Puddling and Quenching:
How Does HI Content Depend on Galaxy Mass?

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with help from David Stark, Lisa Wei,
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Q: what is the most commonly used predictor of M_{HI}/M_* by theorists?

GALMASS: A SMARTPHONE APPLICATION FOR ESTIMATING GALAXY MASSES

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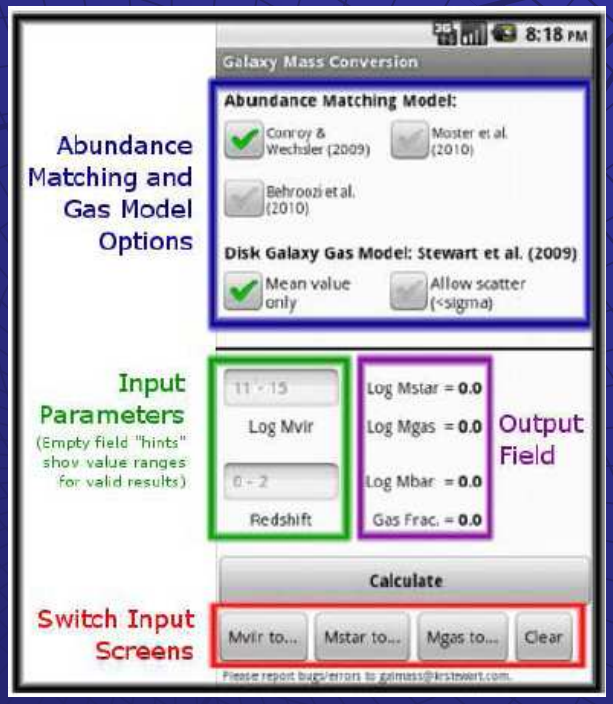
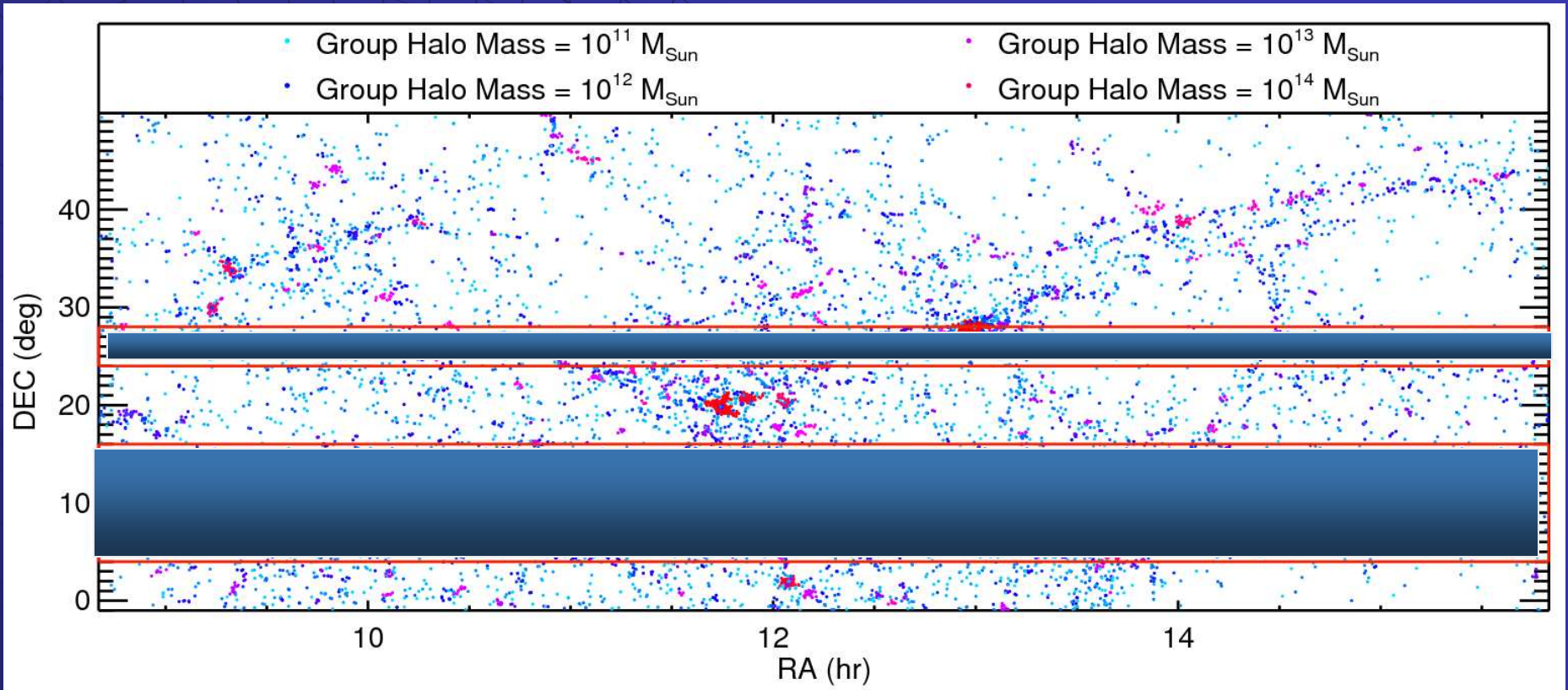


A: stellar mass

$$M_{\rm gas} = 0.04\, M_{\rm star} \left(\frac{M_{\rm star}}{4.5 \times 10^{11}\, M_\odot} \right)^{-\mu(z)}$$

explore with volume-limited subsample of ALFALFA+SDSS

(Haynes et al. 2011 α40 data release)

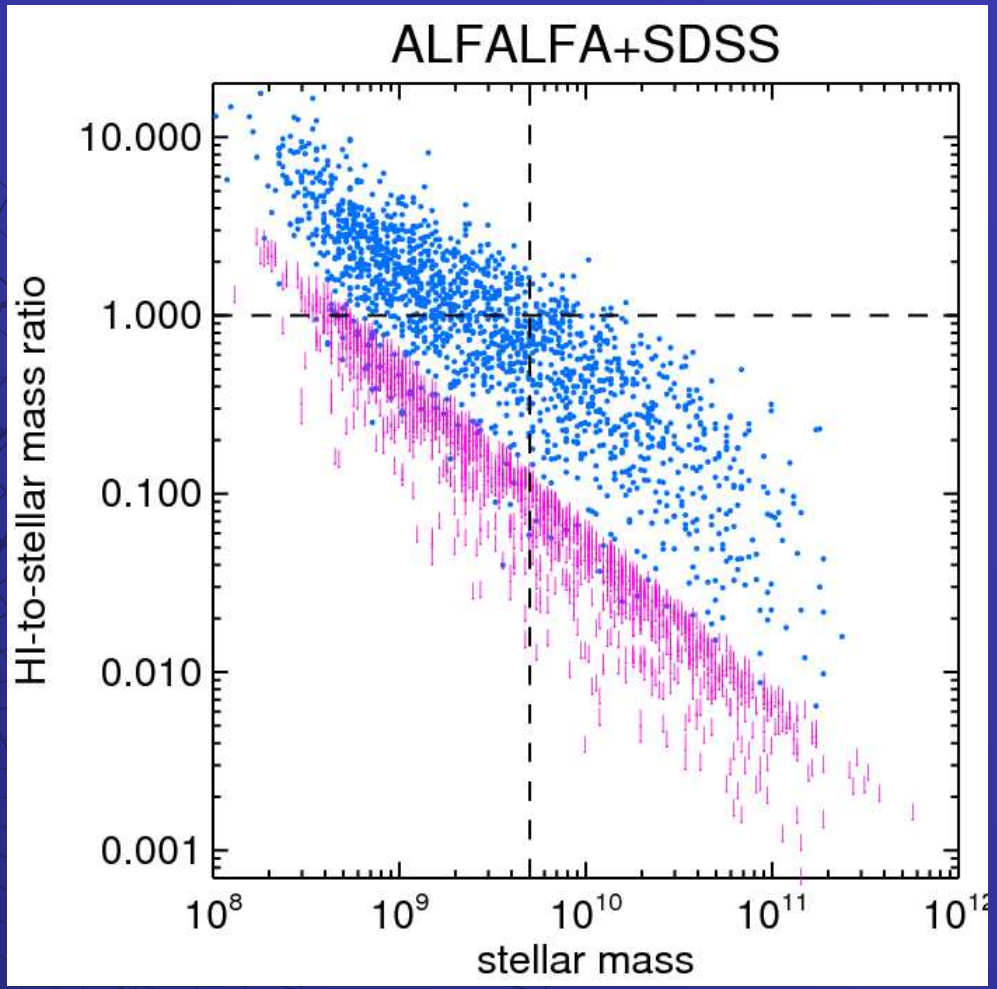


approx. 3000 galaxies between cz=2500-7000 km/s

selection: SDSS M_r<-17.23 + HyperLeda (≈CfA survey)

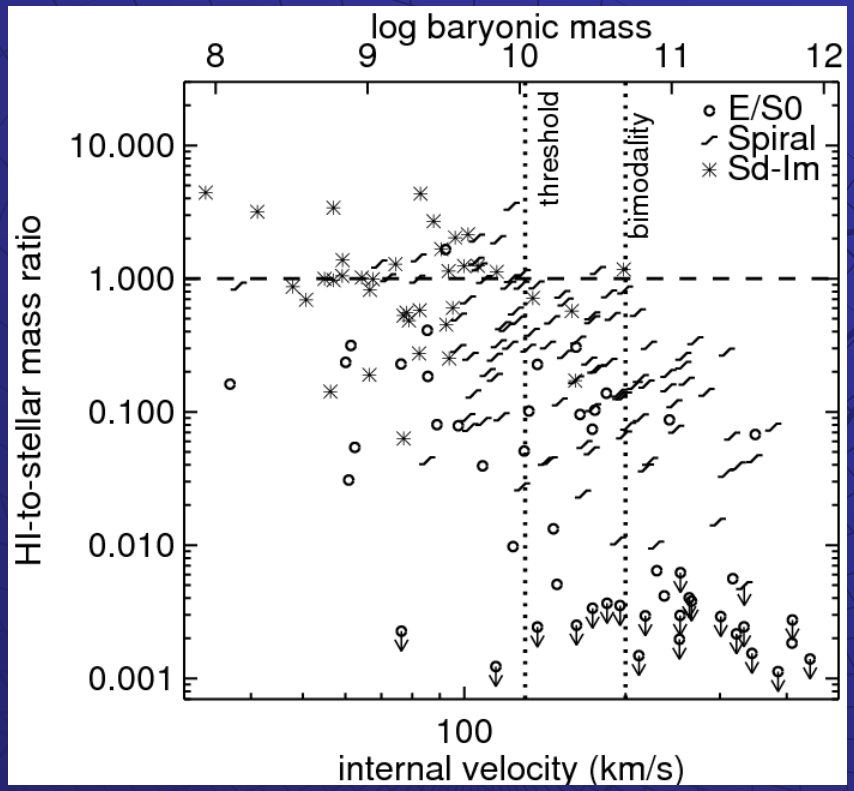
looks like a correlation…

- custom reprocessed ugrizJHK photometry
- stellar masses from SED fitting
- upper limits using r-band TFR + photometric inclination (preliminary)

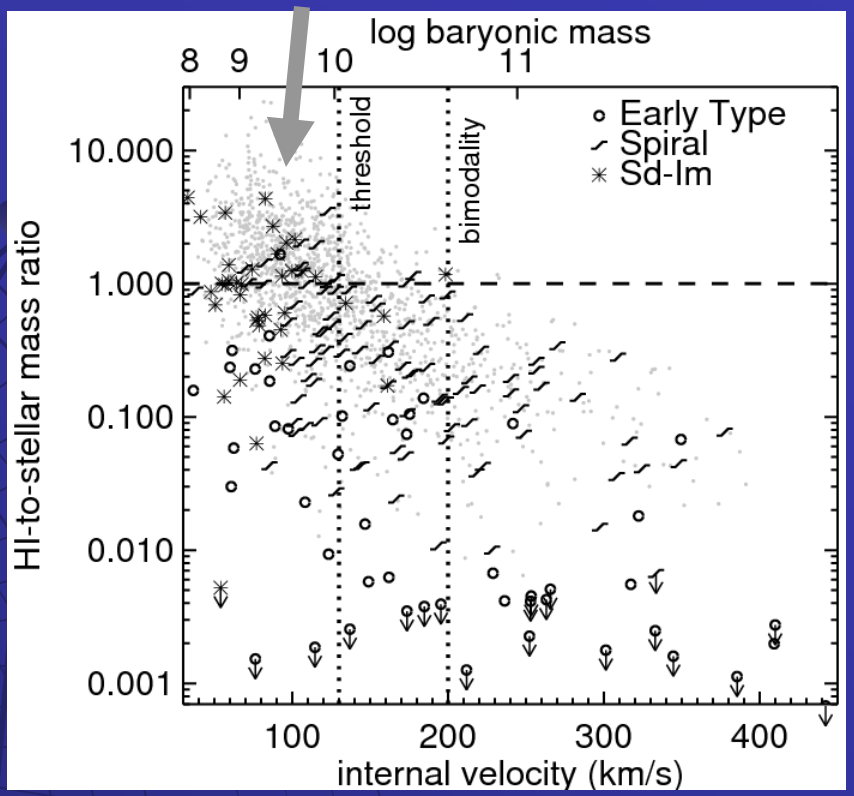


…but covariant and full of upper limits

try V, a more fundamental mass metric…



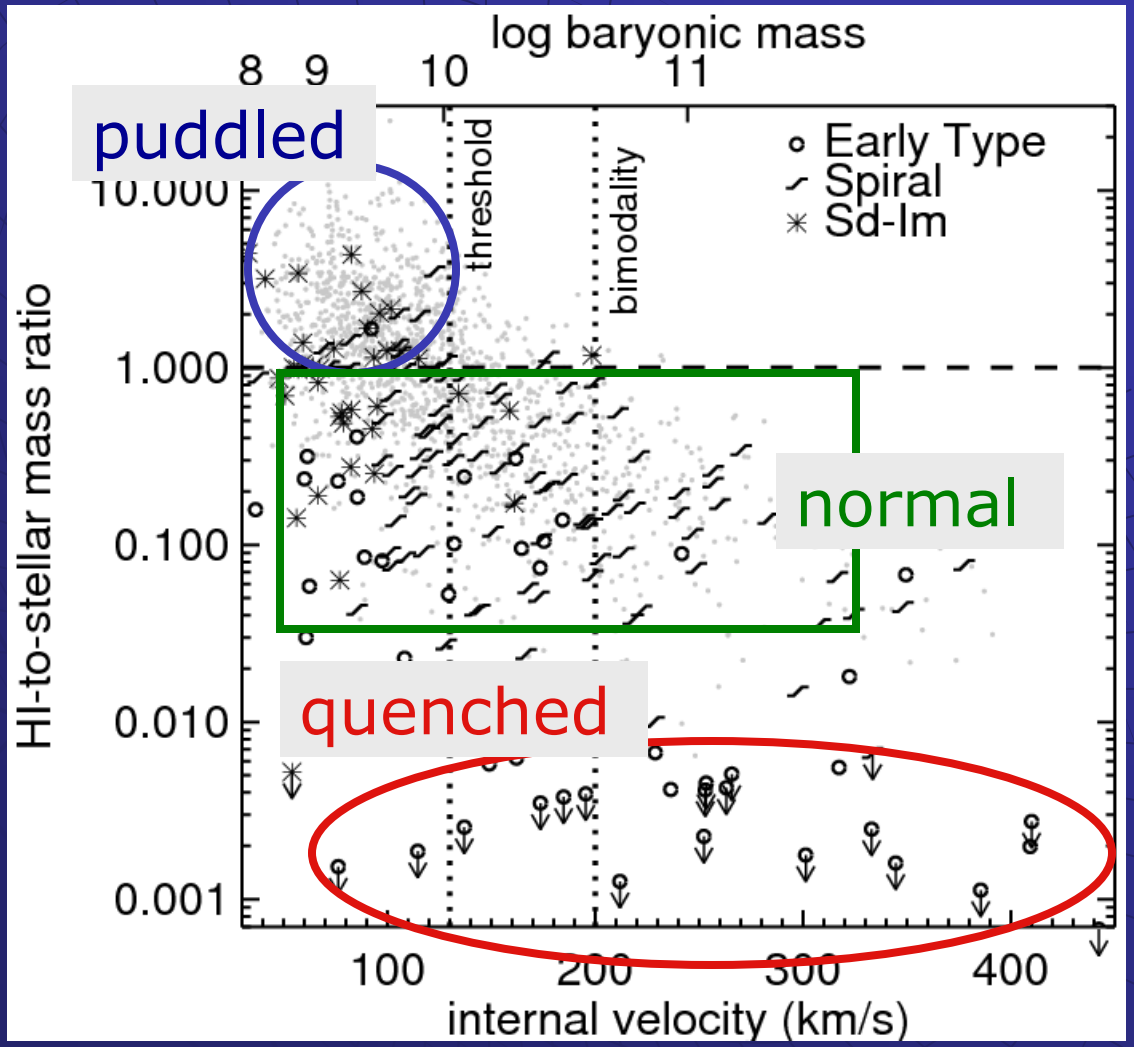
ALFALFA underlaid

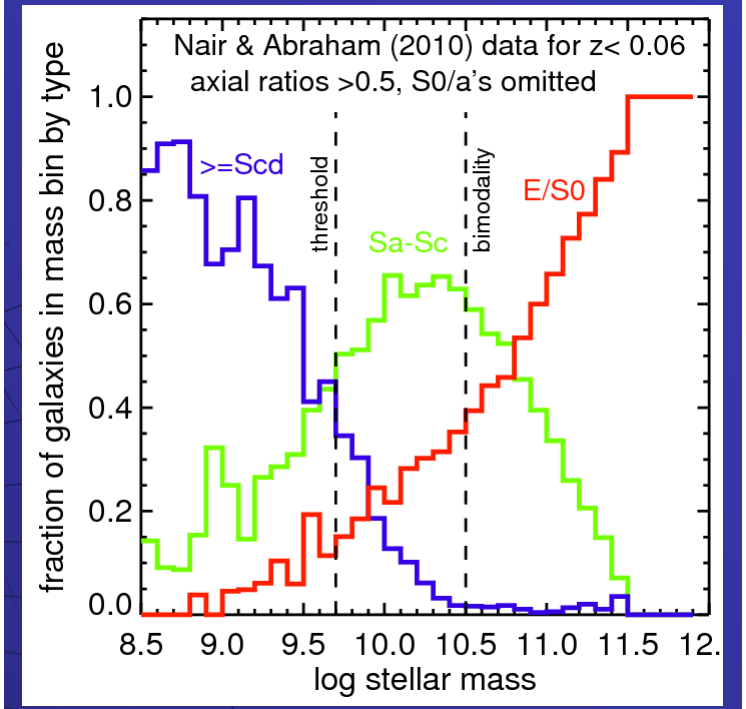


strong upper limits in HI inventory for broadly representative Nearby Field Galaxy Survey

(new GBT data: Wei + 2010a; Kannappan + in prep)

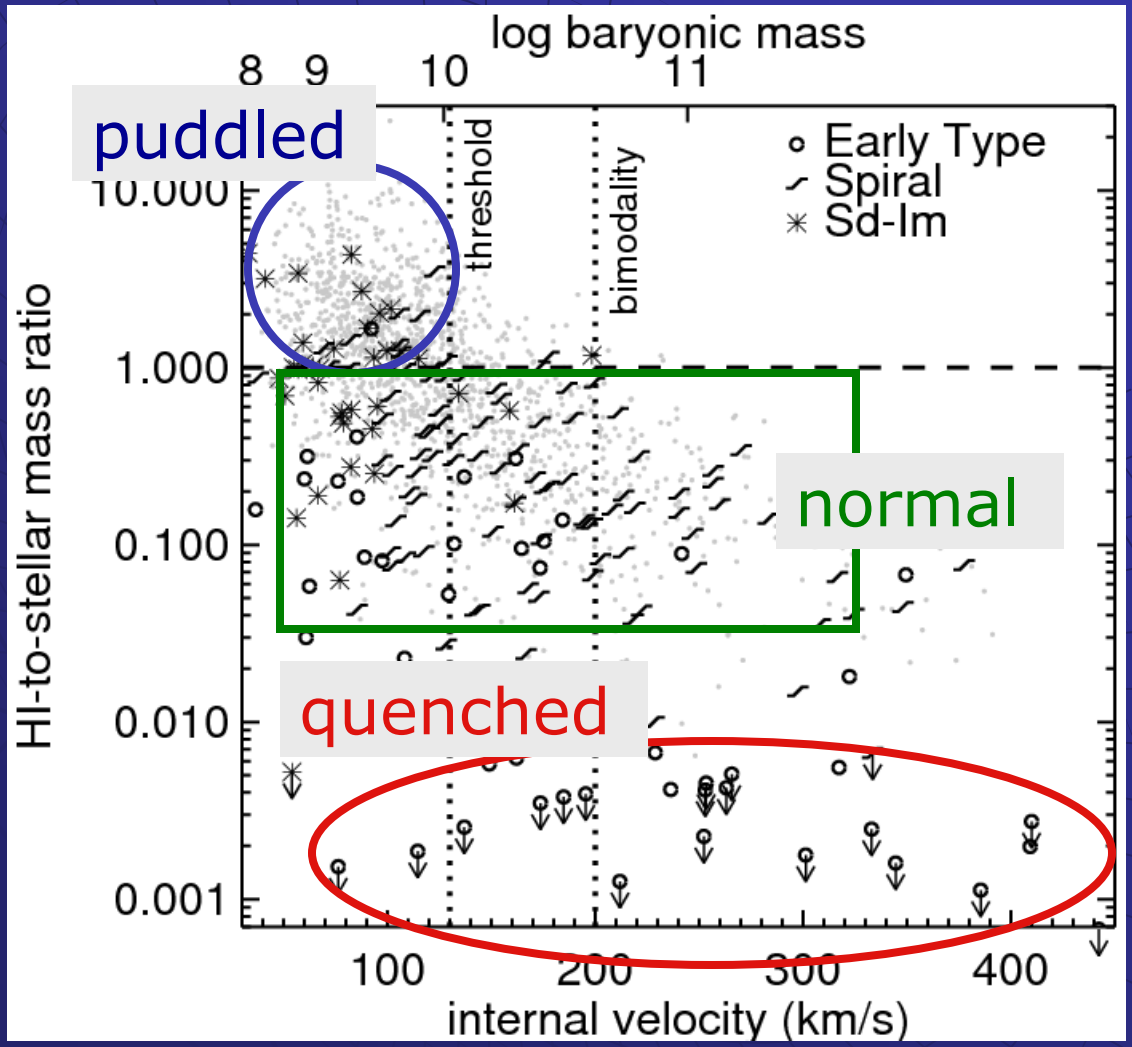
discrete regimes?





Kannappan + 2012 in prep

discrete regimes?



puddled regime

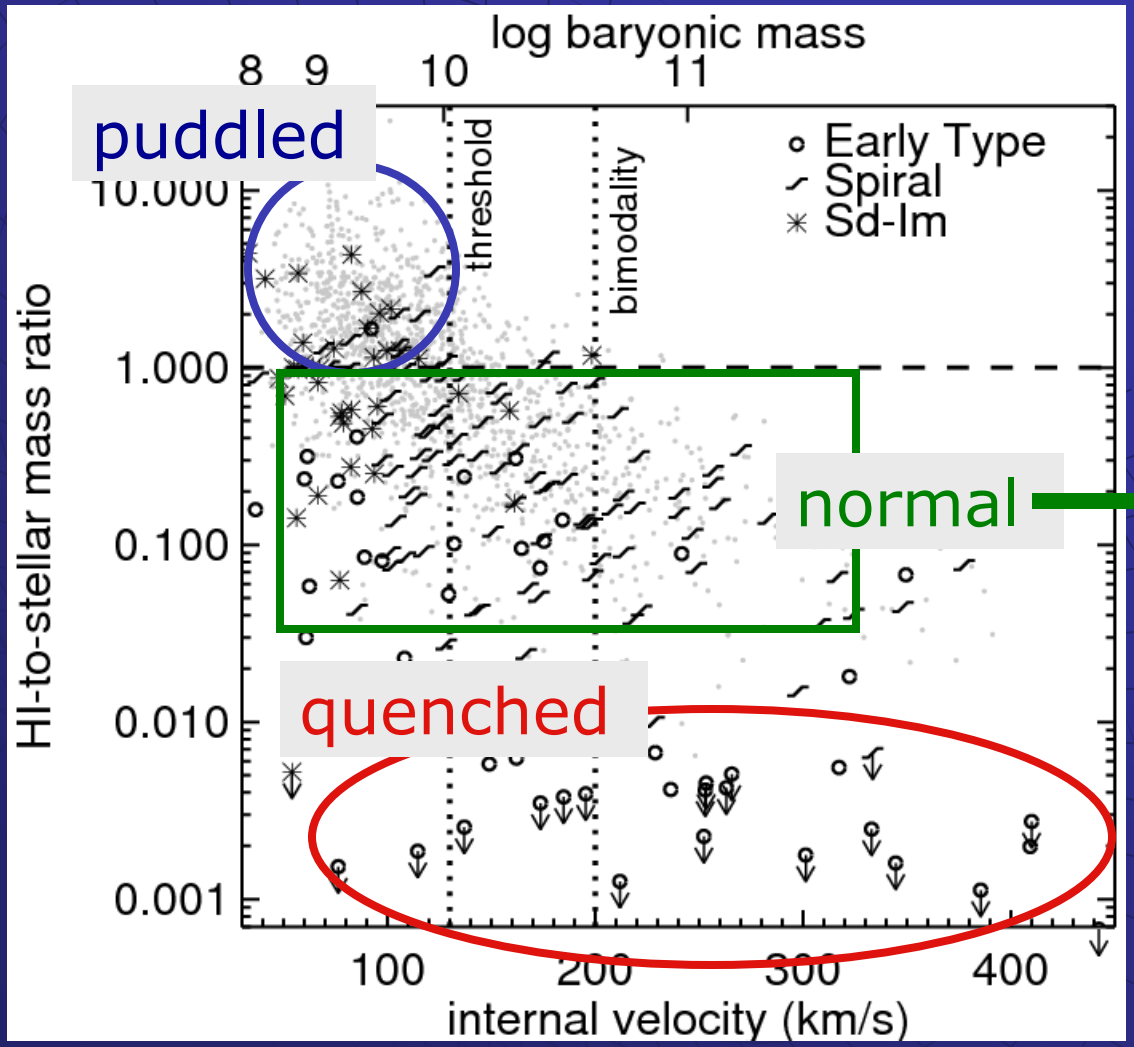
- divergence of stellar and baryonic Tully-Fisher relations

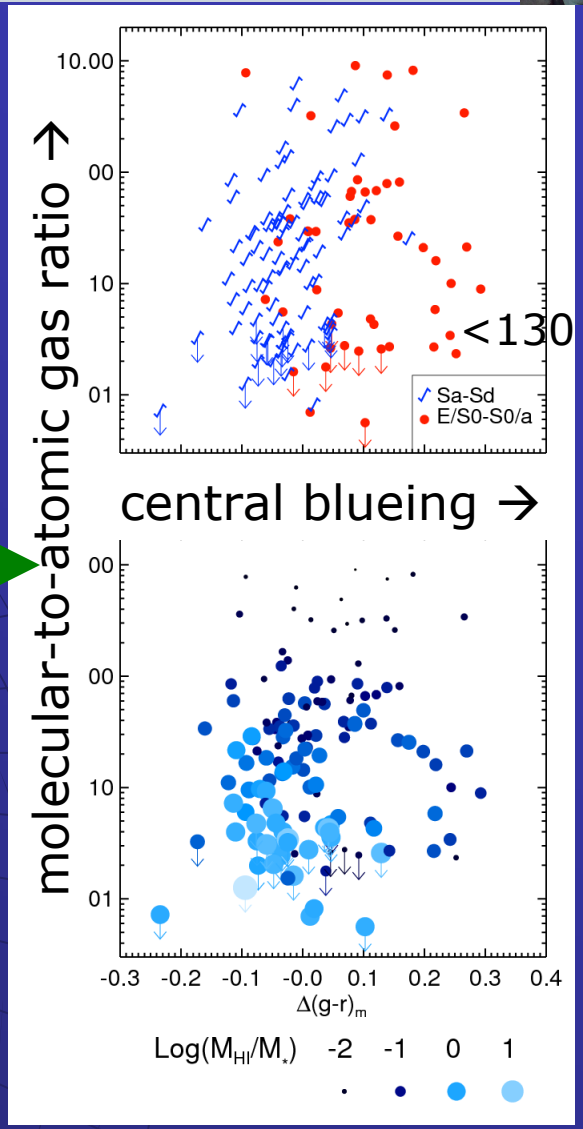
- sharp changes in metallicity and dust (Garnett 2002; Dalcanton + 2004)

– connection to cold accretion scale? (Dekel & Birnboim 2006; Krumholz & Dekel 2012)

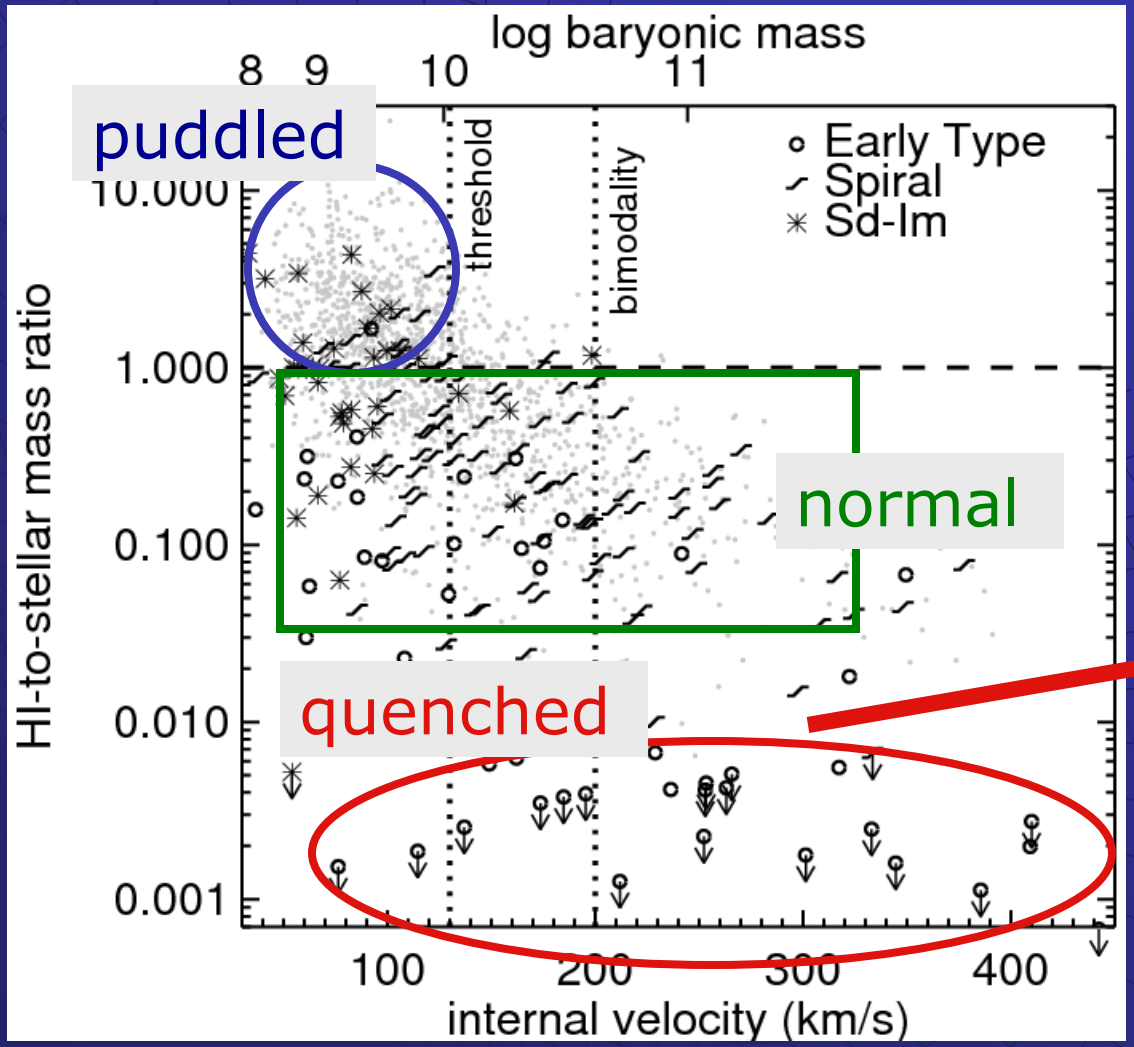
discrete regimes?

"fueling diagram"
(Stark talk Tues.)

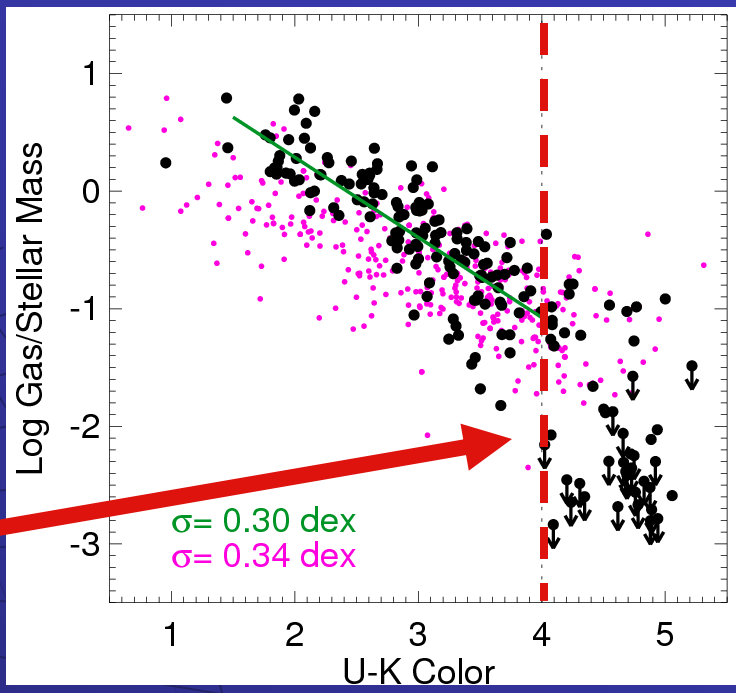




discrete regimes?

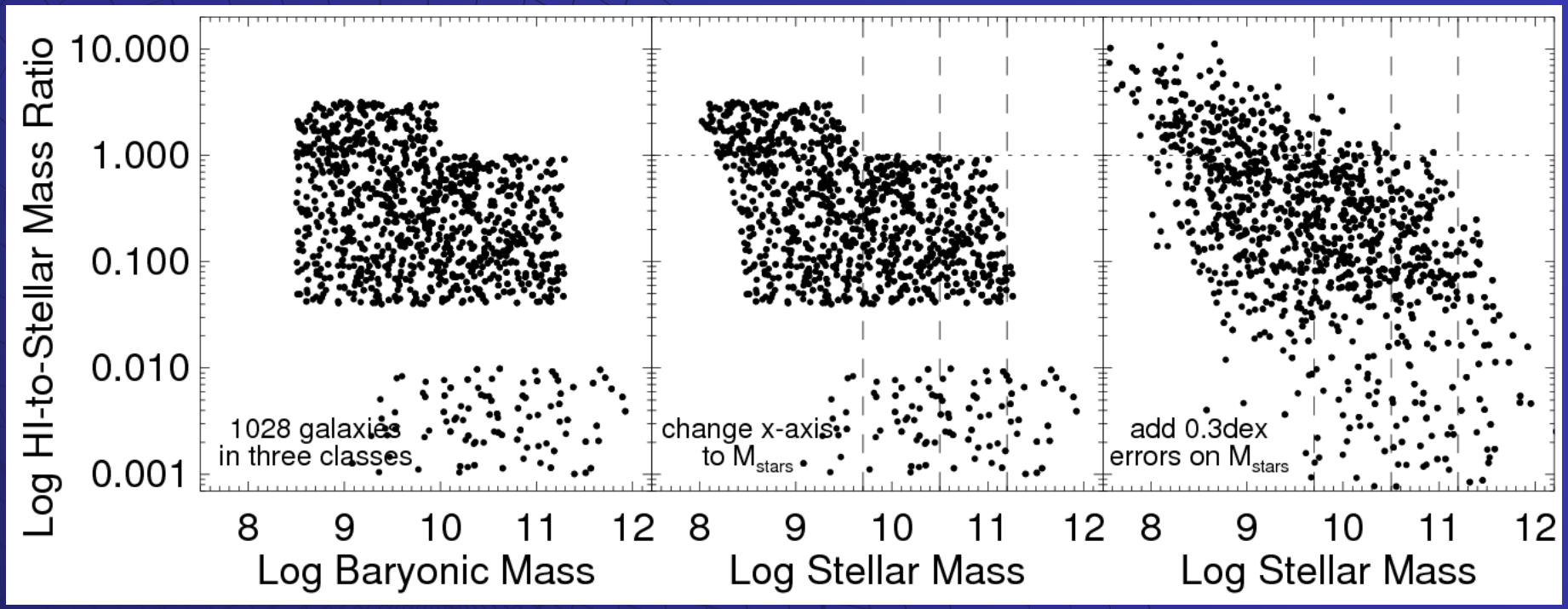


quenched regime clear in U-K color:



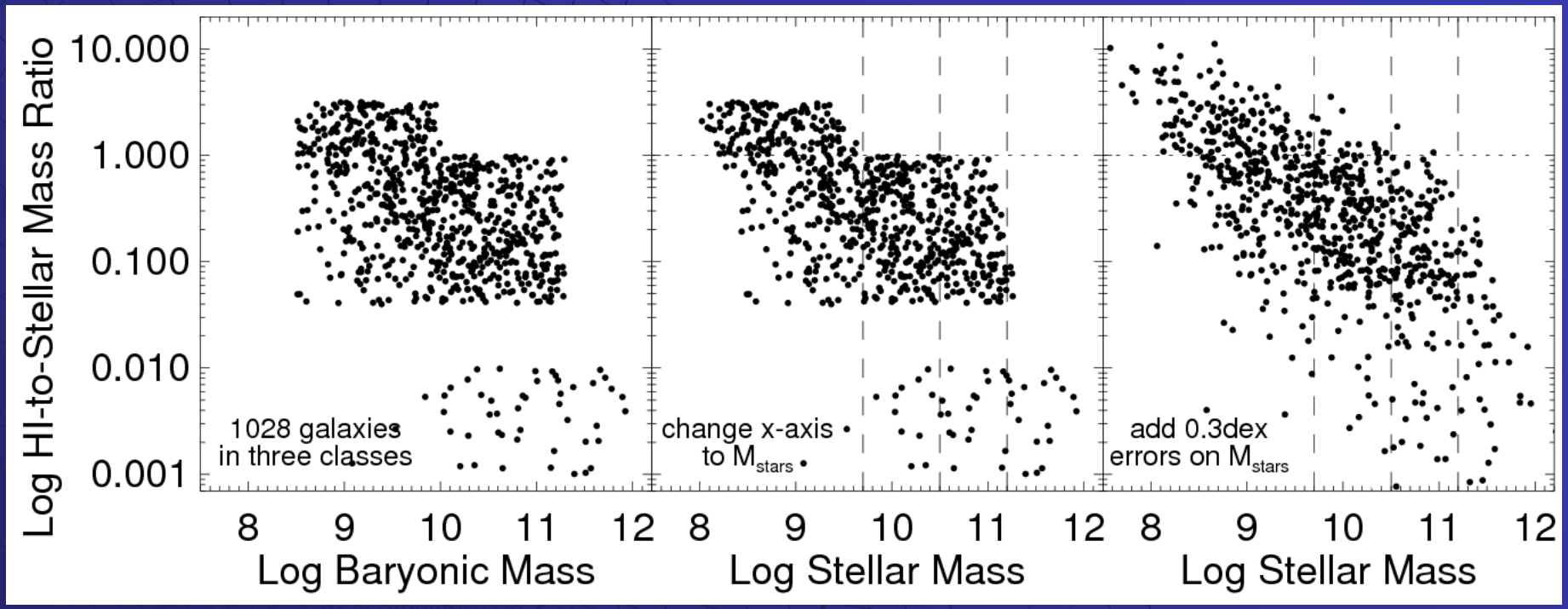
(notice what *does* correlate with M_{HI}/M_* → accretion again?)

…so is there any *continuous* mass dependence?



simulated data in very simple model:
first add covariance, then M_* errors…

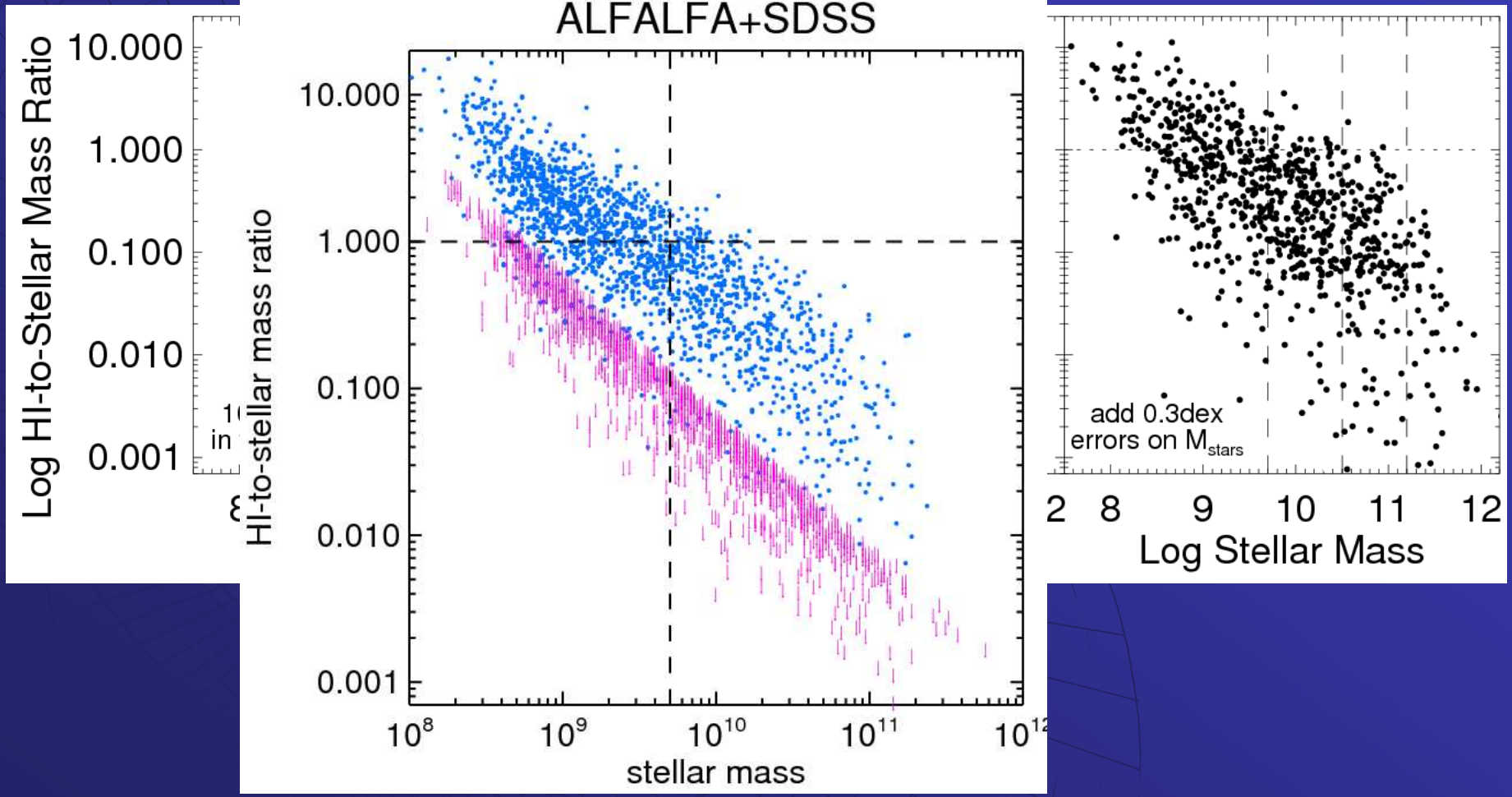
…so is there any *continuous* mass dependence?



simulated data in very simple model:
first add covariance, then M_* errors…

then flux-limited selection

…so is there any *continuous* mass dependence?



conclusions

- HI content correlates poorly with mass
- we must entertain the possibility that the rise & fall of three discrete regimes (puddled, normal, quenched) creates any correlation we see
- these three regimes might simply be defined by excess accretion, normal cyclic accretion-inflow-consumption, and quenched accretion