## The Cold Gas Reservoir in UV-luminous Star-Forming Galaxies



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### Star formation in galaxies



Baugh (2006)

## The Schmidt-Kennicutt relation





#### Galaxies are different at different epochs...

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#### Local universe

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### High redshift

#### Local universe



## **Evolution of SF galaxies**



#### Main sequence





#### **Cold flows and the formation of giant clumps**



Dekel & Birnboim 2006

#### Immeli et al. 2004



#### Interactions and mergers (major+minor)



Volonteri+



#### See also Kaviraj+13,14

#### Gas consumption times at high-redshift are fast! Cold flows?



Daddi+10

# BUT: studies at high-z are hard!!

- Luminosity distances are large!
- Resolution loss
- Cosmic surface brightness dimming

Wouldn't it be great to have local galaxies that looked like high-z ones?



# The sample of Lyman break analogs



 $\frac{L_{FUV} \ge 2 \times 10^{10} L_{\odot}}{I_{1530} \ge 10^9 L_{\odot} \text{ kpc}^{-2}}$ 

Hoopes et al. (2007) Overzier et al. (2009)

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Hoopes et al. (2007) Overzier et al. (2009)

#### LBAs are similar to high-z starbursts!



Overzier+11

Santos-de-Oliveira et al., in prep

Low extinction

#### Mass-metallicity relation



#### Escaping Ly-continuum



#### Strong winds (>1000 km/s)

#### Cavities in ISM

#### Borthakur+14

### **IFU: LBAs are turbulent**







Velocity dispersion ~an order of magnitude higher than local SFGs

Gonçalves+10

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## Mergers vs disks?



See also work by Chao-Ling Hung et al.

## The molecular gas in LBAs





15 antennas in Cedar Flat, California

CO(1-0) survey of Lyman break analogs with CARMA (~100h)

D configuration, spatial resolution ~5"

## High gas fractions in starbursts

## Very similar to other high-z samples



Erb+06, Gonçalves+14



#### Daddi+10



Gonçalves+14

The conversion factor for starburst galaxies IR-bright galaxies: hot AND turbulent! => High CO luminosities Narayanan+11 aco ~ 4 (MW), aco ~ 0.9 (ULIRGs) The conversion factor for metal-poor galaxies



## High-z galaxies?



#### Genzel+ 11

## High-z galaxies?



Genzel+ 11

BUT: UV-bright galaxies are turbulent AND metal-poor!!



Genzel+ 11



#### Gonçalves+14

## The FIR-CO relation



Gonçalves+14

## Assuming high alpha...



#### S-K Law? a(Z)? L'(CO)-L(FIR)?

## Assuming high alpha...



#### S-K Law? a(Z)? L'(CO)-L(FIR)?



- Galaxies in the past had more gas and less metals; how were they formed? Cold flows, mergers?
- LBAs make an excellent case for local analogs to star forming galaxies at z~2-3, and can be studied in more detail
- LBAs have a lot of very dense, turbulent gas, but still follow S-K relation
- The a<sub>co</sub> problem: very unclear for high-z UV-bright star-forming galaxies



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