arXiv:1609.01301

“Dark” RELHICs in the Local Group

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Dex XIII short talk

Benitez-Llambay, Navarro, Frenk et al. (2016)

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Motivation

- **A distinctive prediction of LCDM** is that the LG must be surrounded by low-mass systems (White 1974), which overwhelm the number of observed galaxies by orders of magnitude (Klypin 1999; Moore 1999).

- Reionization prevents low-mass halos ($M_{200} < 10^9\ M_\odot$) from forming stars, thus making them effectively “dark”. (Bullock et al. 2000, Benítez-Llambay et al. 2015; Sawala et al. 2016)

- The gas that remains in “dark” systems is in hydrostatic equilibrium with the dark matter halo (e.g, Rees 1986) **--> We need robust predictions**.

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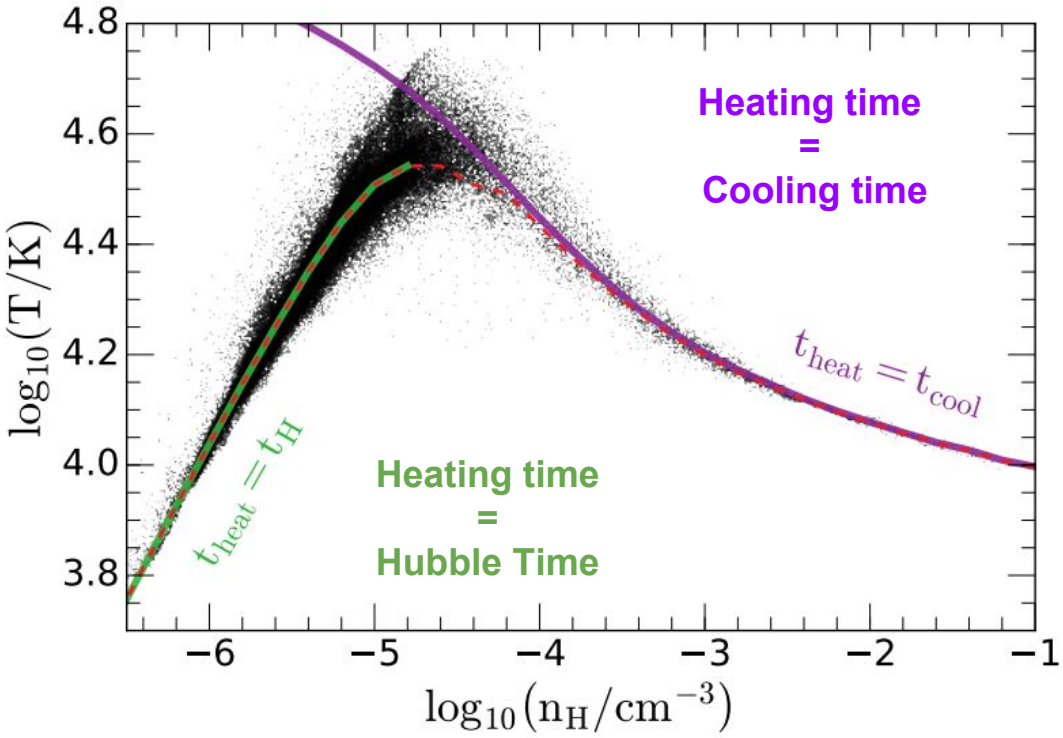
Temperature-Density relation of RELHICs



Hydrostatic Equilibrium:

$$\frac{1}{\rho}\frac{dP}{d\tilde{r}} = -V_{200}^2 \frac{\tilde{M}(\tilde{r})}{\tilde{r}^2}$$

$$\left(\frac{T}{\rho} + \frac{dT}{d\rho}\right) d\rho = -2T_{200} \frac{\tilde{M}(\tilde{r})}{\tilde{r}^2} d\tilde{r}$$

Where M(r) can be calculated from a Navarro-Frenk-White density profile

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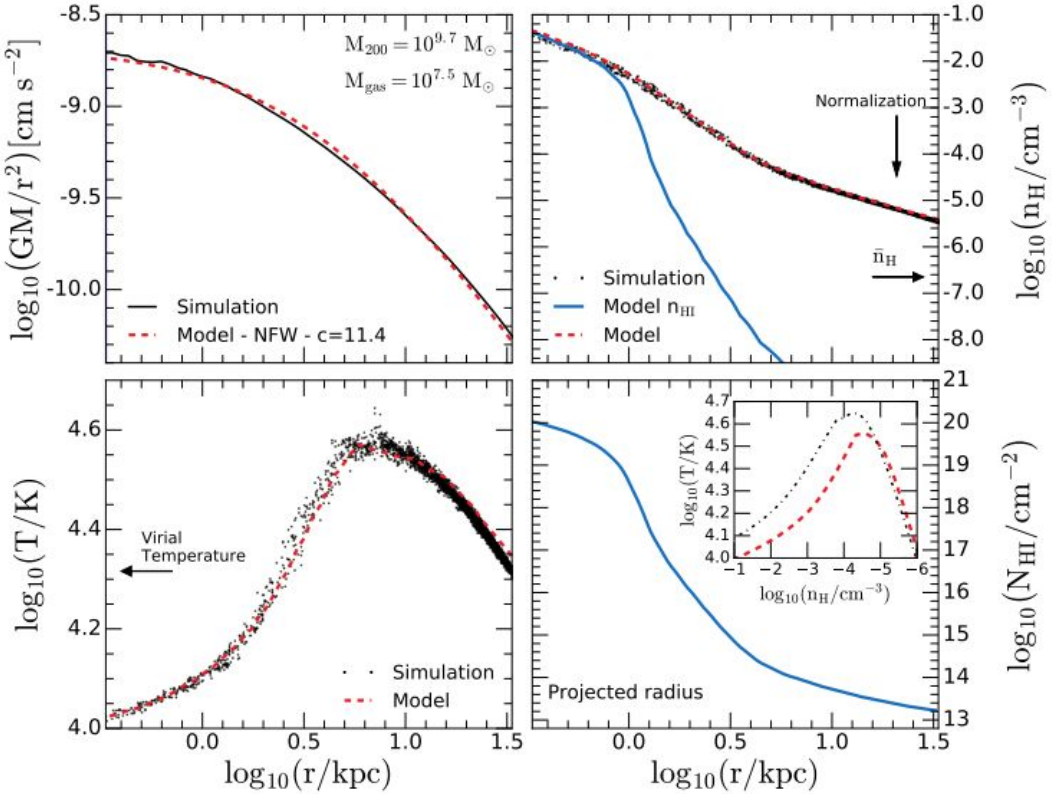

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Blue lines: HI density (top right) and HI column density (bottom left) calculated using fitting formula of Rahmati +13

UCHVCs as RELHICs

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- We compared the properties of simulated RELHICs to those of UCHVCs from ALFALFA (Adams et al. 2013).

- **Al**
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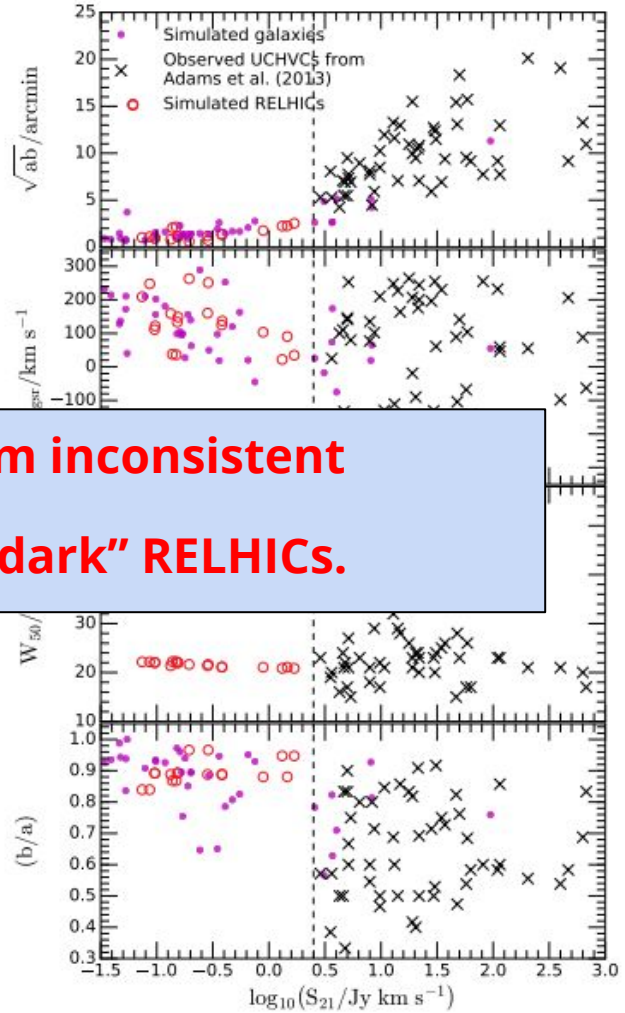
  a well-defined thermal broadening.

- However, simulated low-mass galaxies have properties compatible with some UCHVCs. After all, Leo P was discovered as an UCHVCs.

UCHVCs observed by ALFALFA seem inconsistent with the properties expected for "dark" RELHICs.



Conclusions

- LCDM + reionization predicts that the Local Group should be teemed by low-mass halos that failed to form a galaxy in their centres (M_{vir} < 3x10^9 $M_{\odot}$).
- We developed an analytical model to predict their thermodynamics properties in detail. This model has proven to be successful in describing the properties of simulated RELHICs.
- We predict that RELCHIs should have **(i) positive galactocentric velocities, (ii) be round (a/b > 0.8) , (iii) low HI fluxes, (iv) very small angular diameter and (v) a well-defined thermal broadening.**
- UCHVCs observed by ALFALFA seems inconsistent with the properties expected for “dark” RELHICs.

Llinares et al. 2020