# Does Stellar Feedback Solve "Dark Matter Problems"?



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Moster 2009

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  - Photoionization (HII)& Photoelectric



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  - Photoionization (HII)& Photoelectric
- *Explicit* Momentum Flux:
  - Radiation Pressure

$$\dot{P}_{\rm rad} \sim \frac{L}{c} \left(1 + \tau_{\rm IR}\right)$$

> SNe

$$\dot{P}_{\rm SNe} \sim \dot{E}_{\rm SNe} \, v_{\rm ejecta}^{-1}$$

Stellar Winds

$$\dot{P}_{\rm W} \sim \dot{M} v_{\rm wind}$$



## Kennicutt-Schmidt relation emerges naturally



PFH, Quataert, & Murray, 2011a

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#### Cosmological Simulations "ZOOM-IN" ON THE FORMATION OF A SINGLE GALAXY



Keres, Onorbe, Faucher-Giguerre, Bullock, & PFH

#### Starburst-Driven Winds SUB-GRID vs. RESOLVED MATTERS!



## Is Star Formation Inefficient?



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## Galactic Super-Winds are Very Efficient



# Galactic Super-Winds are Very Efficient





Saturday, March 9, 13

BUT...



Keres & PFH et al. Bullock, & Onorbe et al. BUT...





# Summary:

- Stellar Feedback naturally explains the stellar mass-halo mass relation (at low-M\*)
  - Resolves satellite/dwarf galaxy luminosity function "problems"
  - Mass-metallicity, Mass-size "for free"

- Does Not automatically produce "cores" or decrease dark matter density
  - Still kicking:
    - Cusp/core problem
    - $\gg$  "Too big to fail" (V<sub>max</sub> is too large in MW satellites)

#### Cosmological Simulations "ZOOM-IN" ON THE FORMATION OF A SINGLE GALAXY

10<sup>10</sup> M<sub>sun</sub> Halo





**IGM** Density

**IGM** Temperature

Keres, Onorbe, Faucher-Giguerre, Bullock, & PFH

BUT...



Keres & PFH et al. Bullock, & Onorbe et al. **BUT...** 



Cosmological Simulations "ZOOM-IN" ON THE FORMATION OF A MASSIVE GALAXY

# Proto-MW: Gas Temperature:

No Feedback	Following Full Feedback

Keres & PFH et al

Cosmological Simulations "ZOOM-IN" ON THE FORMATION OF A MASSIVE GALAXY

# Proto-MW: Gas Temperature:

Insert Winds "By Hand" (Sub-Grid)	Following Full Feedback

Keres & PFH et al