

Bridging the Gap between Galactic and Extragalactic Star Formation Research

Schmidt's Conjecture and the Nature of SFR Scaling Relations

Jan Forbrich, Charlie Lada, Chris Faesi, Marco Lombardi, & Joao Alves

Conclusions

1. The star formation efficiency in even the local molecular clouds varies considerably.
2. The integrated SFR of a cloud scales *linearly* with and is most reliably traced by the dense gas mass, over many orders of magnitude.
3. Beyond the dense gas fraction, the physical structure of a cloud plays an important role in setting its SFR.
4. There is *no* Schmidt law *between* molecular clouds.
5. A Schmidt law exists *within* a cloud but does not adequately describe its star formation activity.
6. The Kennicutt-Schmidt law for galaxies is largely the result of unresolved measurements of GMCs and not a result of any underlying physical law of star formation.

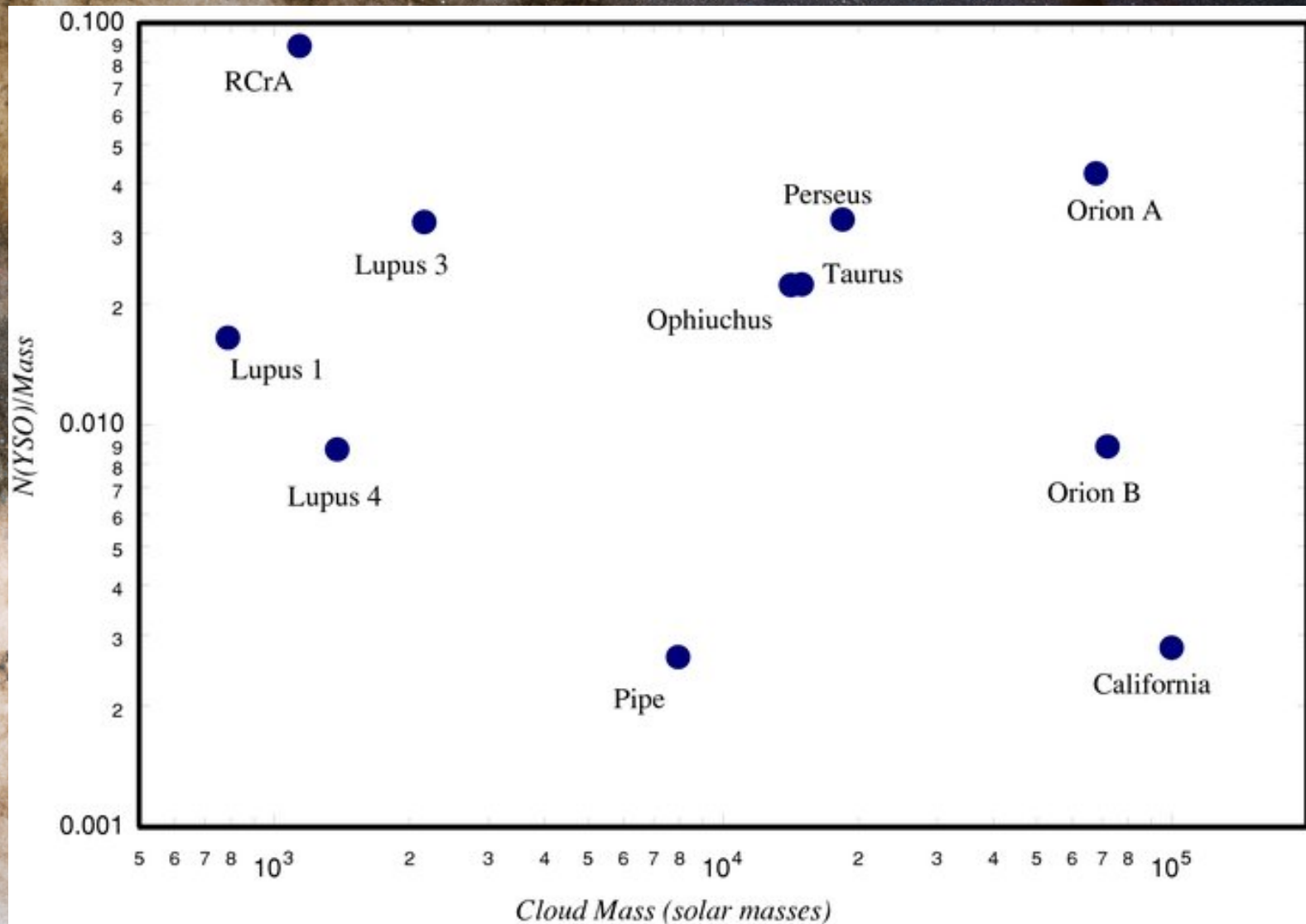
1. The star formation efficiency in even the local molecular clouds varies considerably.



$M(\rho \text{ Oph}) \sim 2 M(\text{Pipe})$, but $\text{SFR}(\rho \text{ Oph}) \sim 15 \text{ SFR}(\text{Pipe})$

Forbrich et al. (2009,2010)

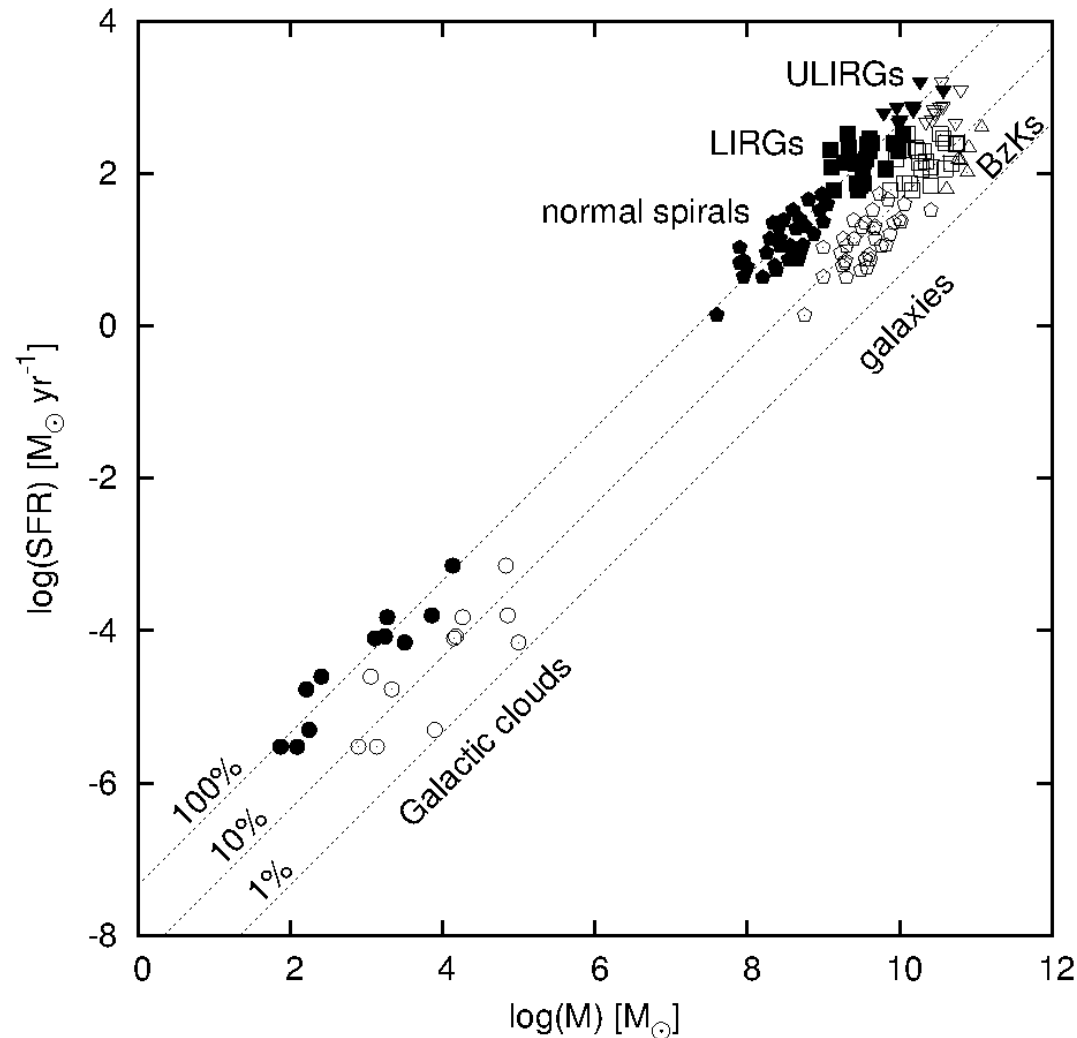
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Lada et al. (2010)

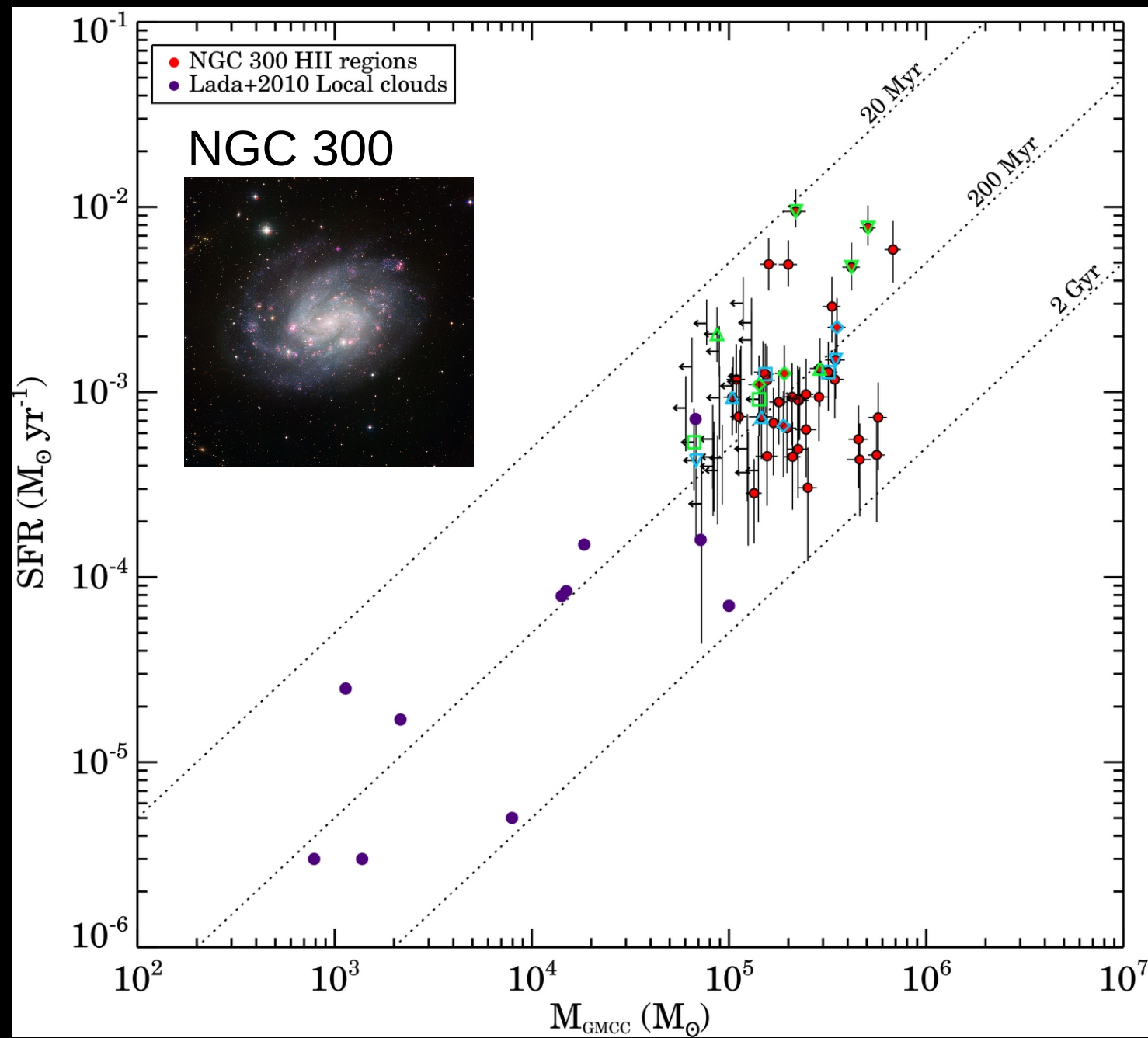
In local clouds, SFR per unit cloud mass shows large variations, independent of cloud mass.

2. The integrated SFR of a cloud scales *linearly* with and is most reliably traced by the dense gas mass, over many orders of magnitude.

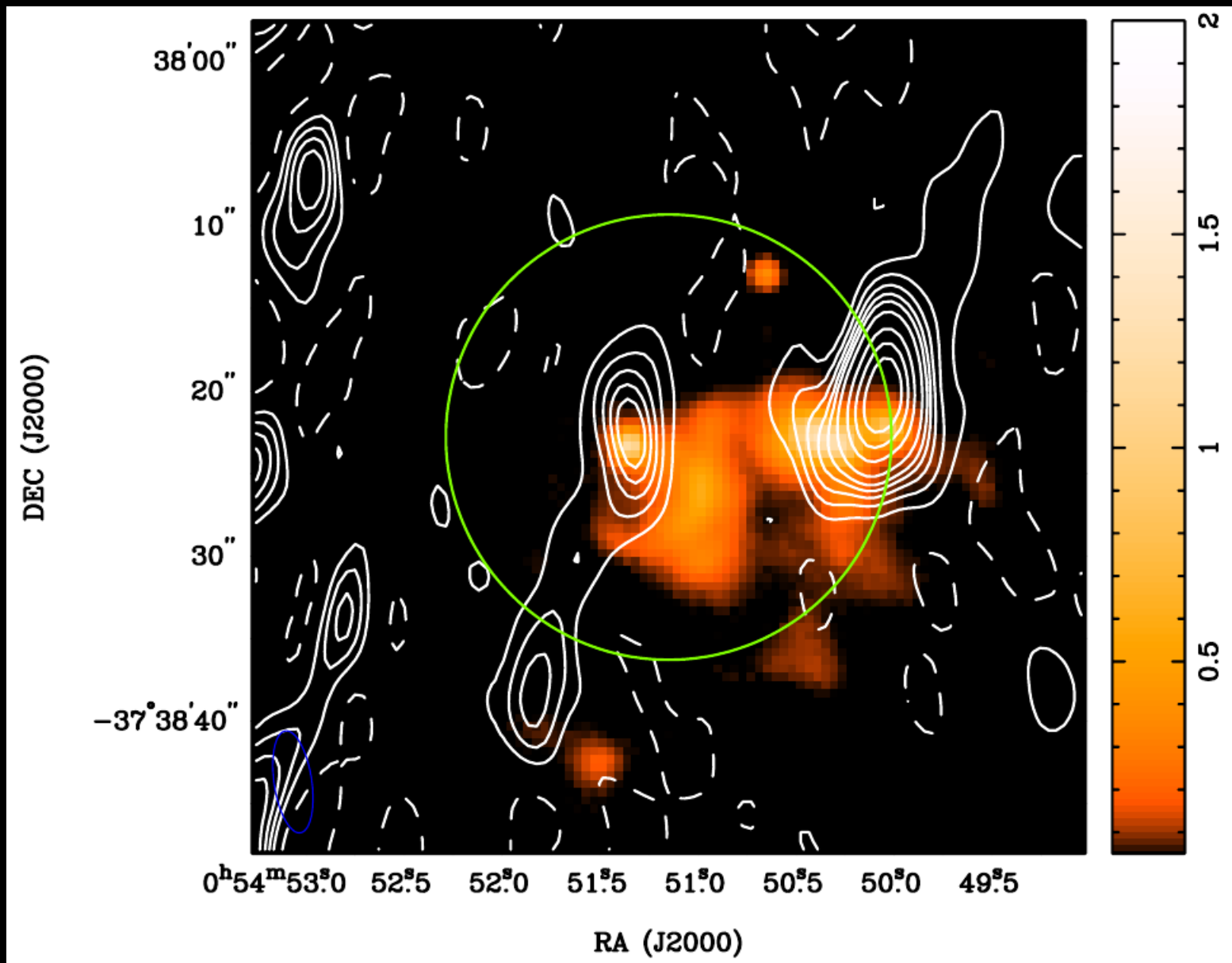


Lada, Forbrich, Lombardi, & Alves (2012)

see poster 63 by Melissa Louie

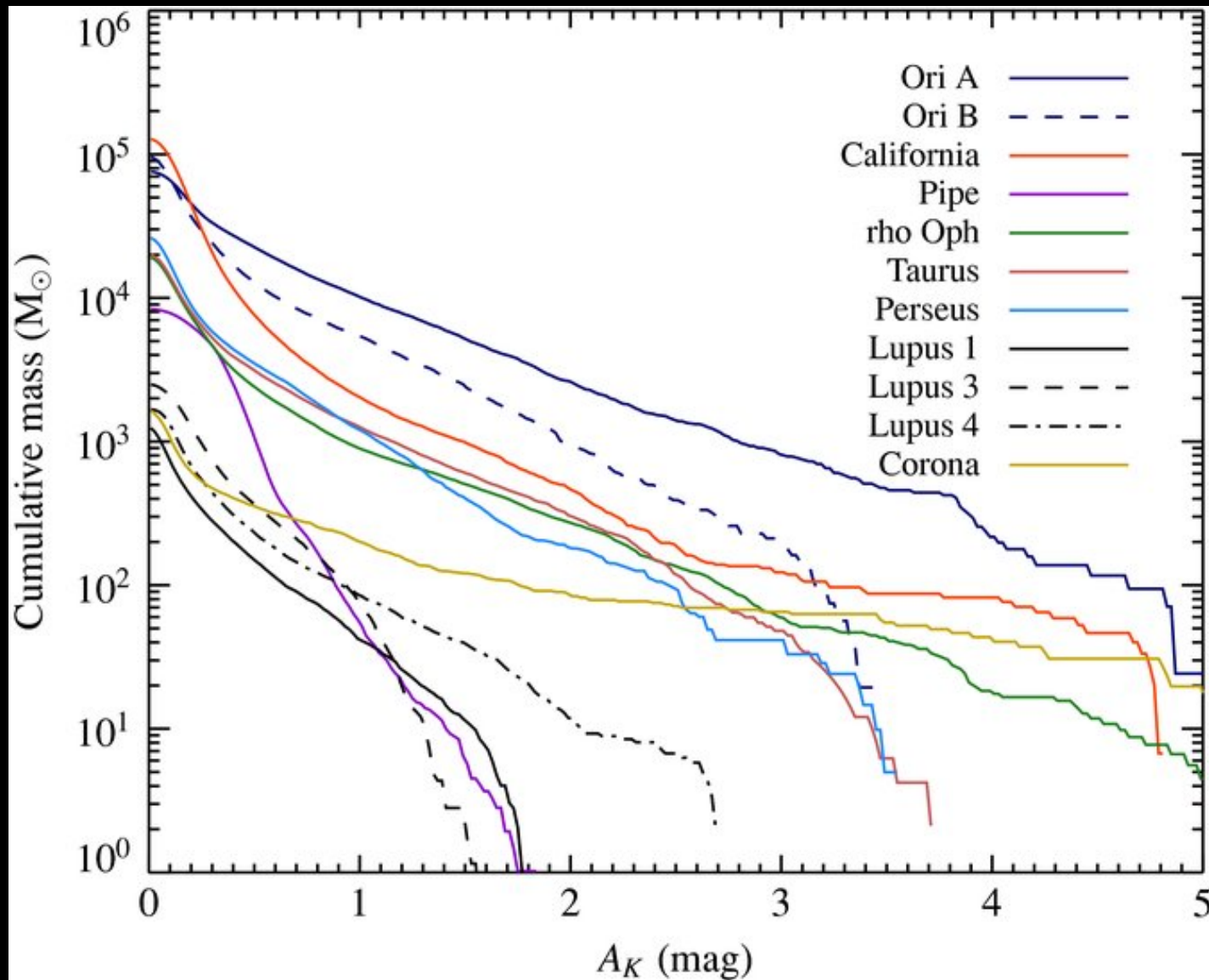


Faesi, Lada, Forbrich, Menten, & Bouy (2014)



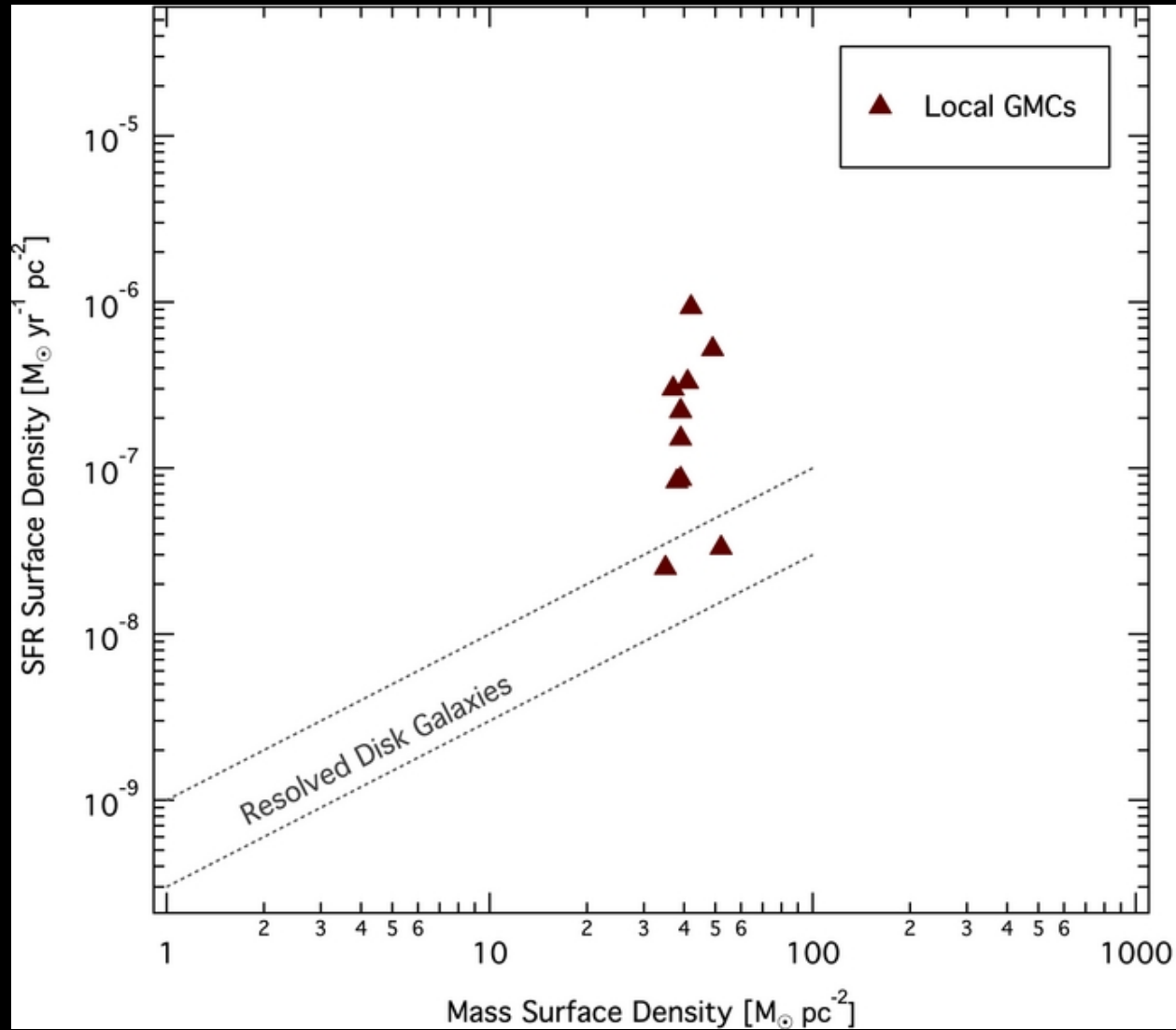
Faesi et al. *in prep.*

3. Beyond the dense gas fraction, the physical structure of a cloud plays an important role in setting its SFR.



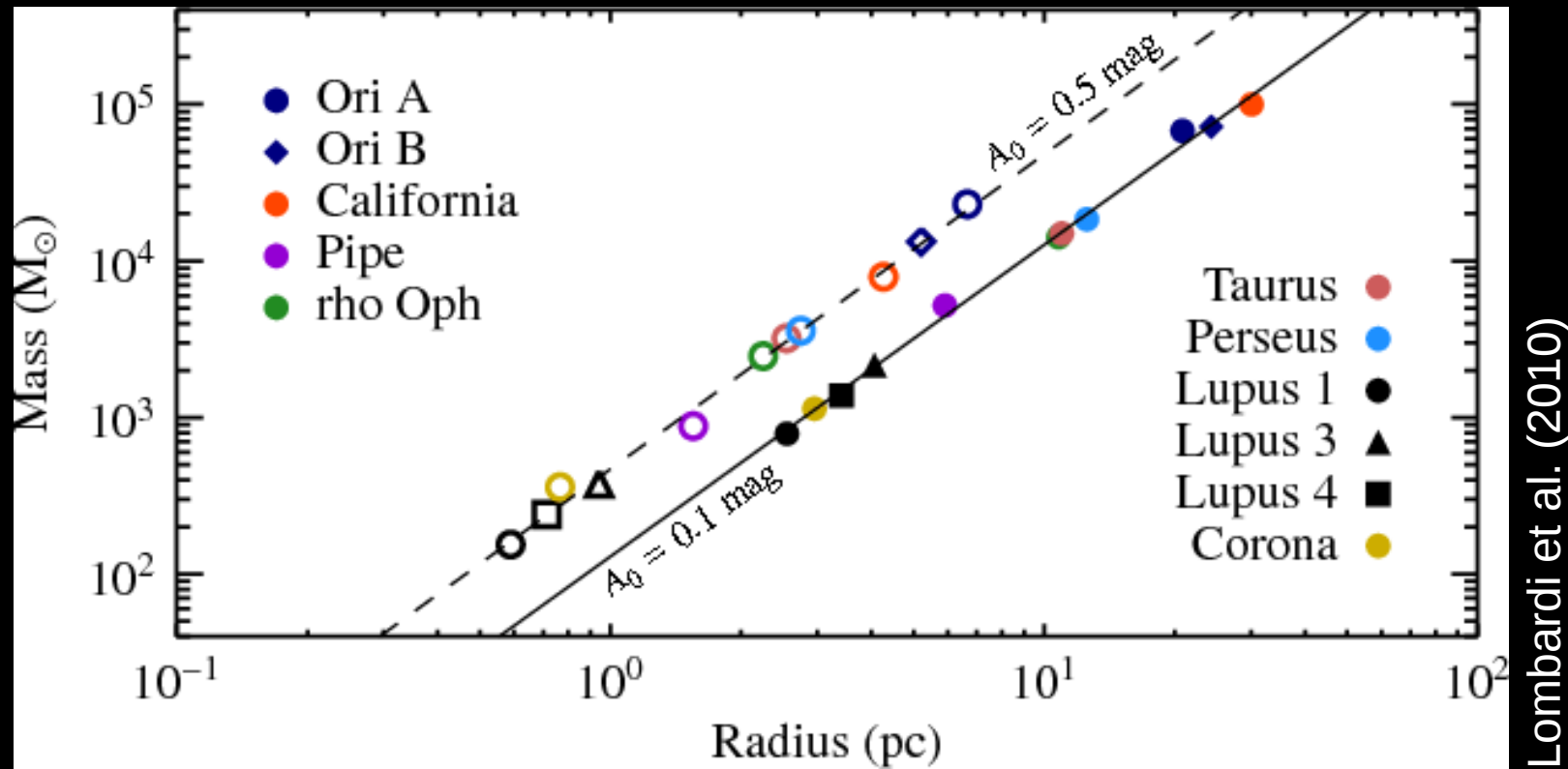
Lada et al. (2010)

4. There is *no* Schmidt law *between* molecular clouds.



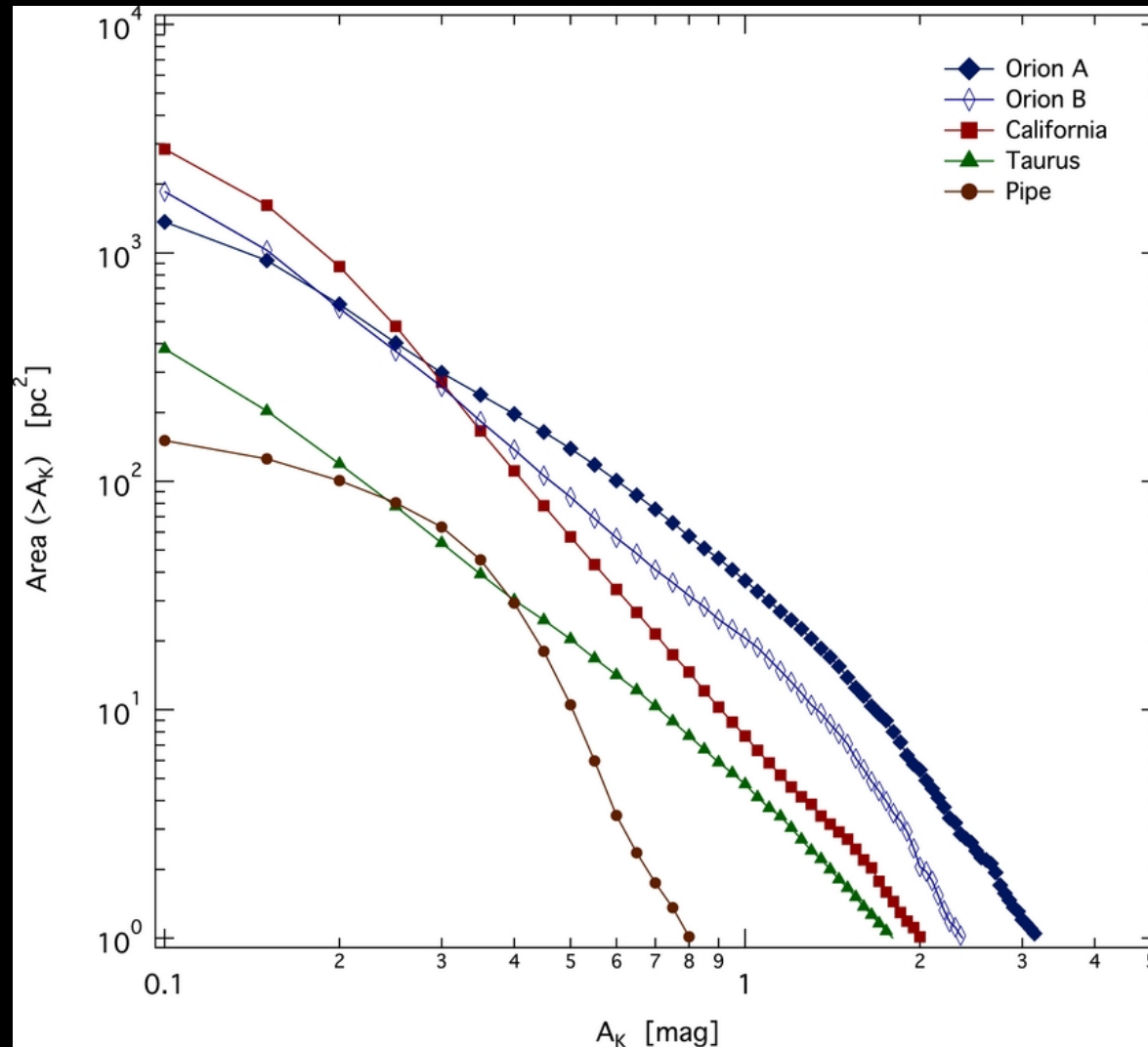
Lada et al. (2013)

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Constant column densities:
scaling relation from Larson (1981)

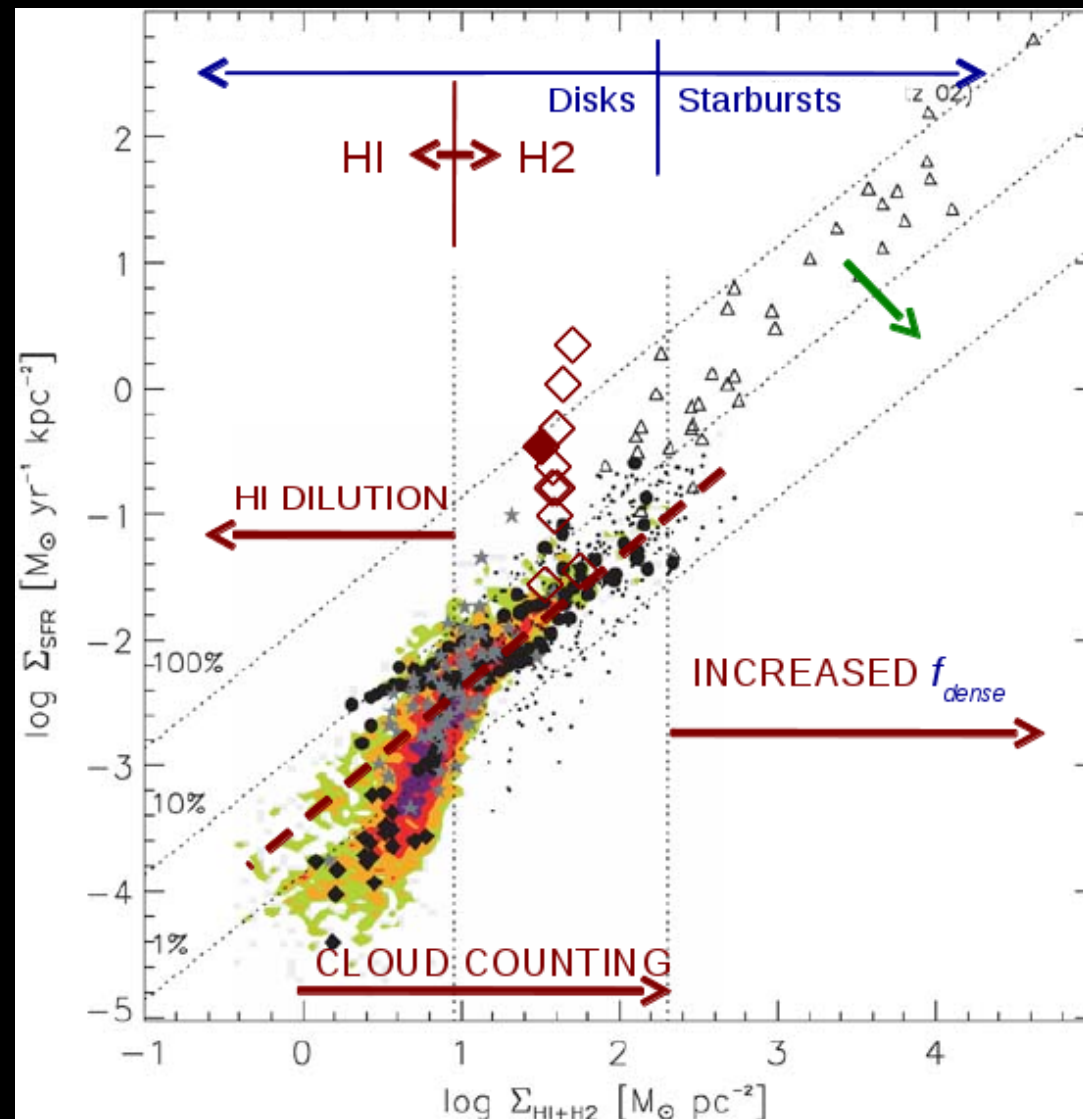
5. A Schmidt law exists *within* a cloud but does not adequately describe its star formation activity.



Lada et al. (2013)

$$N_* = \int \Sigma_*(A_K) dS = \int \Sigma_*(A_K) |S'(>A_K)| dA_K$$

6. The Kennicutt-Schmidt law for galaxies is largely the result of unresolved measurements of GMCs and not a result of any underlying physical law of star formation.



Bigiel et al. (2008)

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