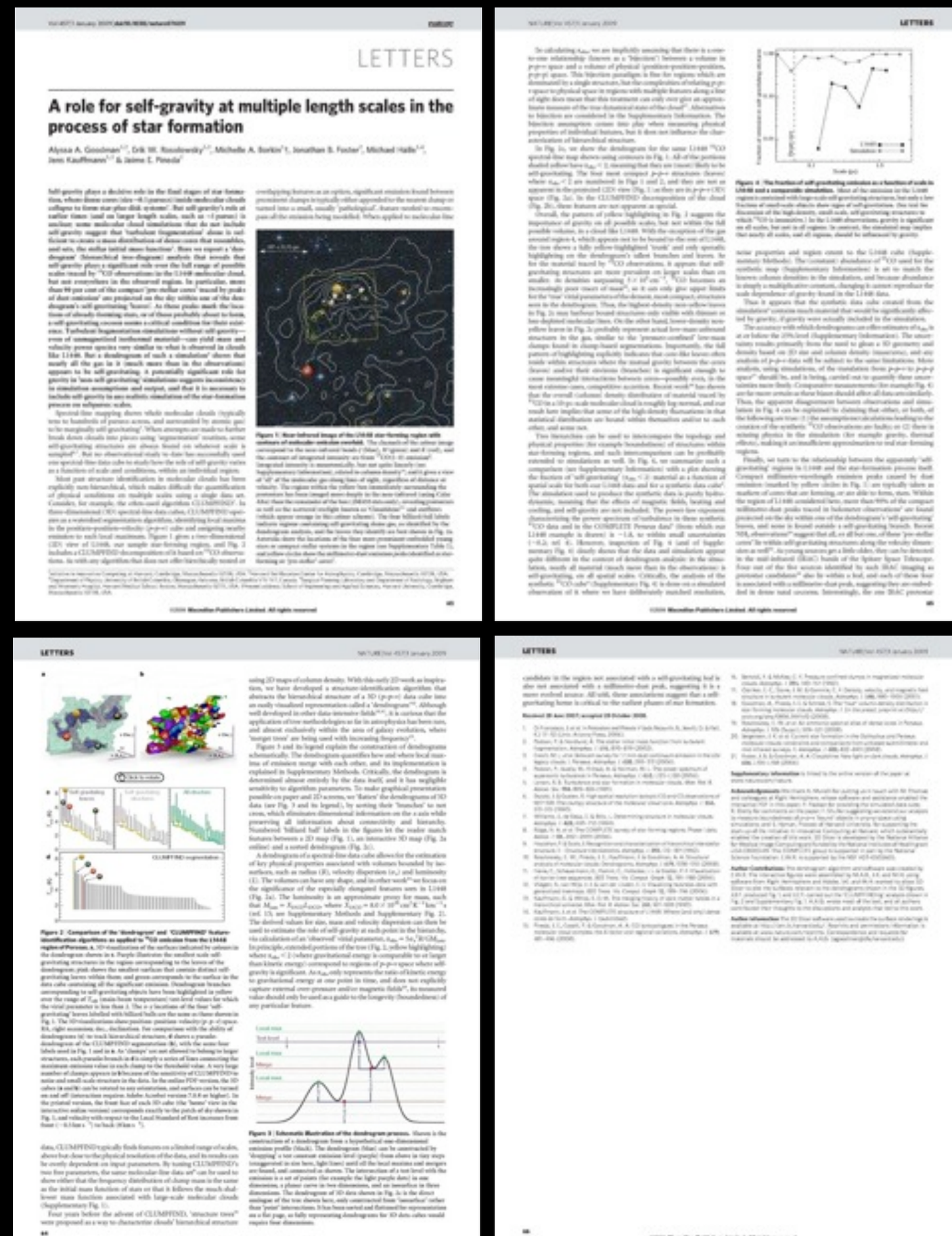
greyscale shows NH_3 velocity dispersion, arrows show gradient in dispersion





These are the new GBT NH_3 observations of the B5 core, which Jaime Pineda spoke about yesterday

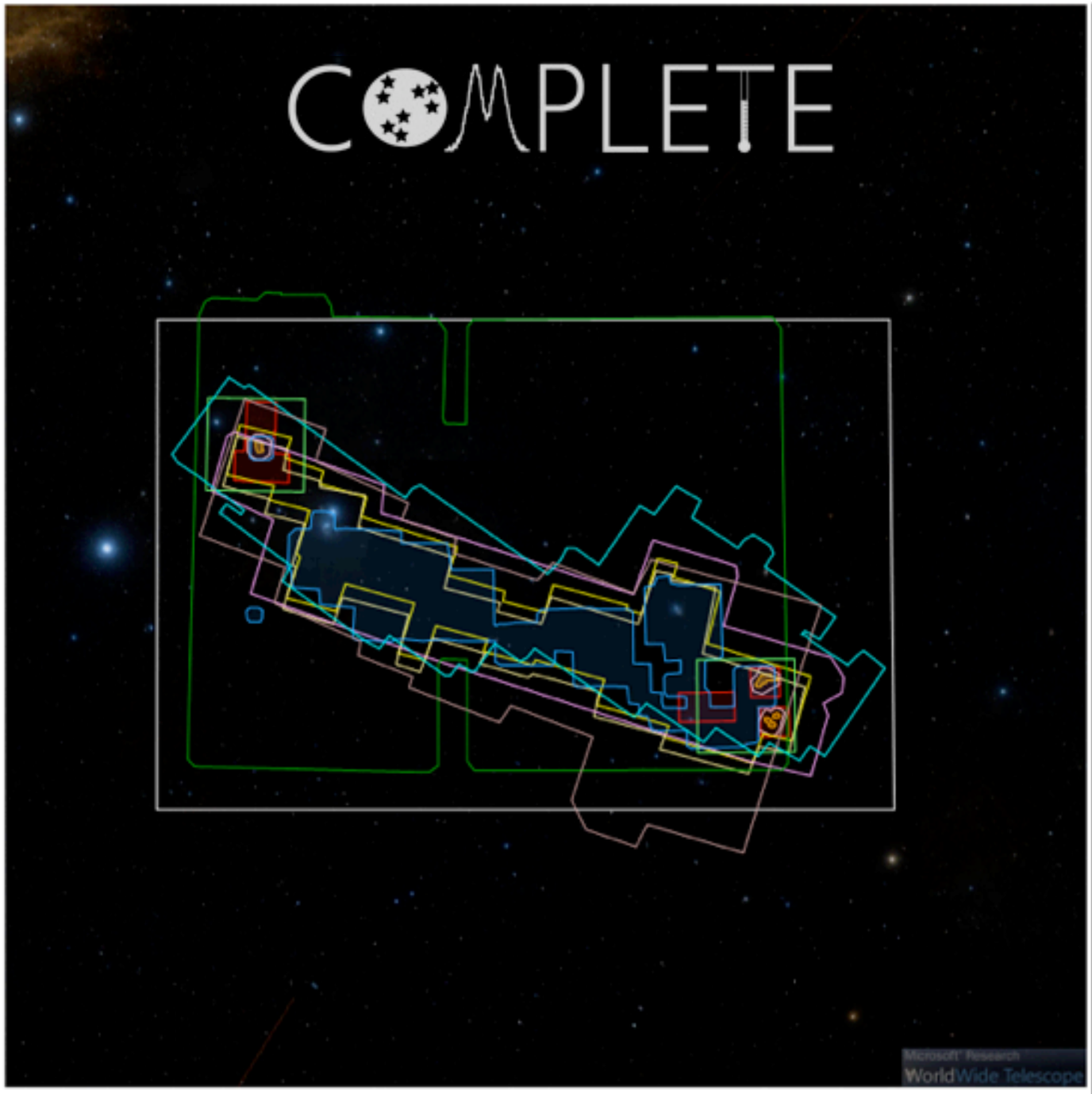
The future is here: 3D PDF


LETTERS

A role for self-gravity at multiple length scales in the process of star formation

COMPLETE Data Coverage Tool

http://www.worldwidetelescope.org/COMPLETE/WWTCoverageTool.htm#



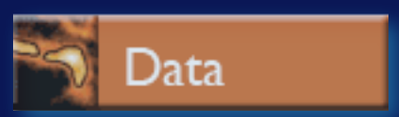
COMPLETE Data Available

Center on Perseus | Center on Ophichus | Center on Serpens

Full-Cloud Data (Phase I, All Data Available)

Dataset	Show	Perseus	Ophiuchus	Serpens	Link
GBT: HI Data Cube	☑	√	√	∅	Data
IRAS: Av/Temp Maps	☑	√	√	√	Data
FCRAO: 12CO	☑	√	√	√	Data
FCRAO: 13CO		√	√	√	Data
JCMT: 850 microns	☑	√	√	∅	Data
Spitzer c2d: IRAC 1,3 (3.6,5.8 µm)	☑	√	√	√	Data
Spitzer c2d: IRAC 2,4 (4.5,8 µm)	☑	√	√	√	Data
CSO/Bolocam: 1.2-mm	☑	√	∅	∅	Data
Spitzer MIPS: Derived Dust Map	☑	√	∅	∅	Data
Targeted Regions (Phase II, Some Data Not Yet Available)					
CTIO/Calar Alto: NIR (J,H,Ks)	☑	√	√	∅	Data
IRAM 30-m: N2H+ and C18O	☑	√	∅	∅	Data
IRAM 30-m: 1.1-mm continuum	☑	√	∅	∅	Data
Megacam/MMT: r,i,z images	☑	√	∅	∅	Data
Catalogs & Pointed Surveys					
NH3 Pointed Survey	☐	√	∅	∅	Data
YSO Candidate list (c2d)	☐	√	√	√	Data

Done

To explore on your own, go to http://www.cfa.harvard.edu/COMPLETE/, then click on 

and choose to see the Interactive Coverage Tool in either Google Sky or WorldWide Telescope.

Many thanks to Jonathan Foster, Gus Muench & Jonathan Fay (MSR/WWT team) for these tools!