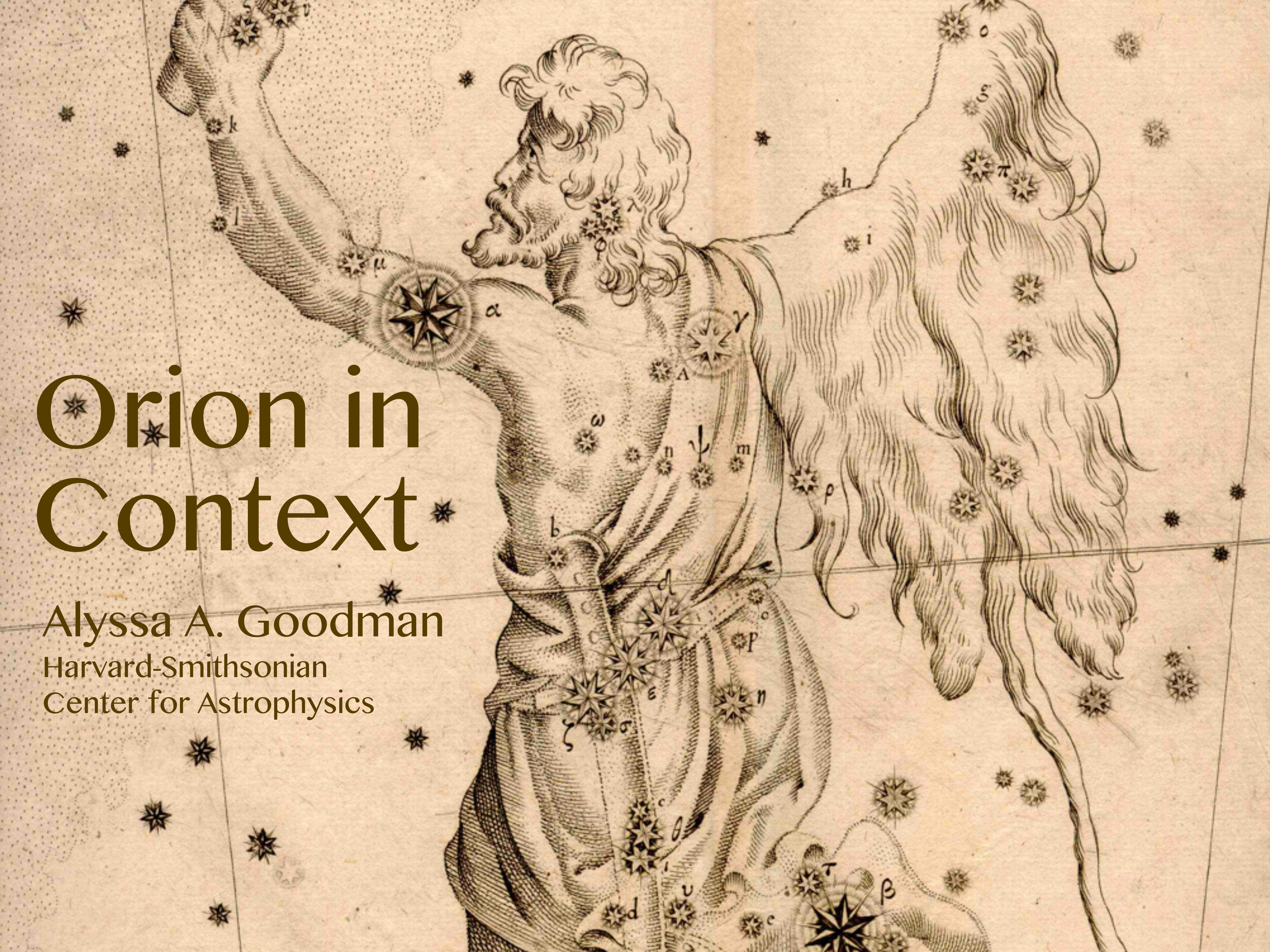
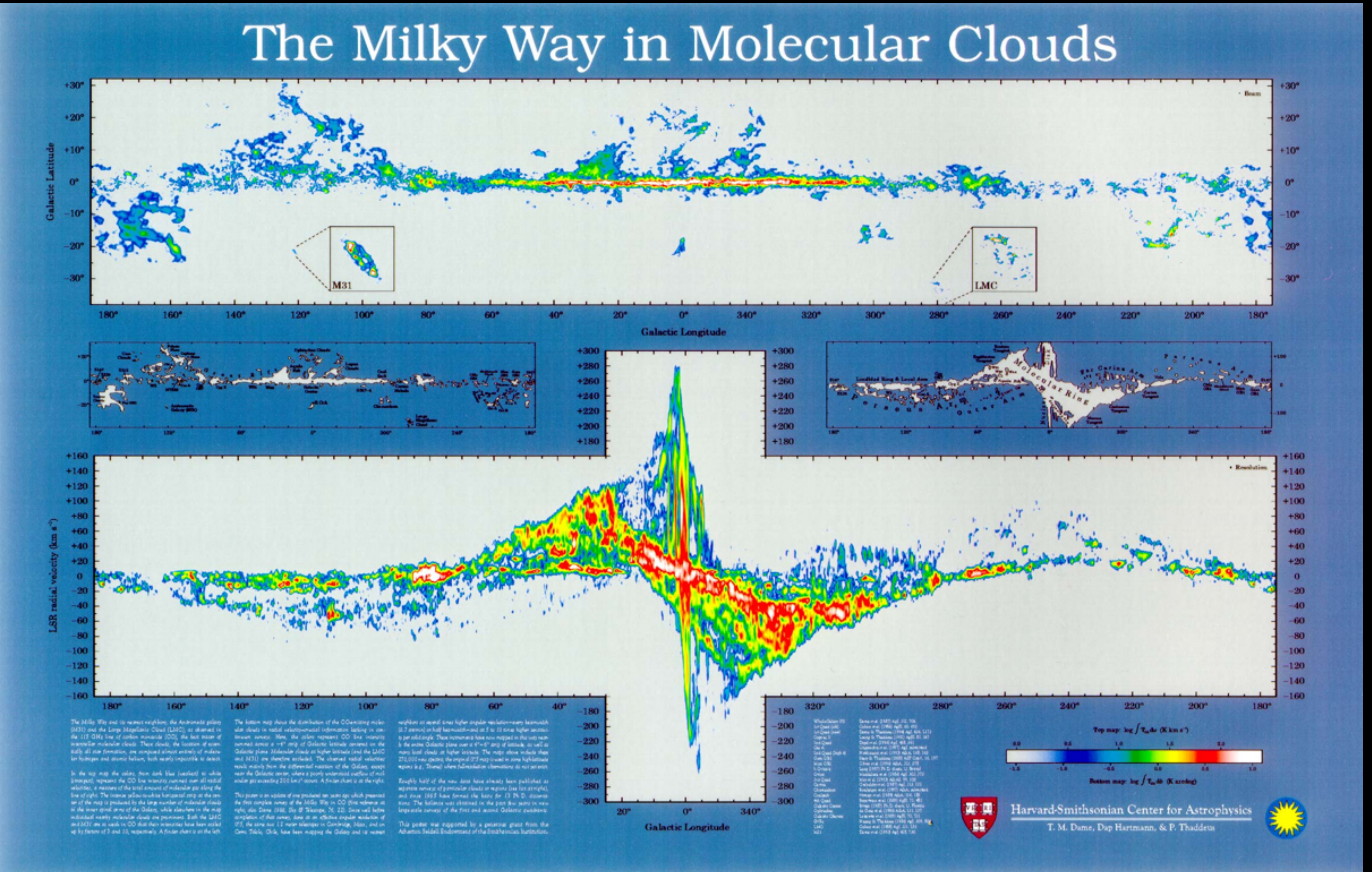


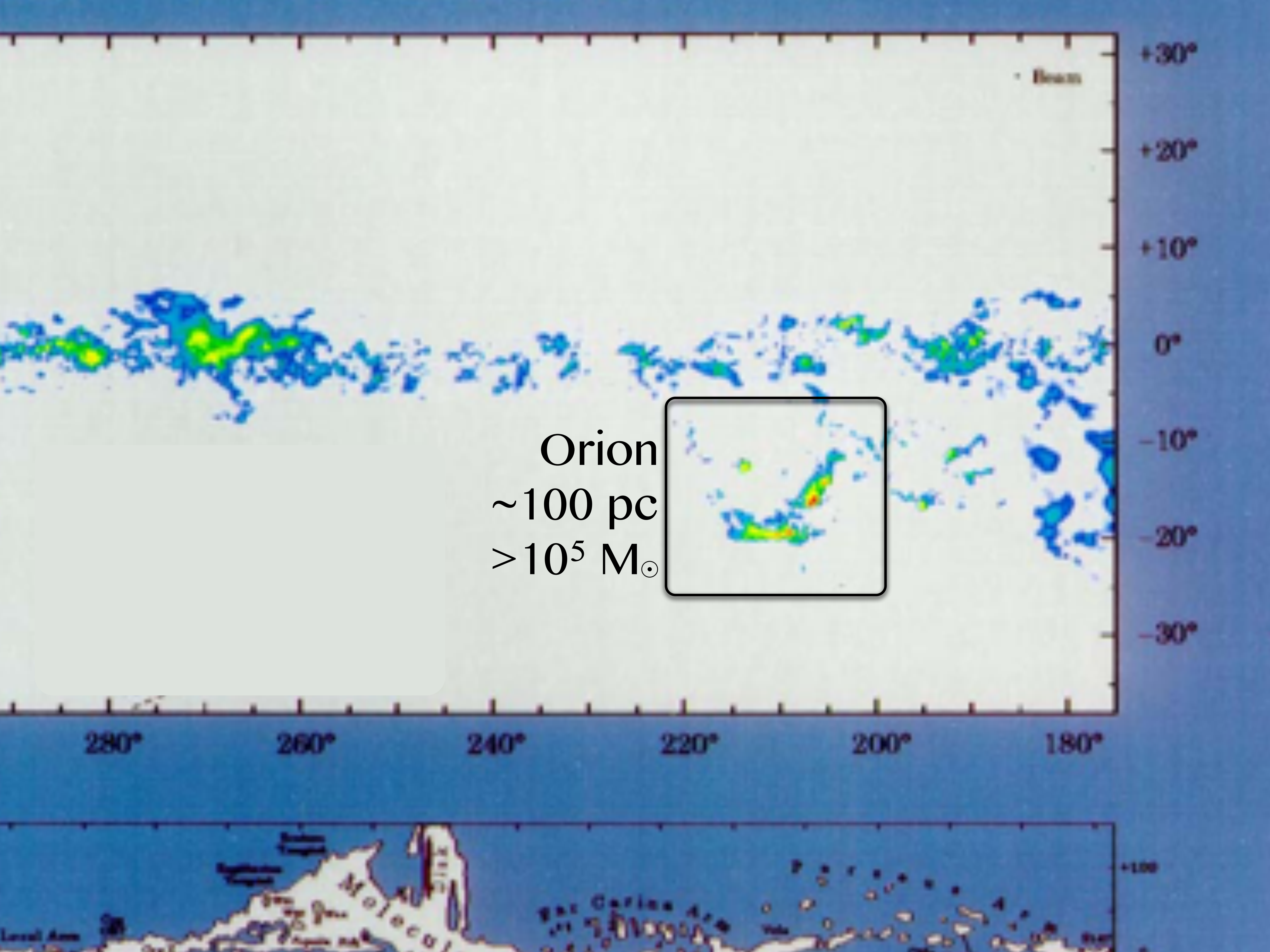
Orion in Context

Alyssa A. Goodman
Harvard-Smithsonian
Center for Astrophysics

Please join me at the unplugged part of the meeting for (more) exploration of Orion in context using WorldWide Telescope...

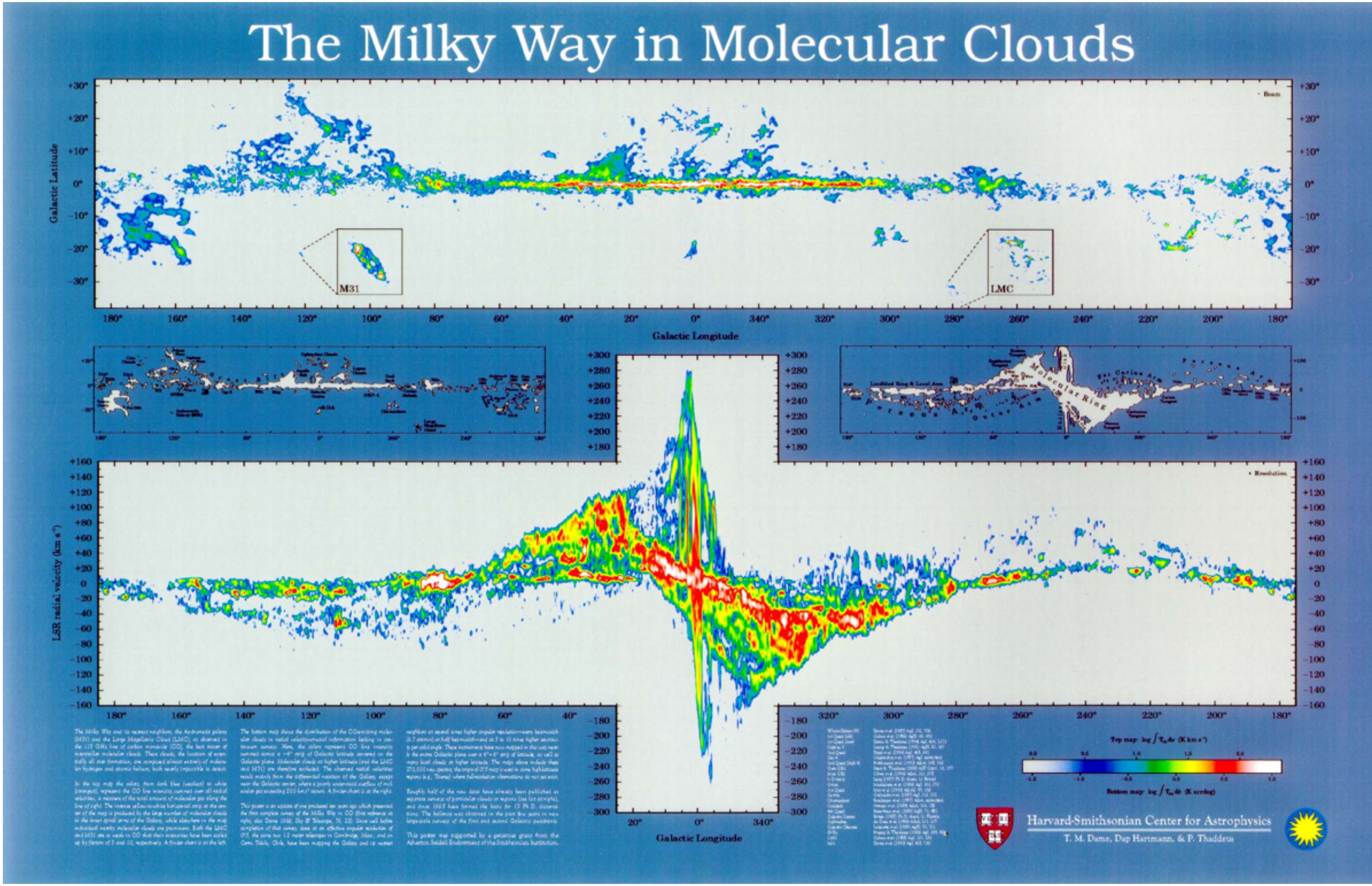
(or visit worldwidetelescope.org)


The Milky Way in Molecular Clouds
Galactic Latitude
Galactic Longitude
LSR radial velocity (km s⁻¹)
M31
LMC
Beam
Resolution
Molecular Ring
Top map: log ∫ T dv (K km s⁻¹)
Bottom map: log ∫ T dv (K arcdeg)
Harvard-Smithsonian Center for Astrophysics
T. M. Dame, Dap Hartmann, & P. Thaddeus


Beam
+30°
+20°
+10°
0°
−10°
−20°
−30°
280°
260°
240°
220°
200°
180°
Orion
~100 pc
>10^5 $M_\odot$

Dendrogramming the Milky Way

cf. Rice, Goodman, Bergin, Beaumont & Dame 2015



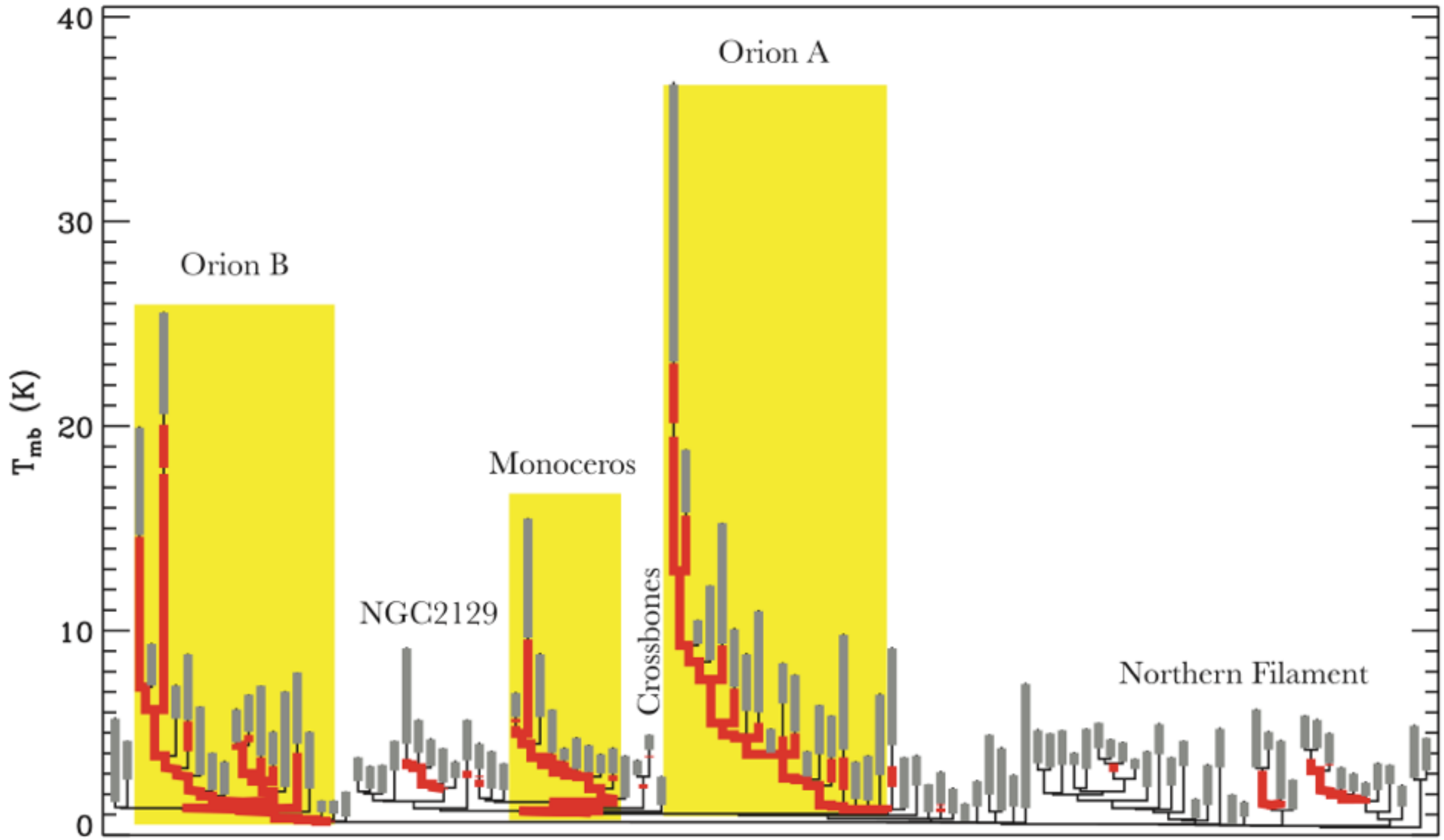


FIG. 15.—Dendrogram of the Orion-Monoceros region. Branches of the dendrogram corresponding to self-gravitating structures are highlighted in red. Regions where the quality of the data prohibit accurate estimation of the virial parameter are shown in gray. The GMCs within the data cube are identified as the largest scale objects that are self-gravitating but not bound to each other. Regions of the dendrogram corresponding to specific objects are labeled and the sections of the dendrogram corresponding to GMCs are shaded in yellow.

Rosolowsky et al. 2008 (original "dendrograms" paper)

VERSION: 18 June 2015

A Catalog of Molecular Clouds in the Entire Galactic Plane

Thomas S. Rice[1],. Alyssa A. Goodman[2], Edwin A. Bergin[1],
Christopher Beaumont[3], and T. M. Dame[2],

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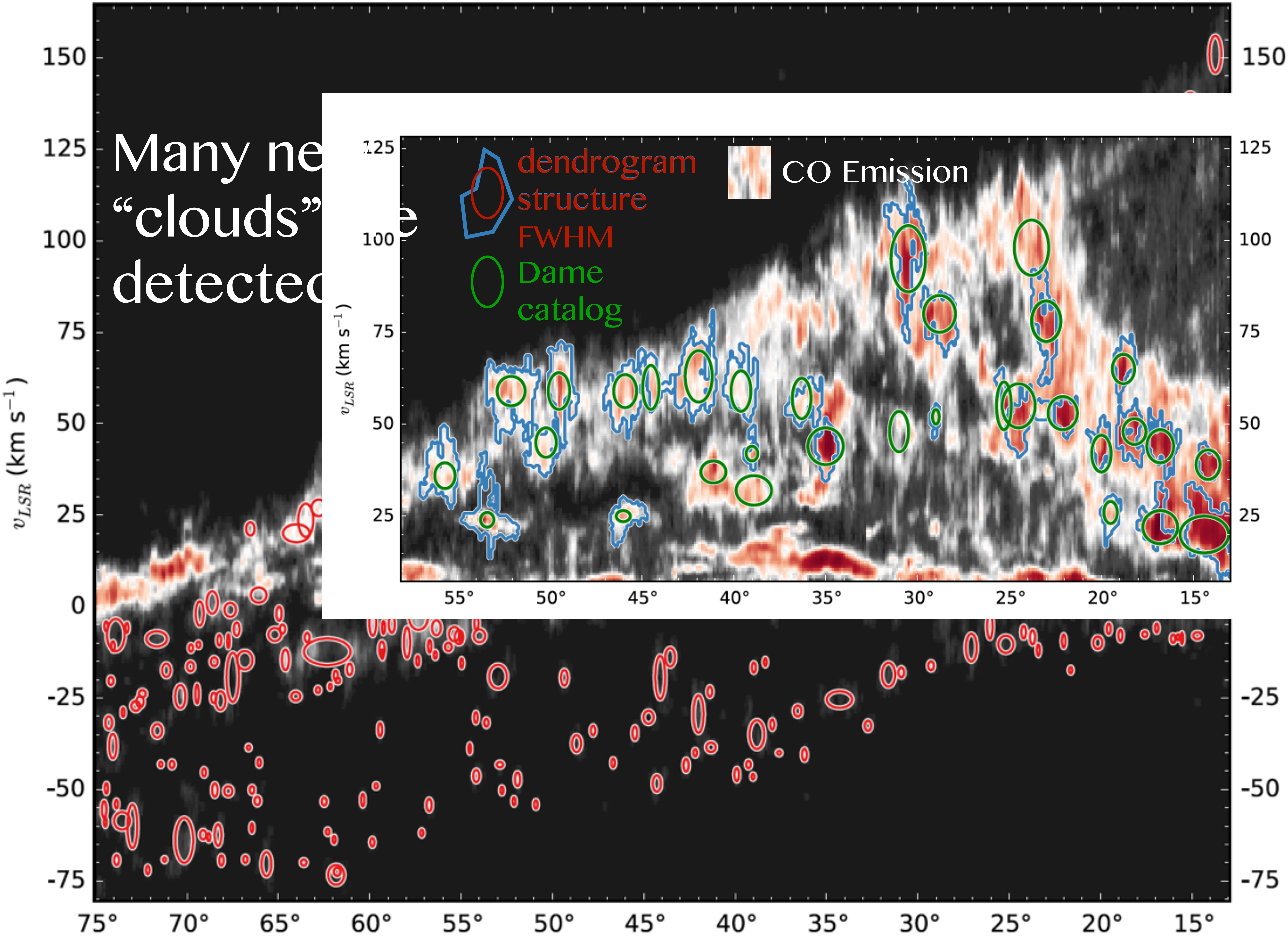
2: Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

Coming very soon to astro-ph!

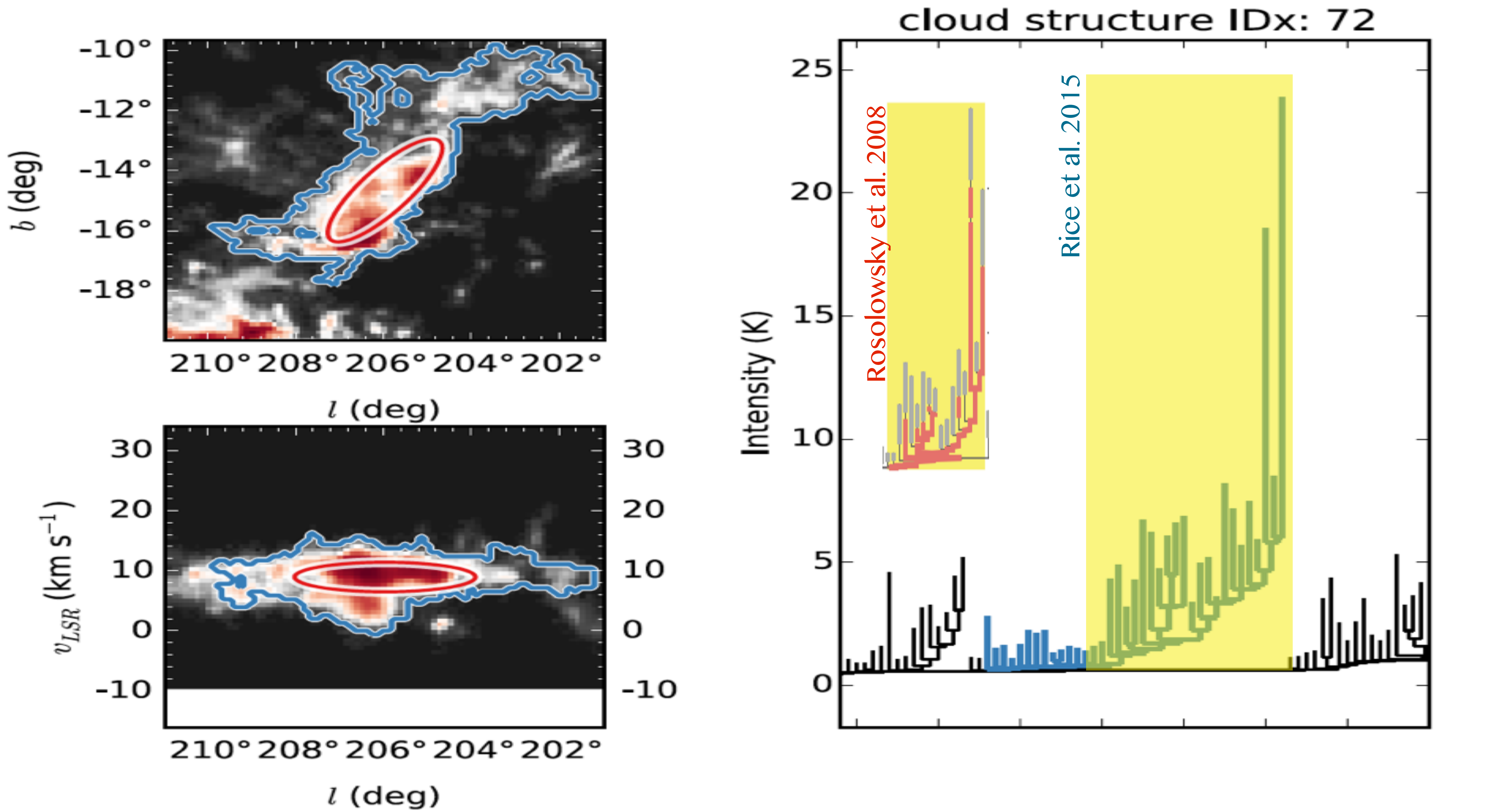
Here we present a systematically produced catalog of 1058 massive molecular clouds throughout the entire Galactic plane, with a total of 2.5×10^8 solar masses, or $25^{+10.7}_{-5.8}\%$ of the Milky Way's estimated H_2 mass, of which $1.96 \times 10^8 M_\odot$ is located within the solar circle. A number of prominent spiral arms, including the Sagittarius, Perseus, Outer, Carina, and Scutum arms are traced in this catalog; some are tracked through multiple quadrants. We find that the power index of Larson's first law, the size-linewidth relation, is consistent with 0.5 in all regions, but that clouds in the inner Galaxy systematically have significantly higher linewidths at a given size, suggesting that their linewidths are set in part by pressure confinement. The slope of the mass spectrum is similar in all regions, but the truncation mass in the inner Galaxy ($\sim 10^7 M_\odot$) is more than an order of magnitude higher than that in the inner Galaxy ($\sim 5 \times 10^5 M_\odot$), indicating that the inner Galaxy is able to form and host substantially more massive GMCs than the outer Galaxy. Using the luminosities and x, y positions of the clouds in this catalog, we have produced simulated CO images of how the Milky Way would appear to an extragalactic observer in CO at different angular resolutions, which can be compared to current and future CO maps of other galaxies.

Rice et al. 2015

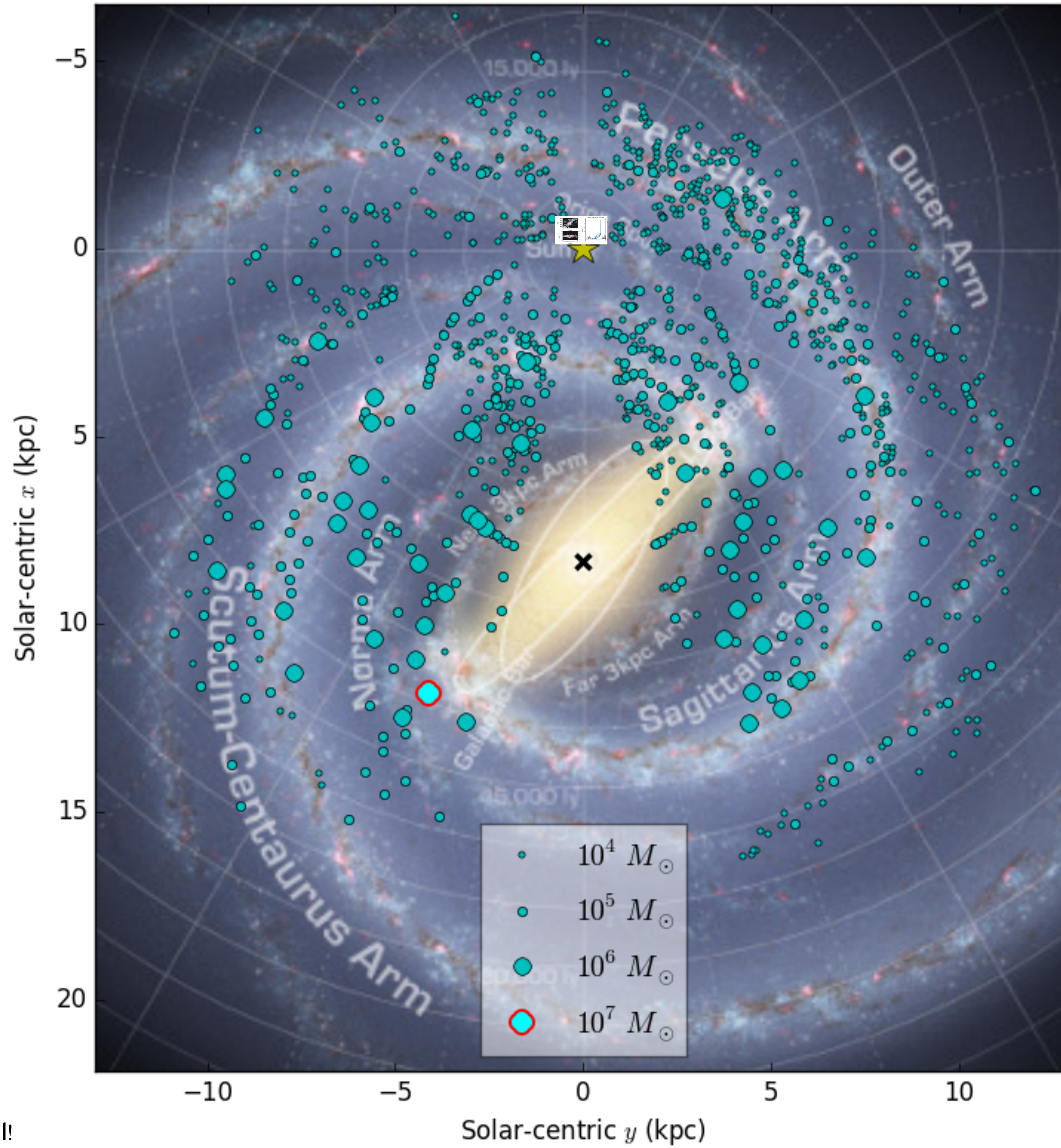


Rice et al. 2015

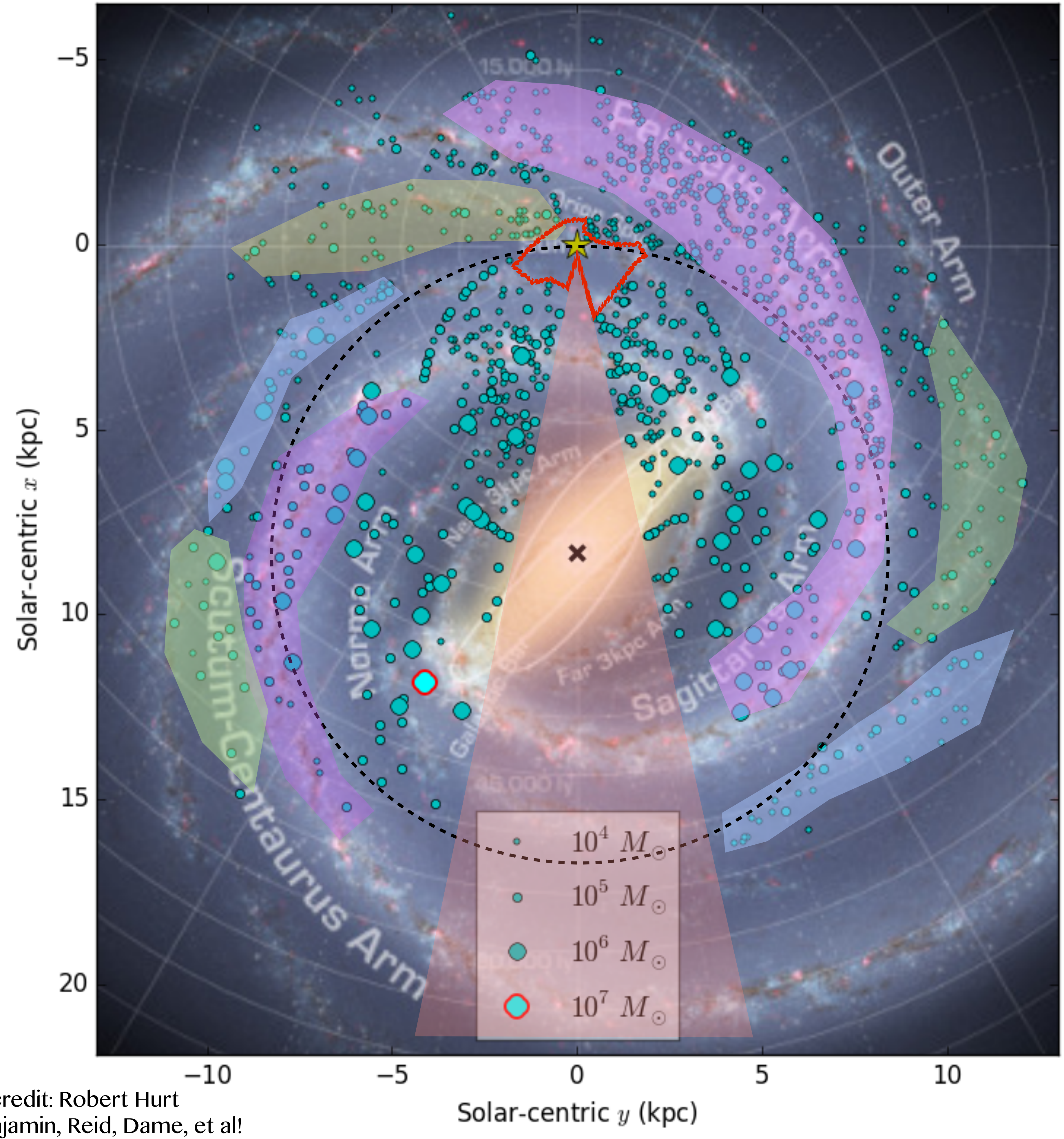
Dendrogramming Orion B

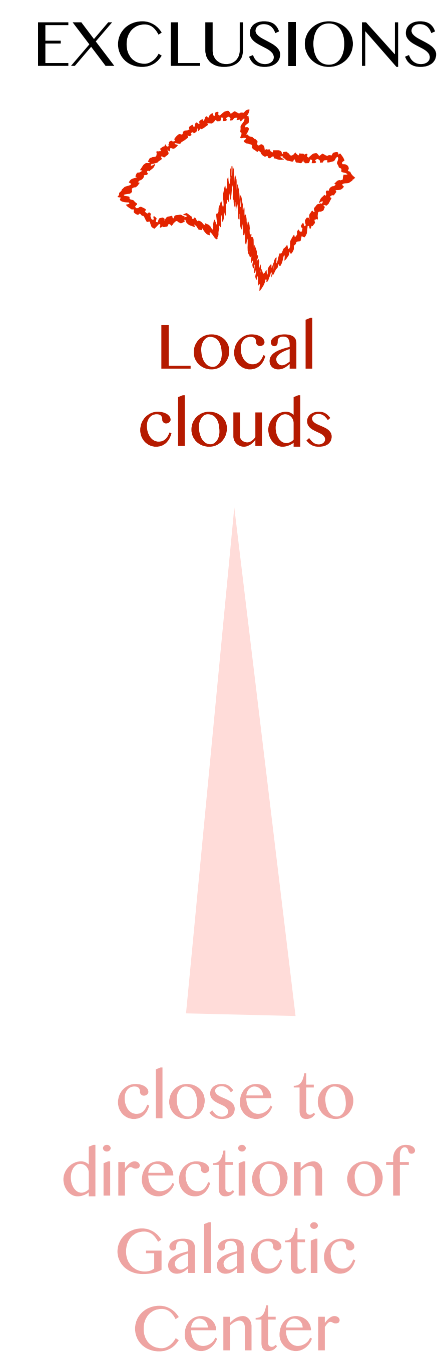


“Orion in Context”



Cartoon(!!) image credit: Robert Hurt
with input from Benjamin, Reid, Dame, et al!





500 pc

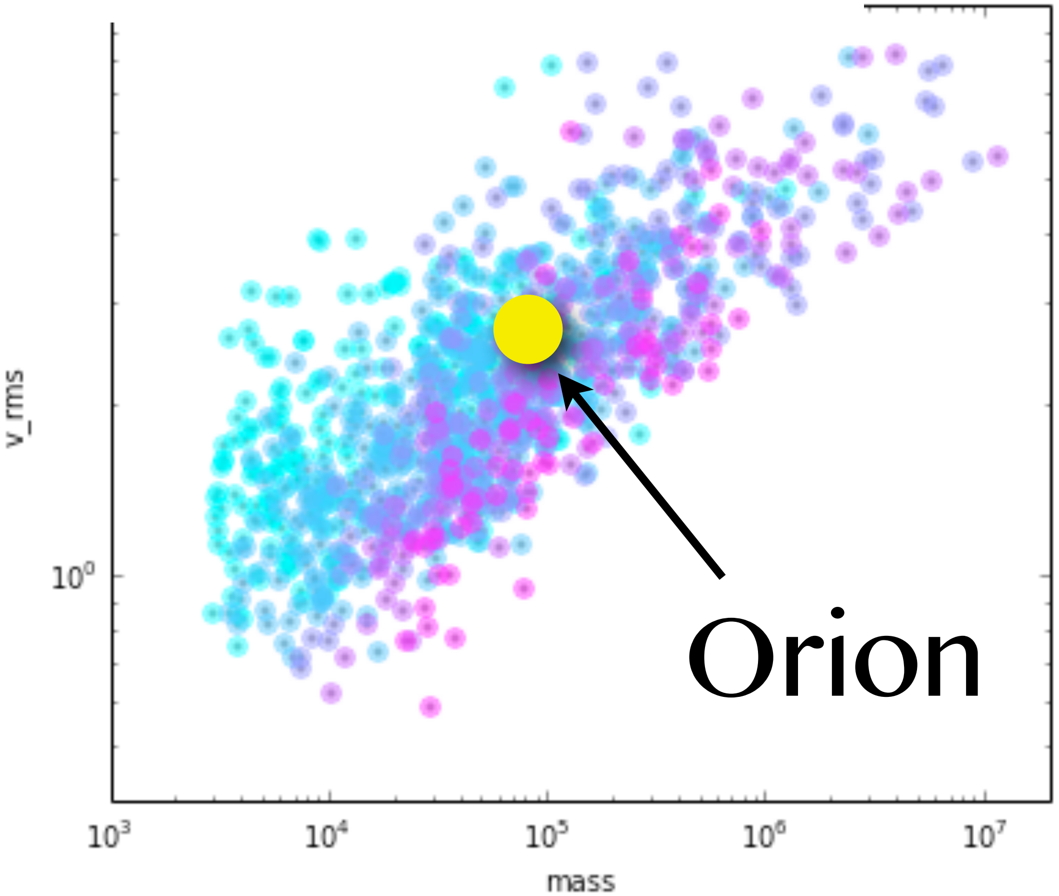
Cartoon(!!) image credit: Robert Hurt
with input from Benjamin, Reid, Dame, et al!

Rice et al. 2015

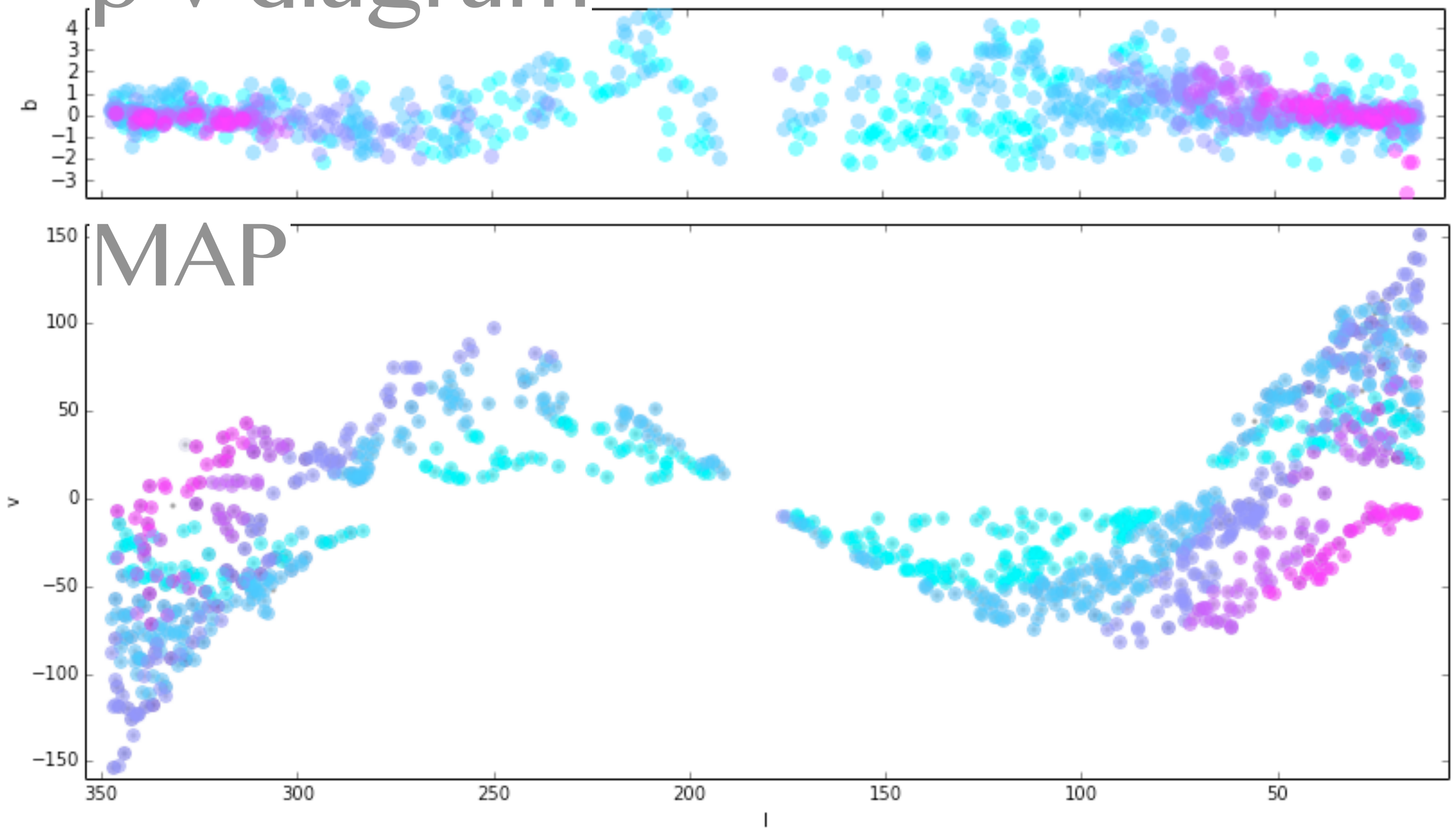
How biased?

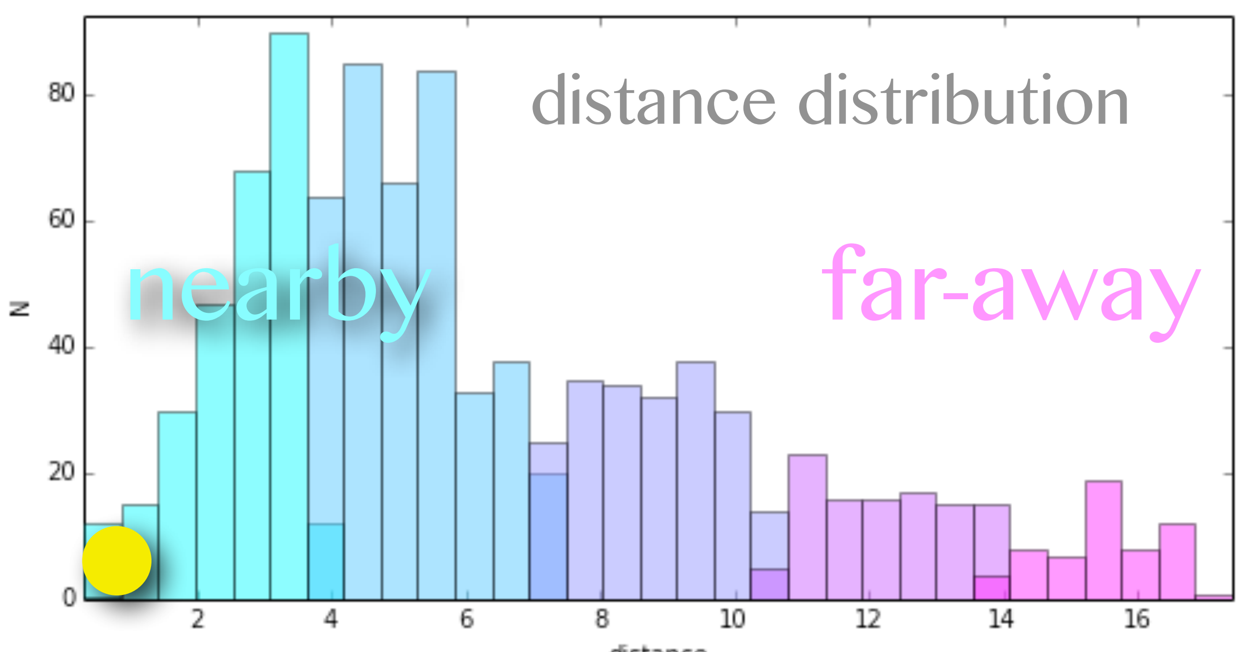
color-code shows distance bins

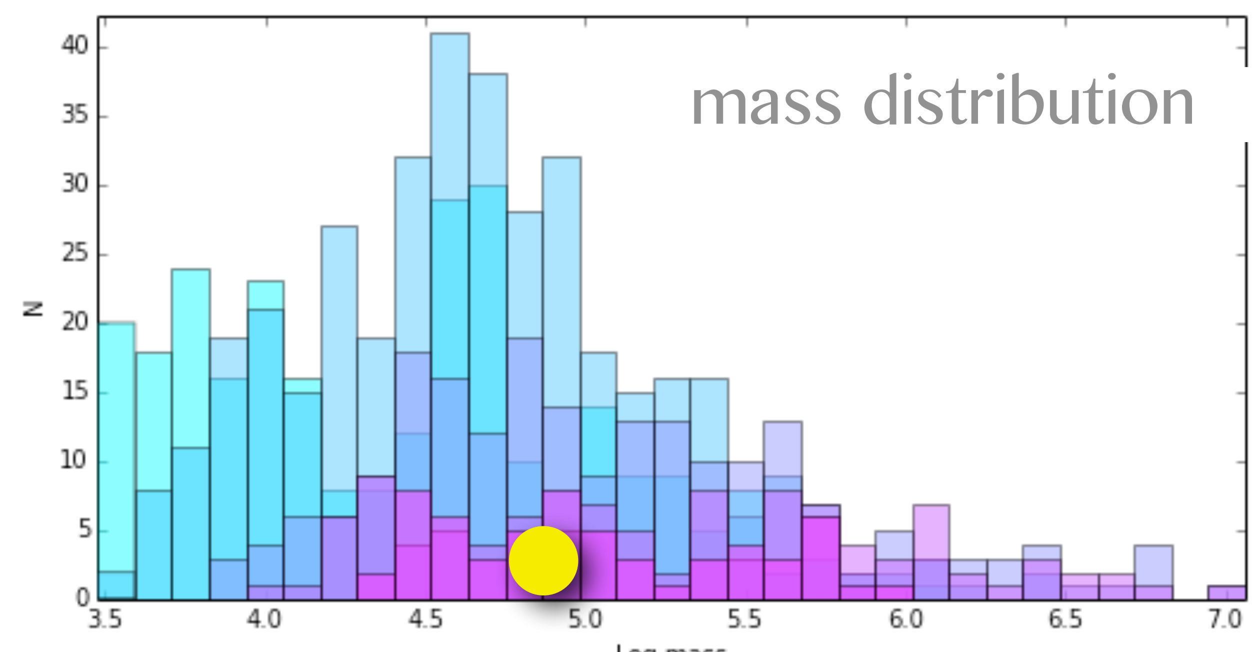
line width vs. mass



p-v diagram

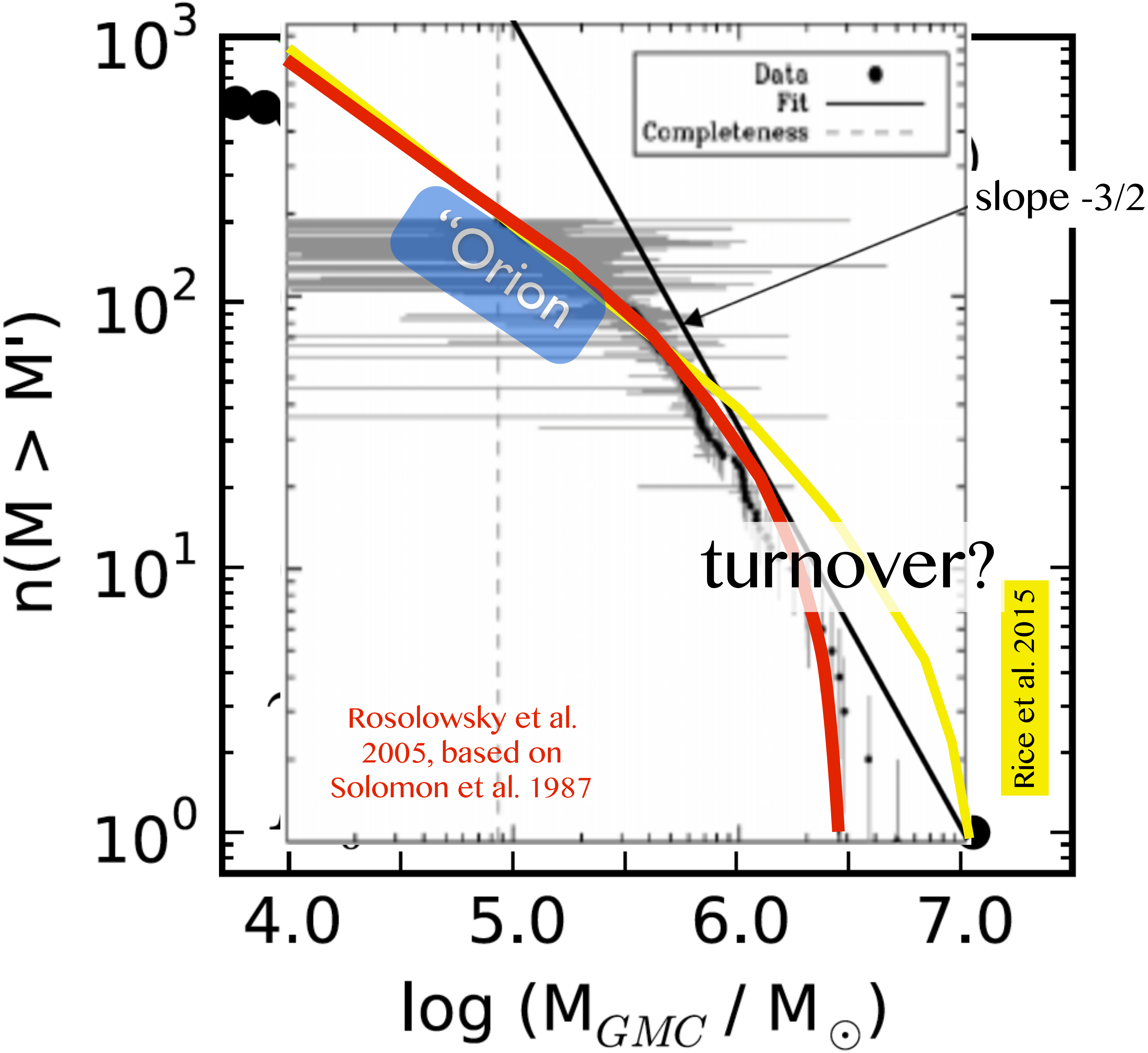




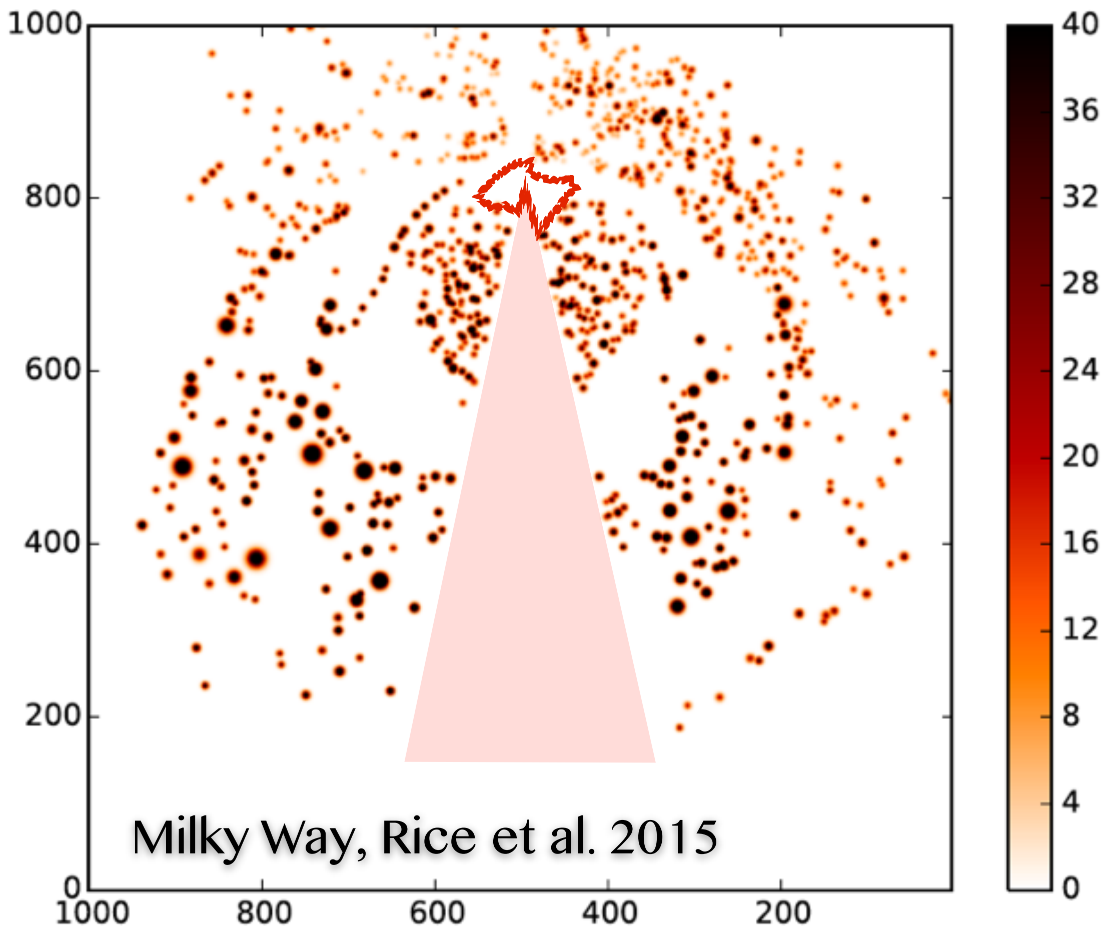


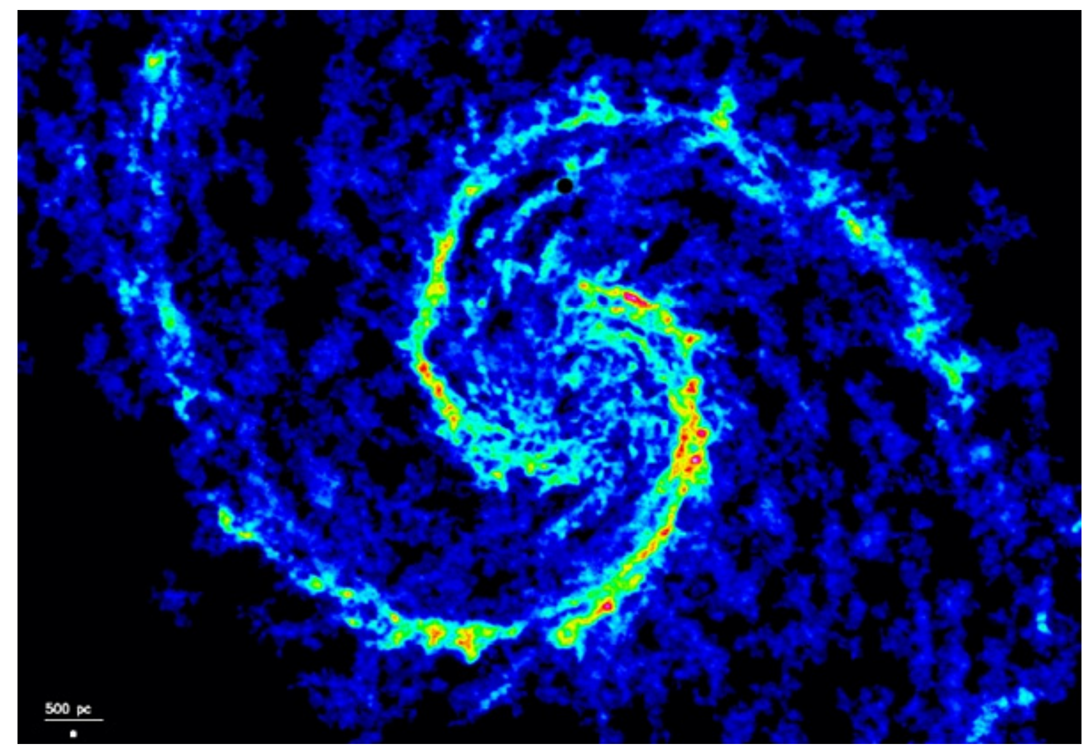
based on Rice et al. 2015

“Cloud Mass Function”



The Milky Way from M51	M51 from the Milky Way
500 pc	500 pc





M51, PAWS, Schinnerer et al. 2013

Fig. 16.— Face-on "simulated" CO image of the Milky Way based on the clouds in this catalog, as seen by two hypothetical extragalactic observers: *Left*: with 40 pc resolution, matching the PAWS survey of M51 (Schinnerer et al. 2013). *Right*: with 400 pc resolution, simulating a galaxy 10 times further than M51. Each image is displayed with a square root intensity scale.

The Milky Way from M51

...and from 10x farther than M51 (400 pc resolution)

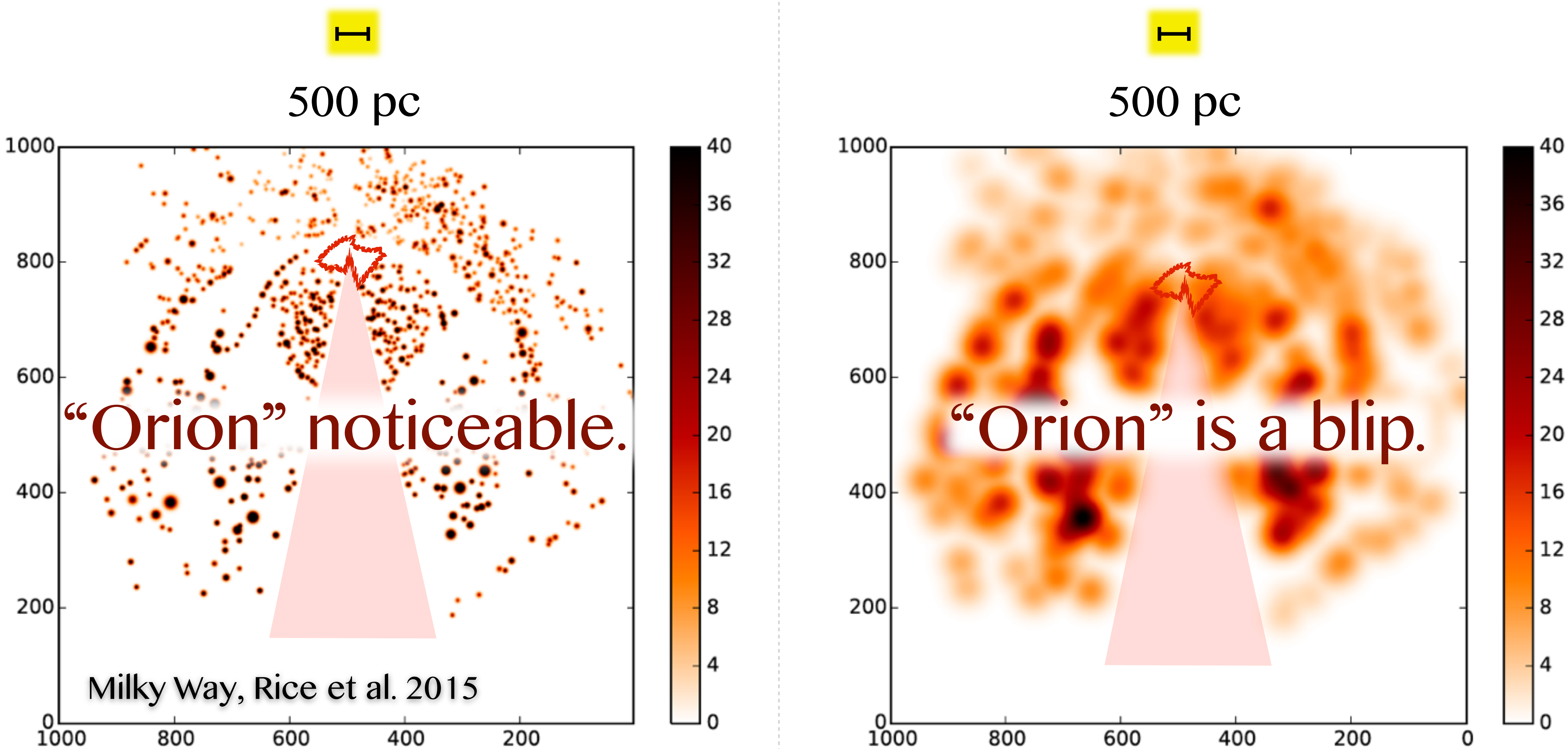
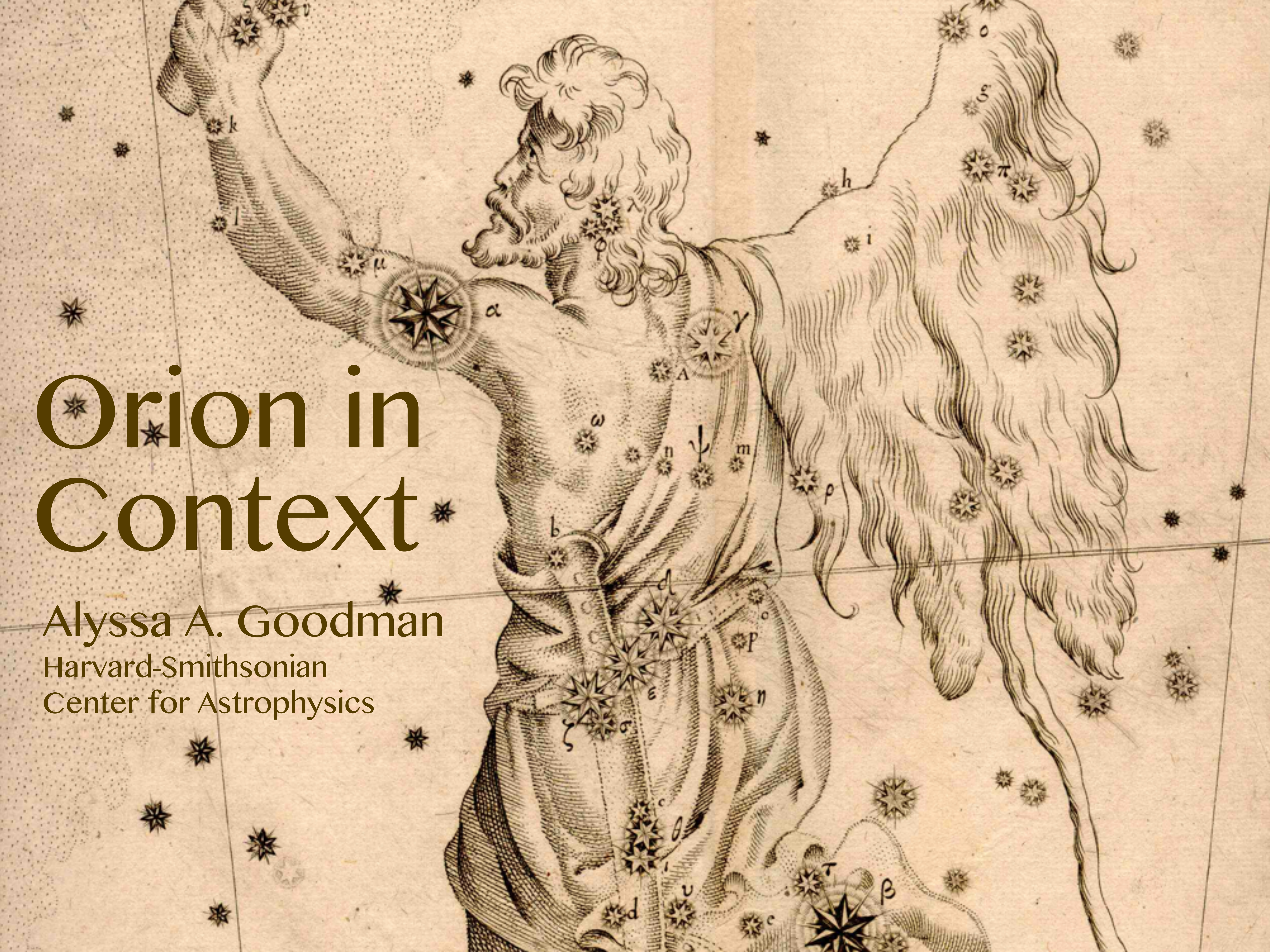


Fig. 16.— Face-on “simulated” CO image of the Milky Way based on the clouds in this catalog, as seen by two hypothetical extragalactic observers: *Left*: with 40 pc resolution, matching the PAWS survey of M51 (Schinnerer et al. 2013). *Right*: with 400 pc resolution, simulating a galaxy 10 times further than M51. Each image is displayed with a square root intensity scale.



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