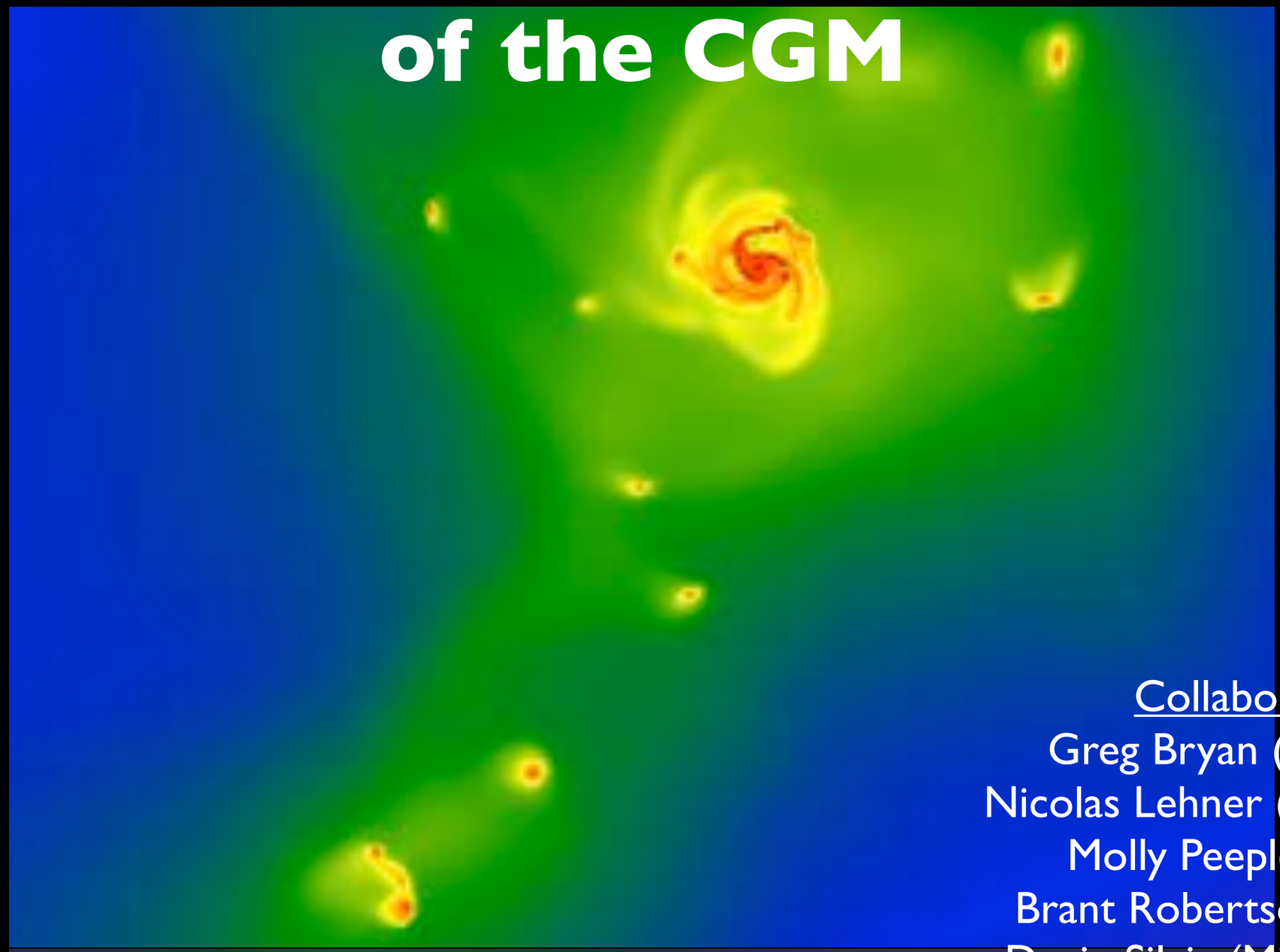
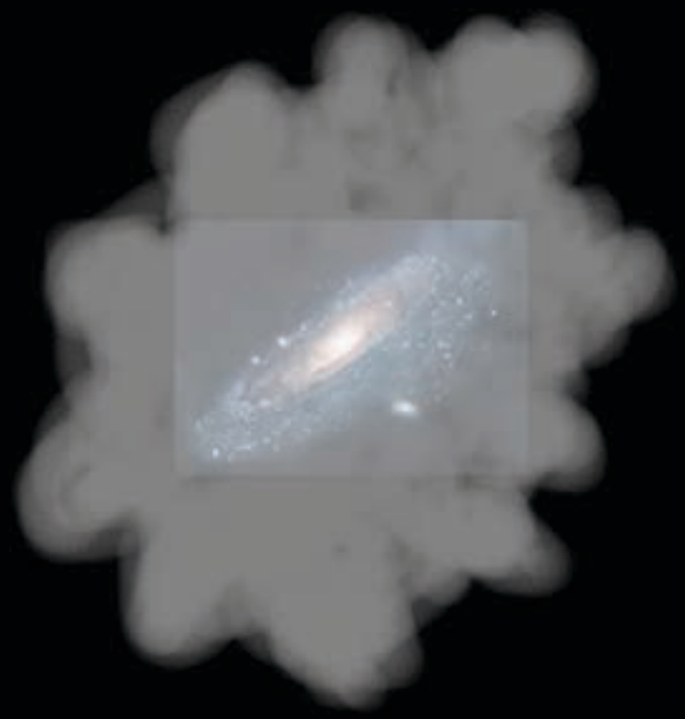
Investigating the Pressure Support and the Metallicity Bimodality of the CGM



Cameron Hummels
University of Arizona

Collaborators
Greg Bryan (Columbia)
Nicolas Lehner (Notre Dame)
Molly Peeples (STSci)
Brant Robertson (Arizona)
Devin Silvia (Michigan State)
Britton Smith (Edinburgh)
Matthew Turk (NCSA)
Jessica Werk (UCSC)

What is the circumgalactic medium and how is it observed?



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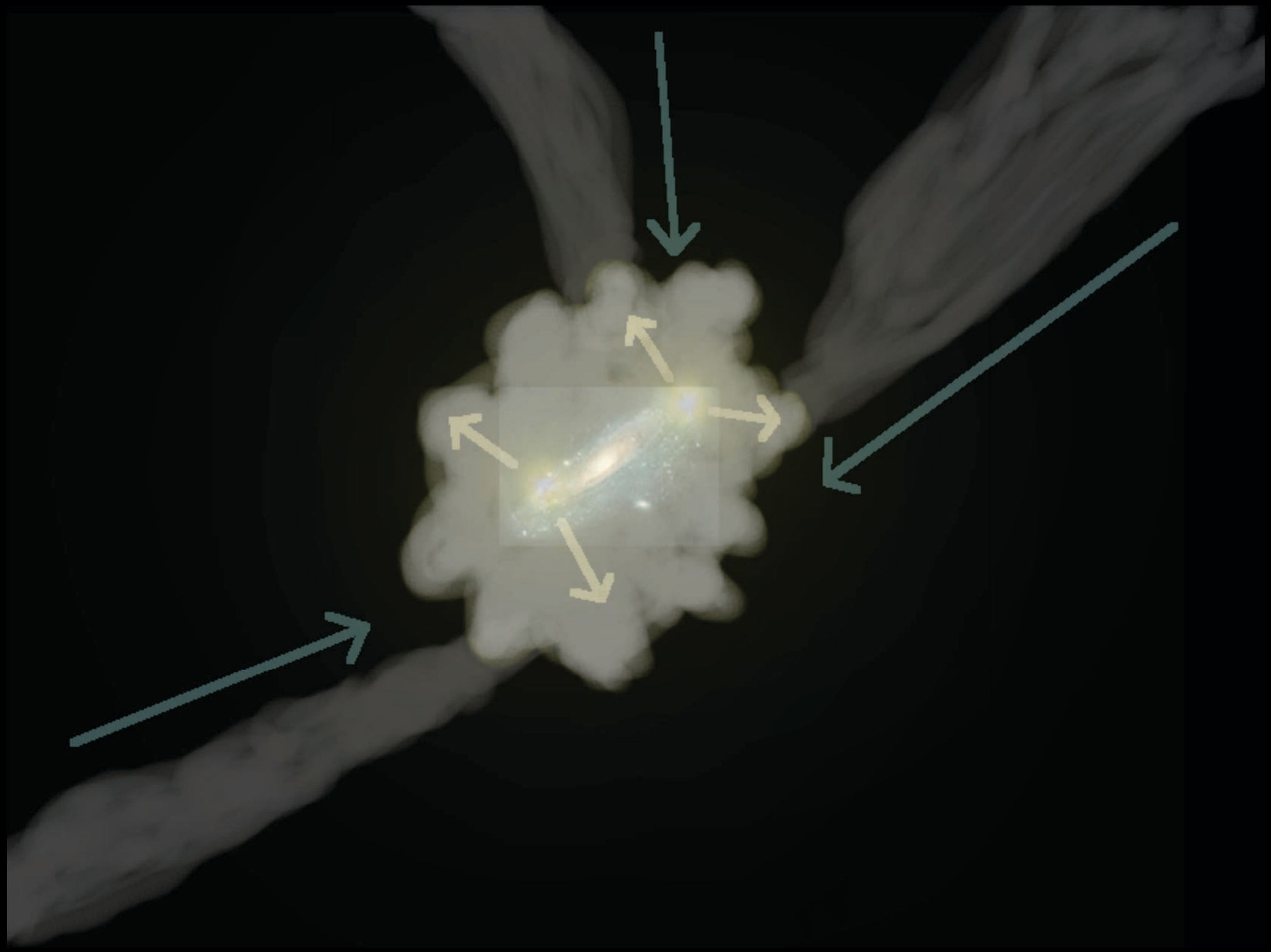

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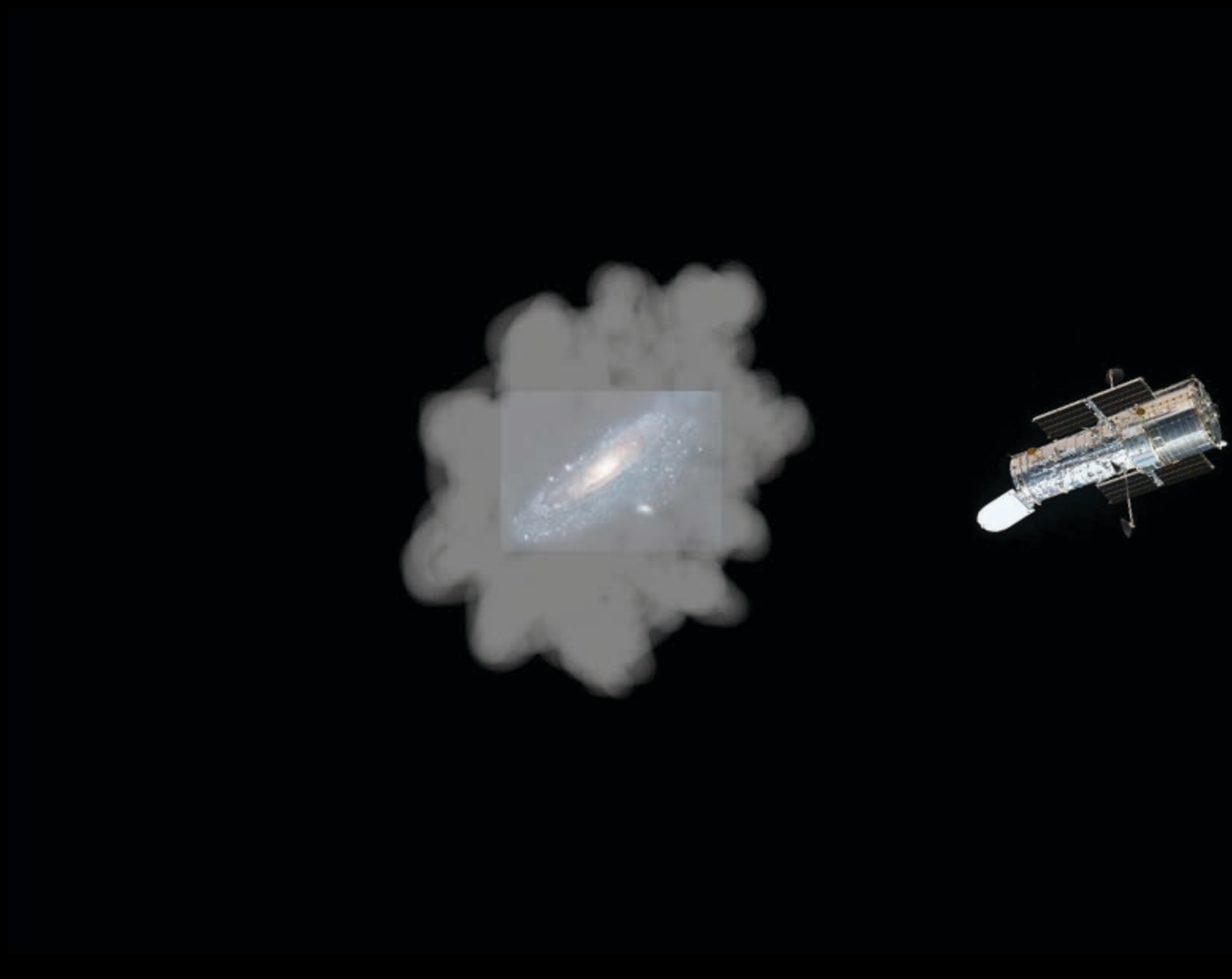

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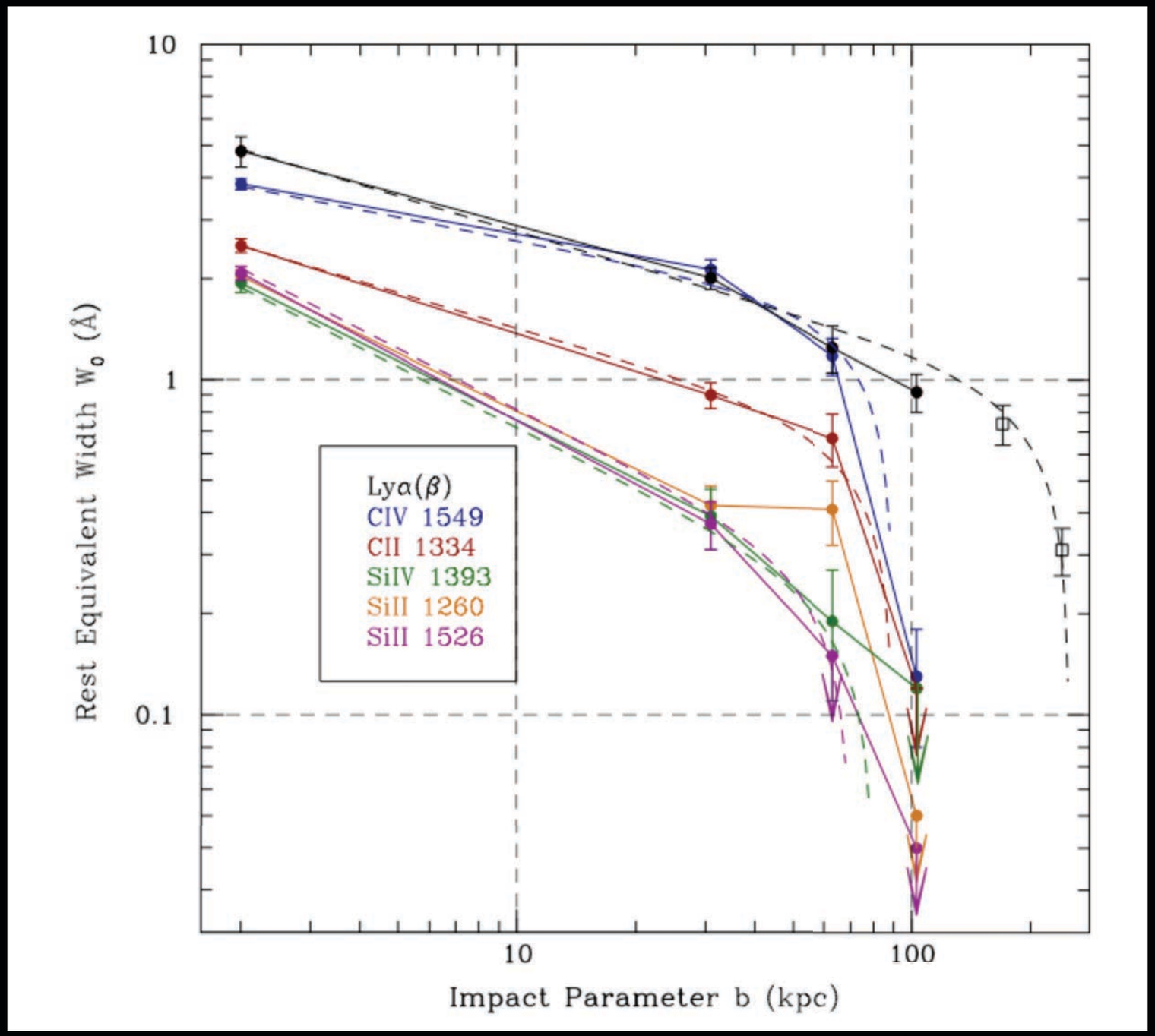
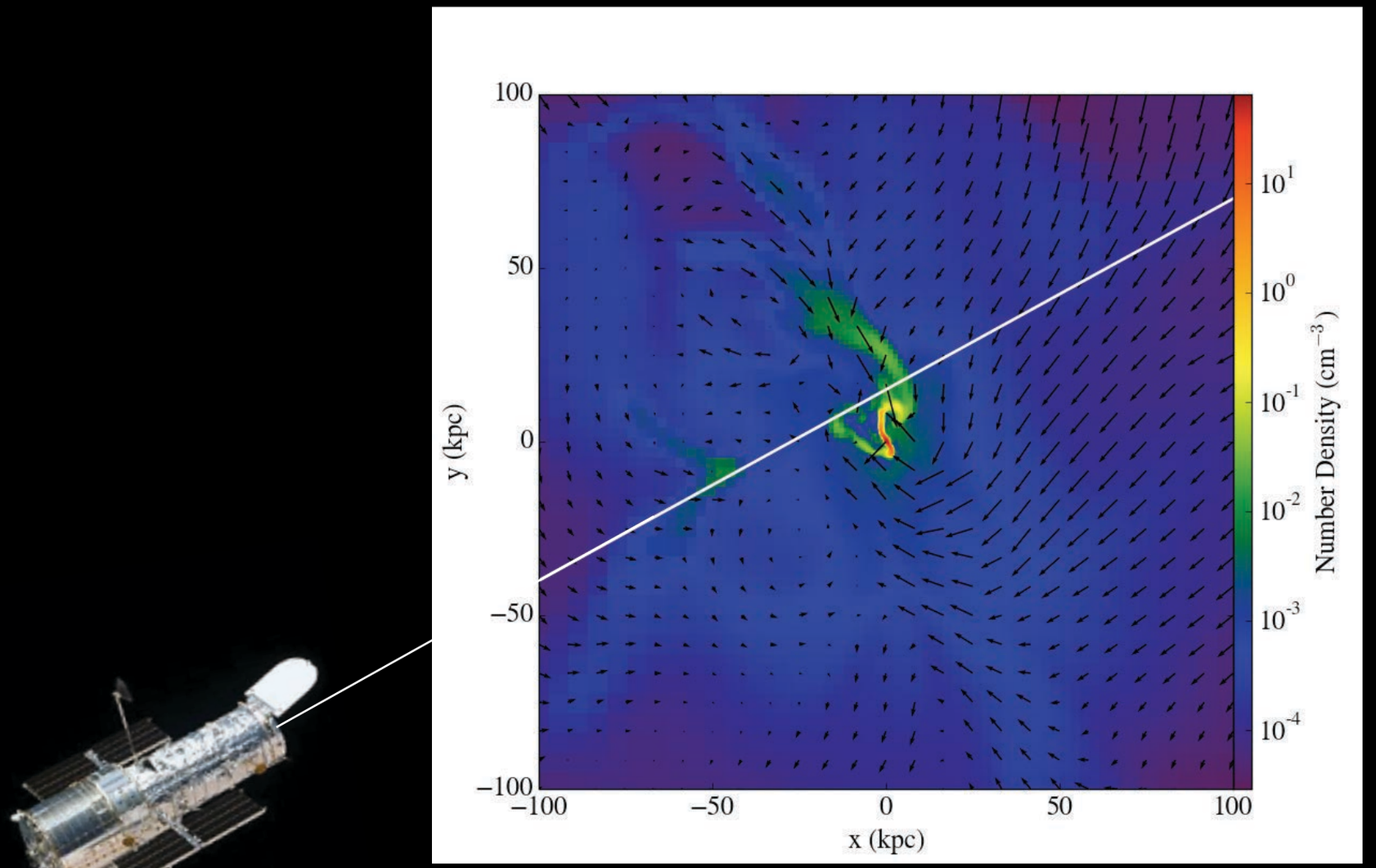


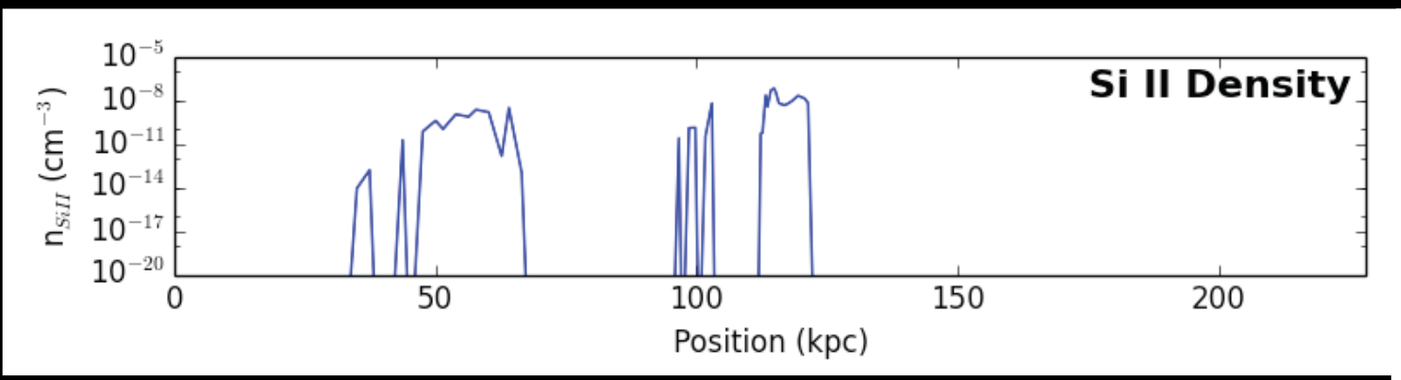
Steidel+ 2010

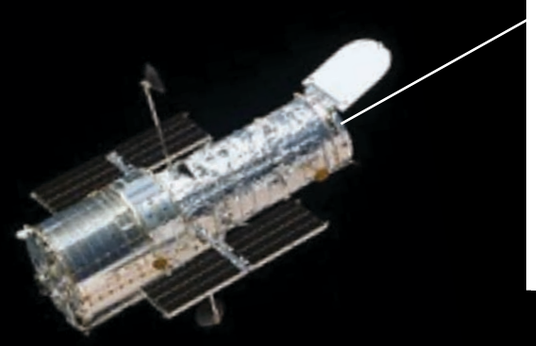
Synthetic observations from simulations fill in our gaps in understanding

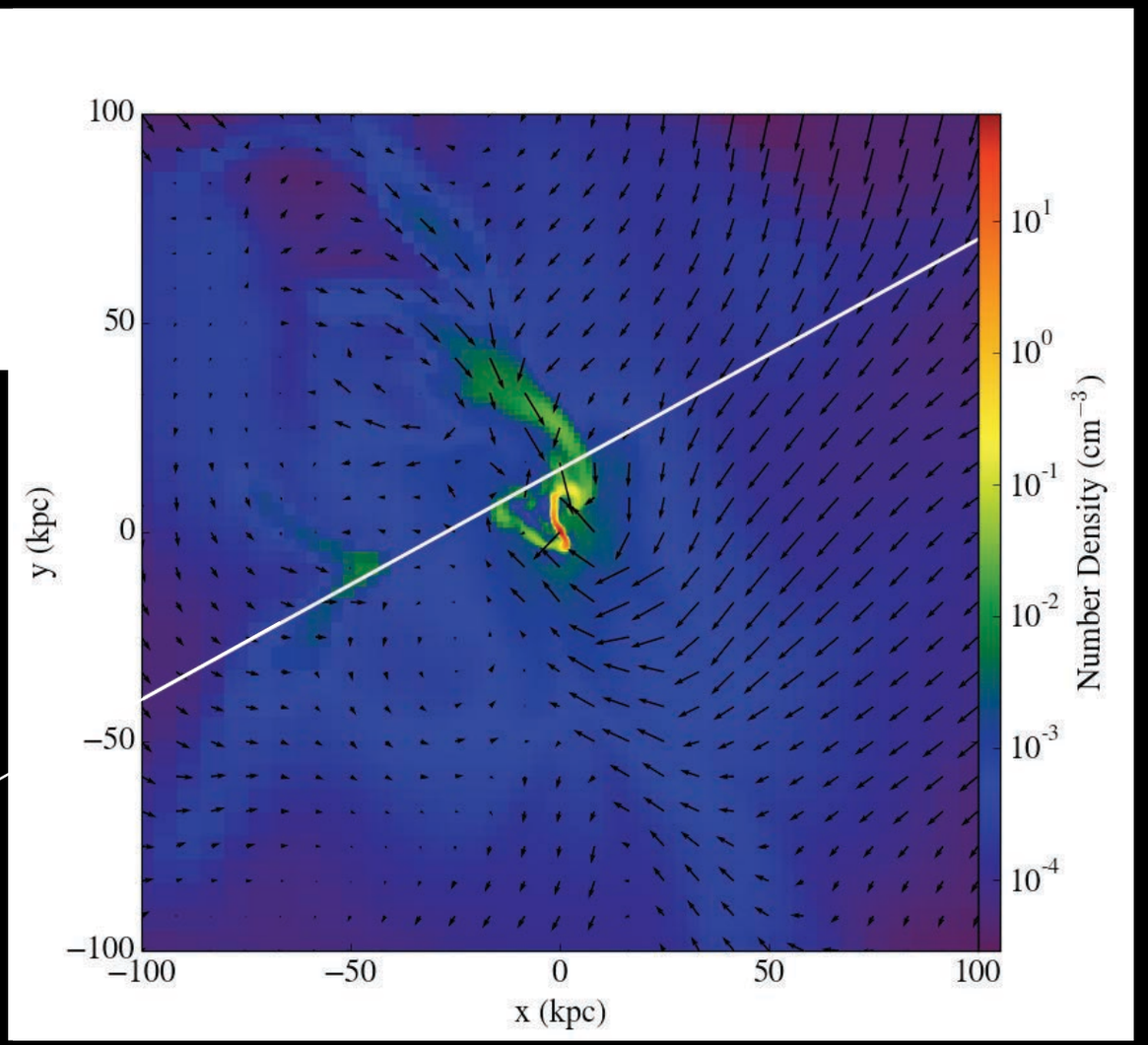


phase(density, temperature, metallicity, radiation field)

Synthetic observations from simulations fill in our gaps in understanding







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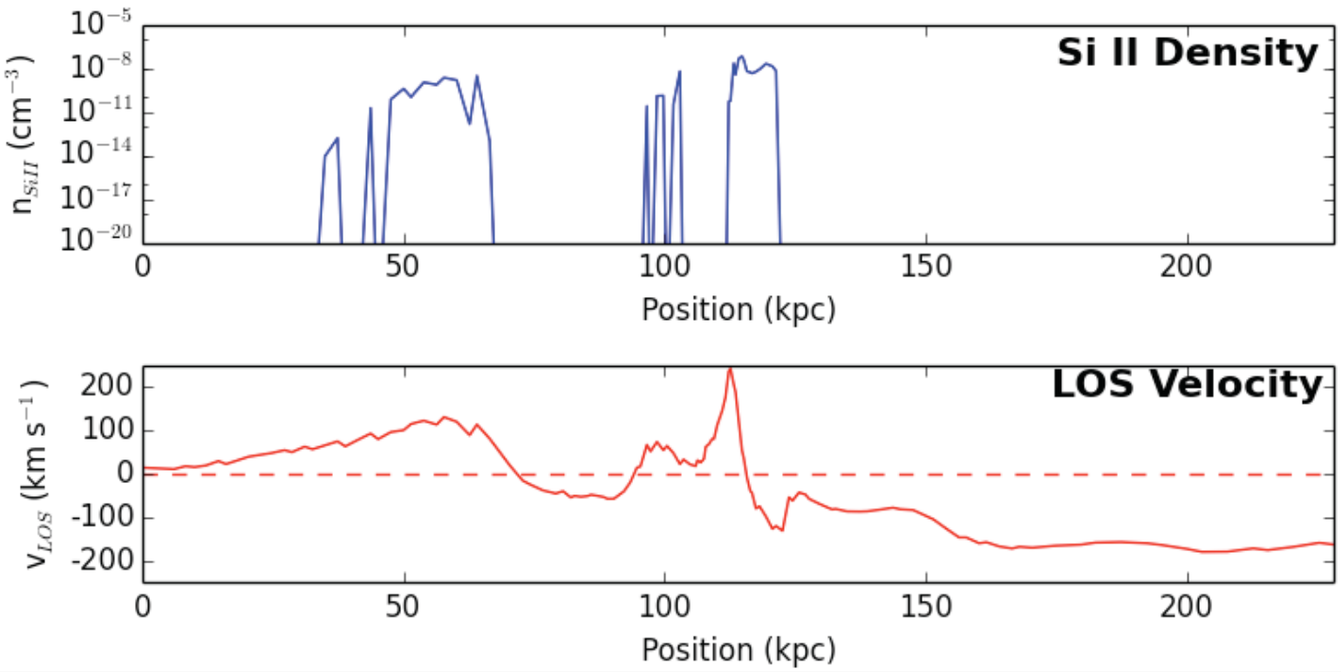

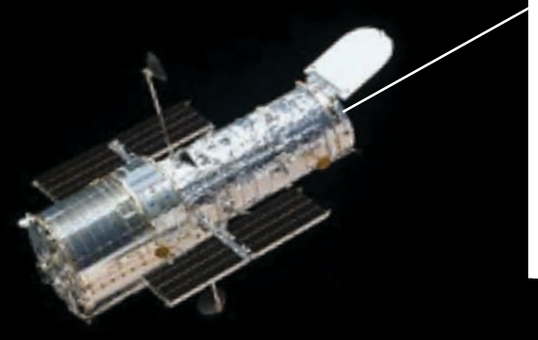

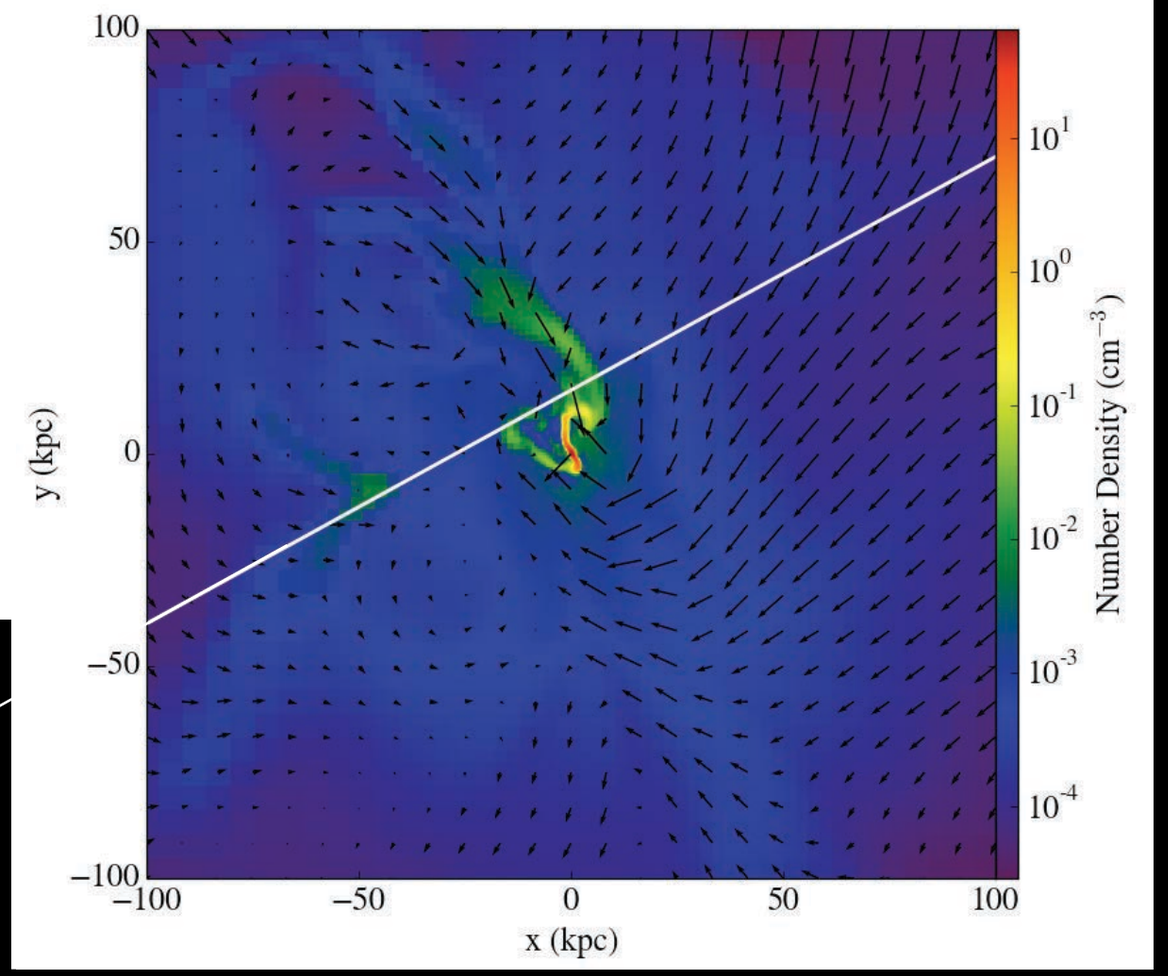

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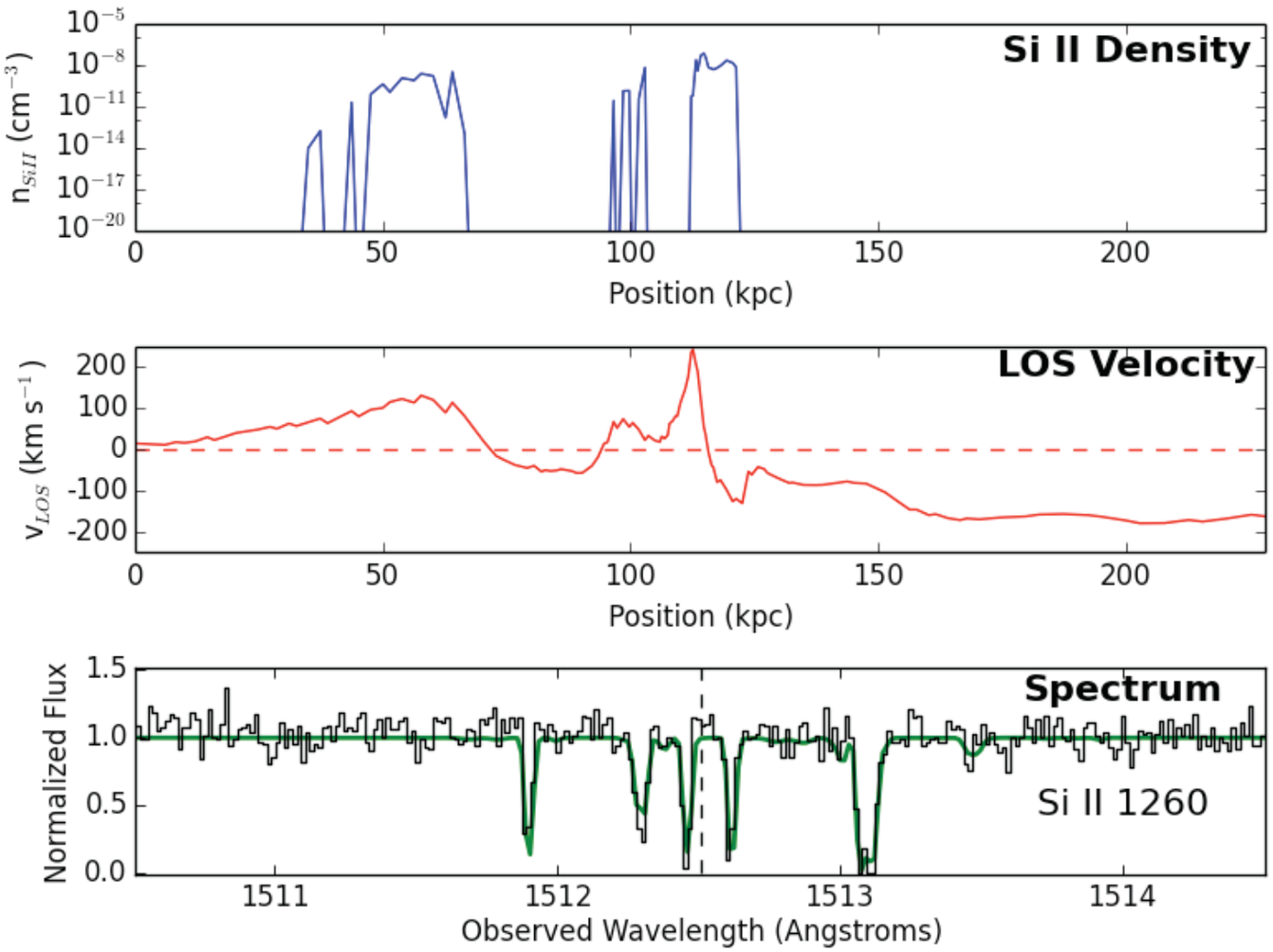
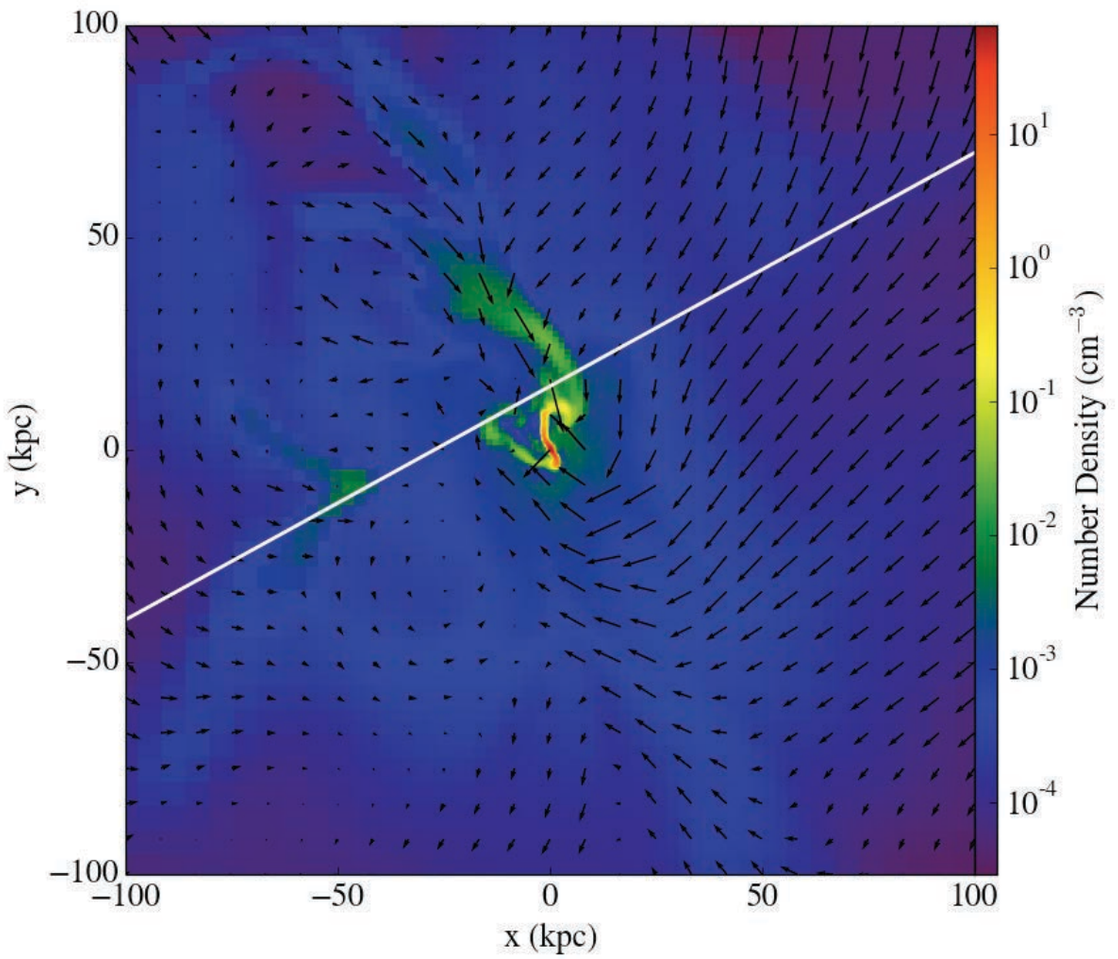
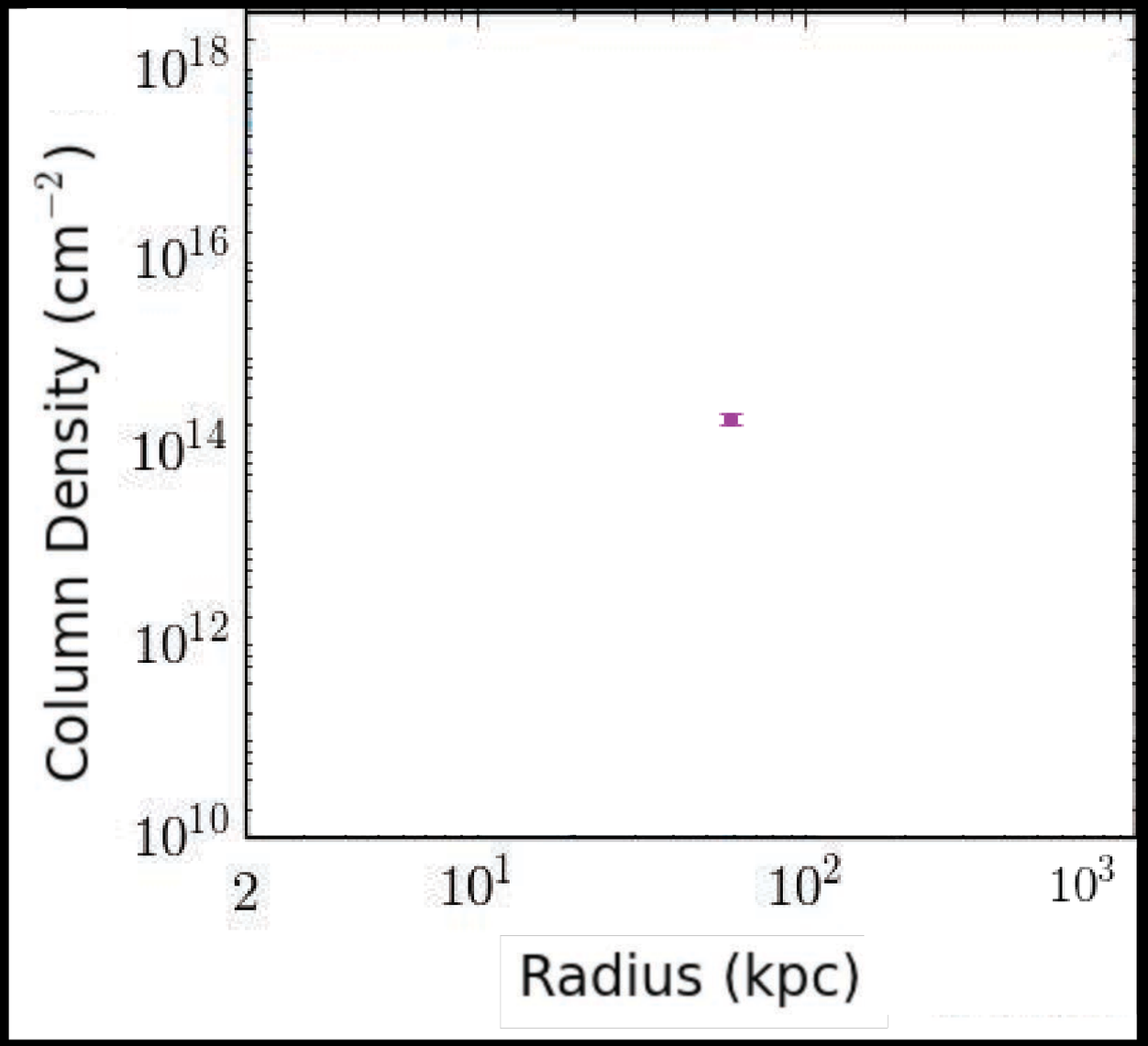




yt 3.0 released (http://yt-project.org)

HST Theory Proposal (PI Peeples) AR-13919
MISTY - Mast Interface to Synthetic Telescopes with yt

Synthetic observations from simulations fill in our gaps in understanding



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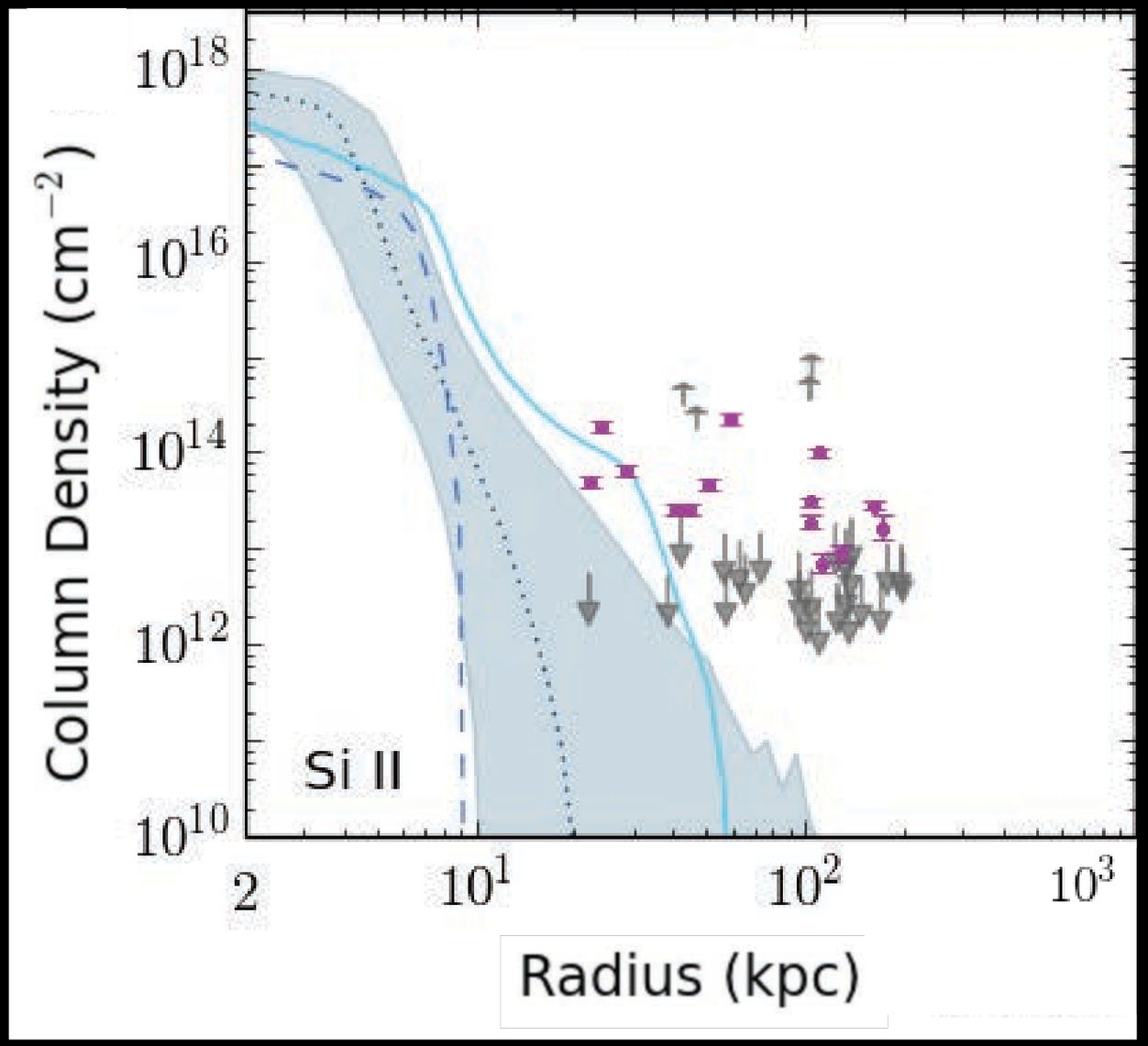
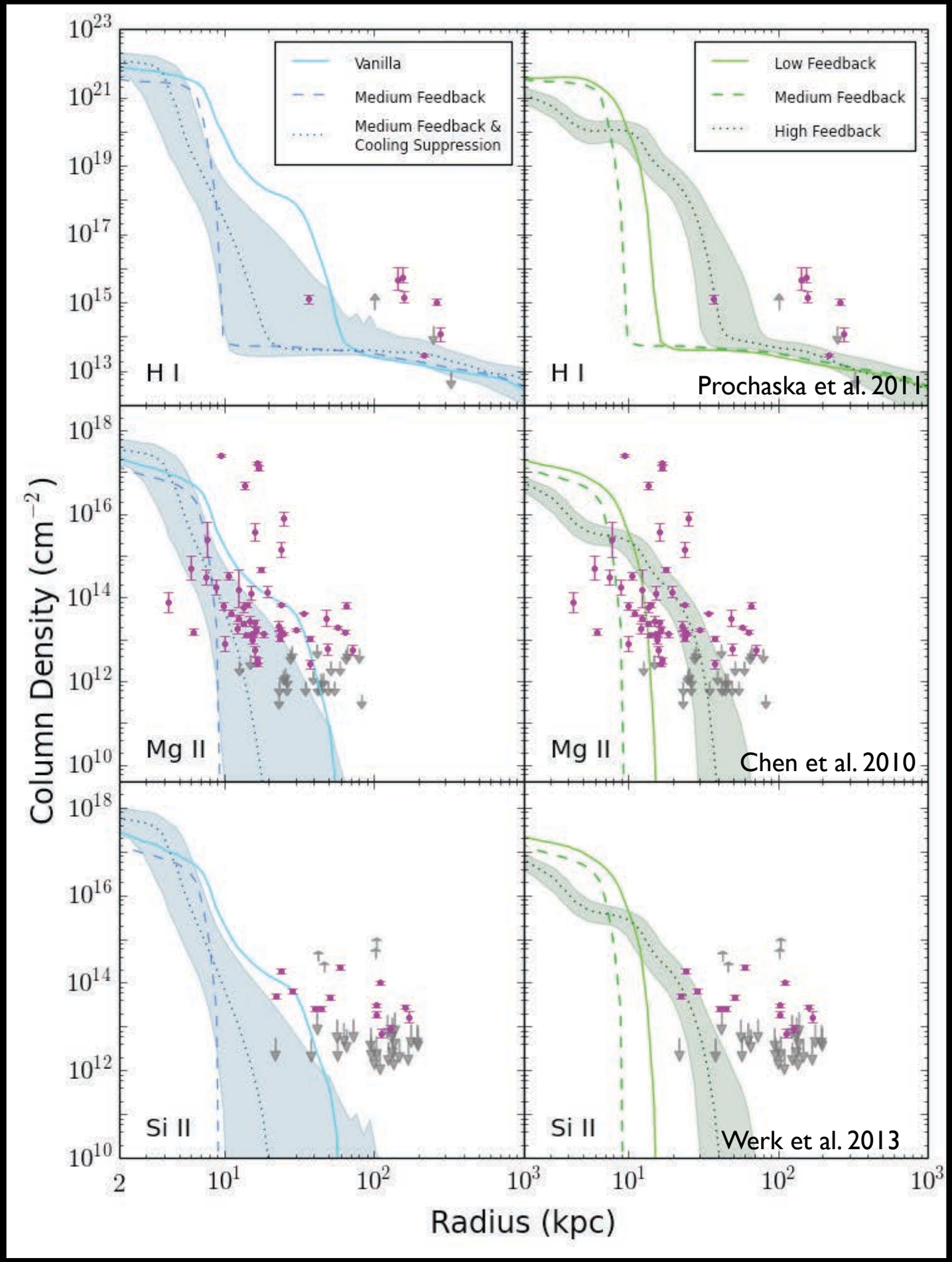


Observational Sample: Werk+ 2013
Hummels+ 2013

H I

Mg II

Si II



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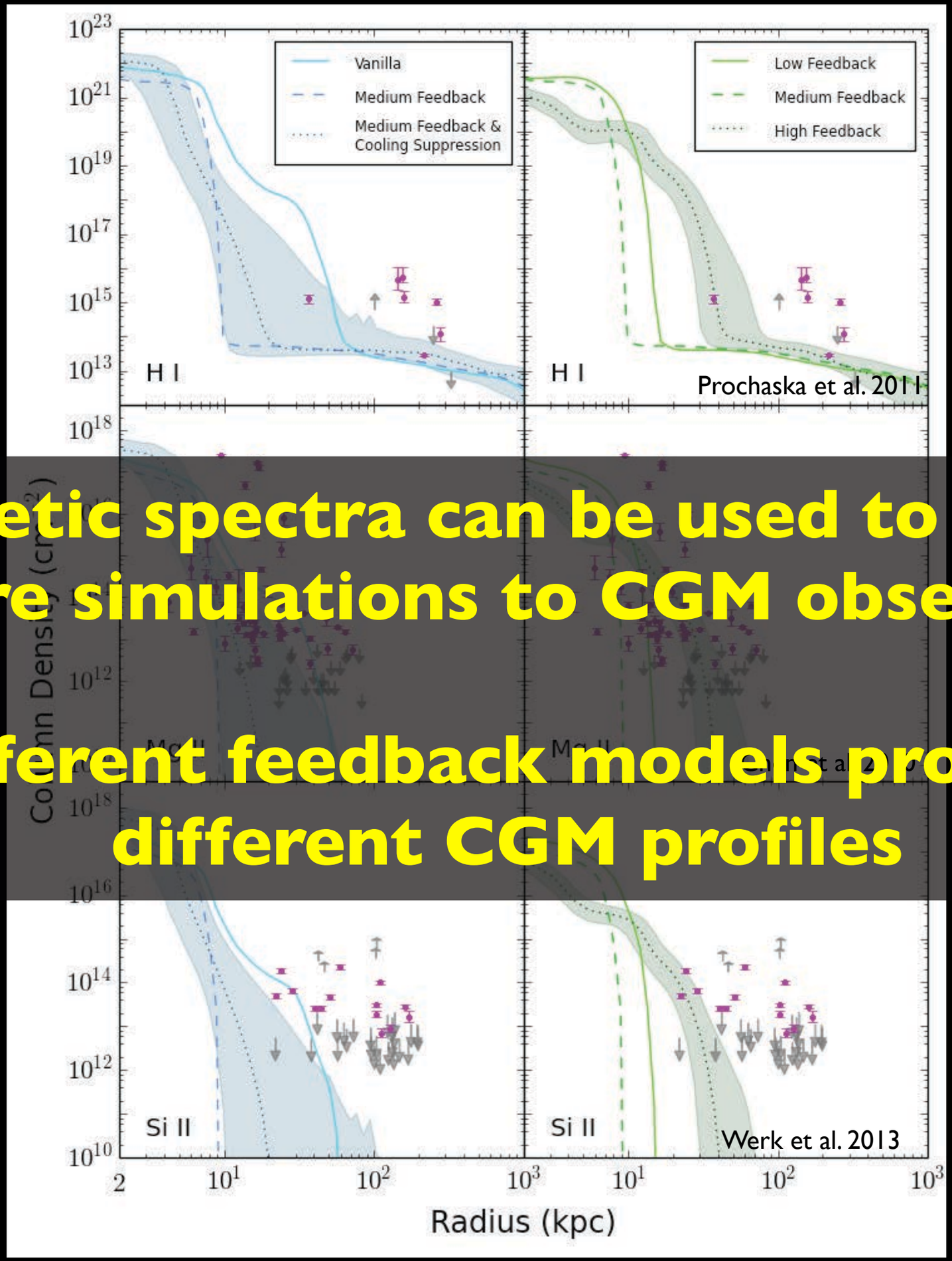


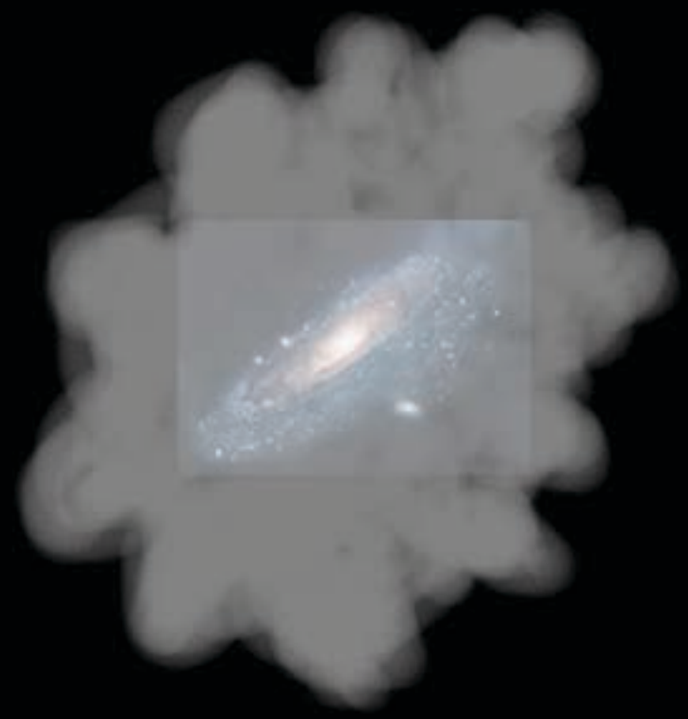
Synthetic spectra can be used to directly compare simulations to CGM observations.

Different feedback models produce different CGM profiles

Hummels+ 2013

Investigating the Pressure Support and the Metallicity Bimodality of the CGM

The pressure support of cold CGM absorbers



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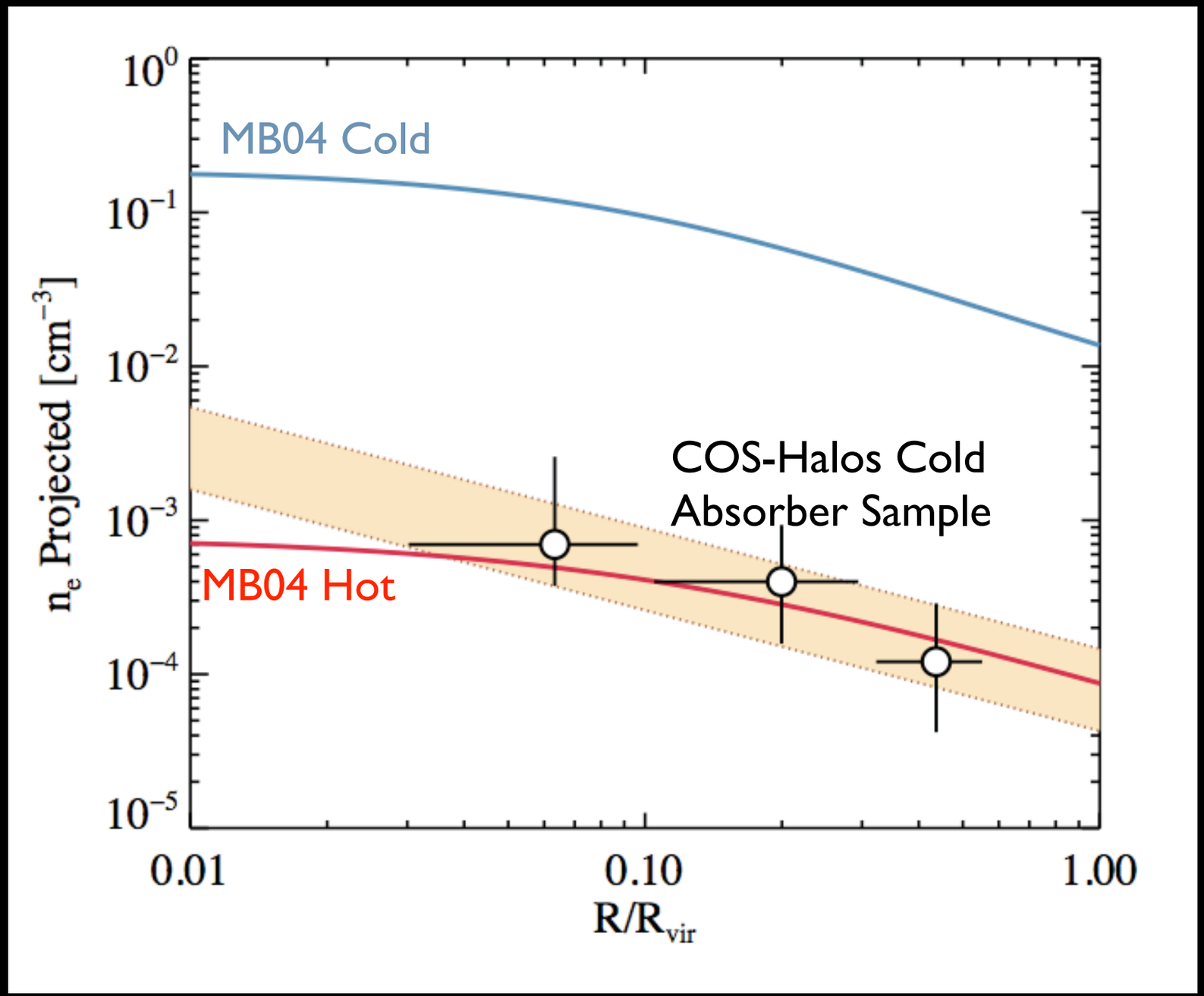

Werk+ 2014

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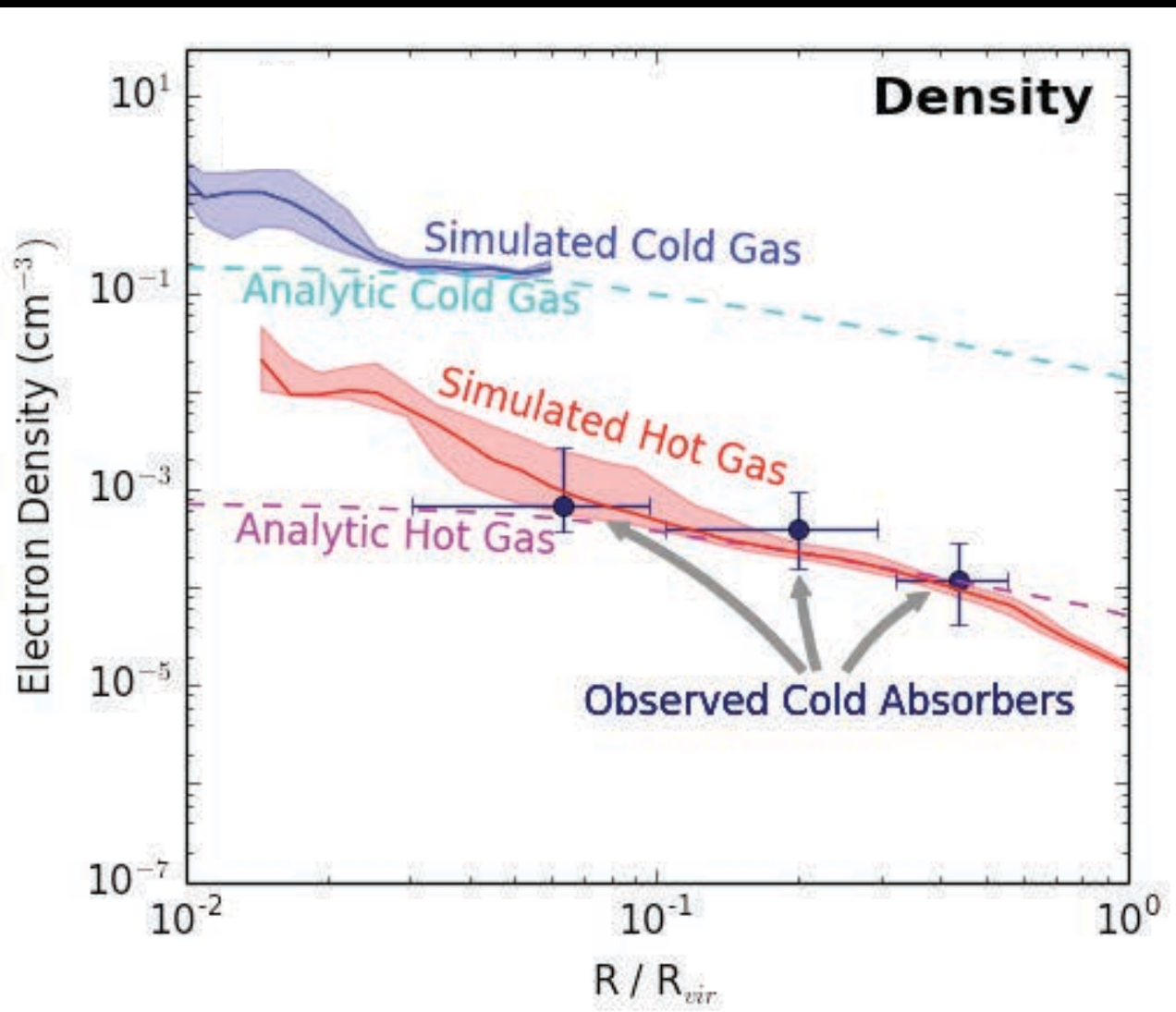
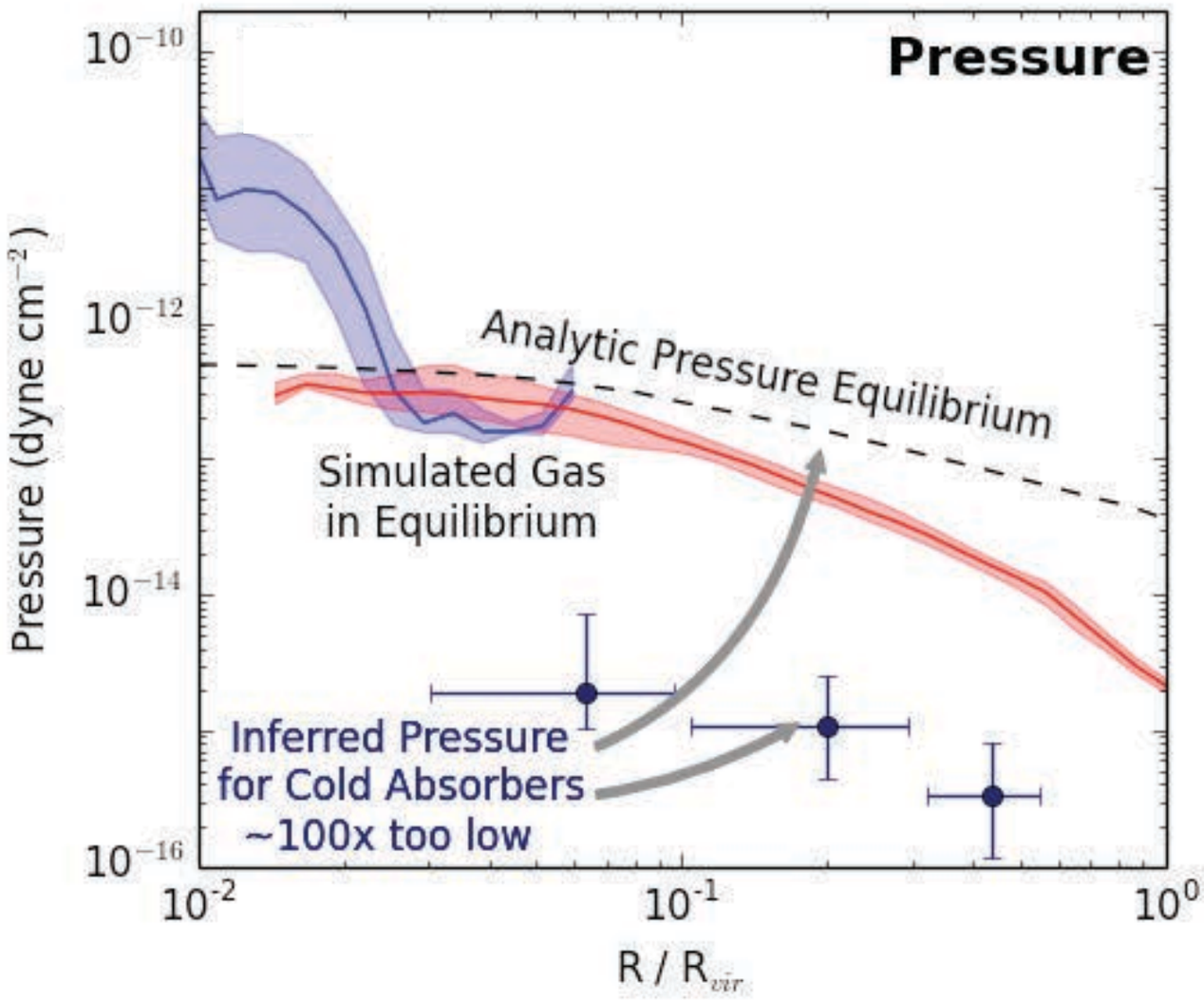
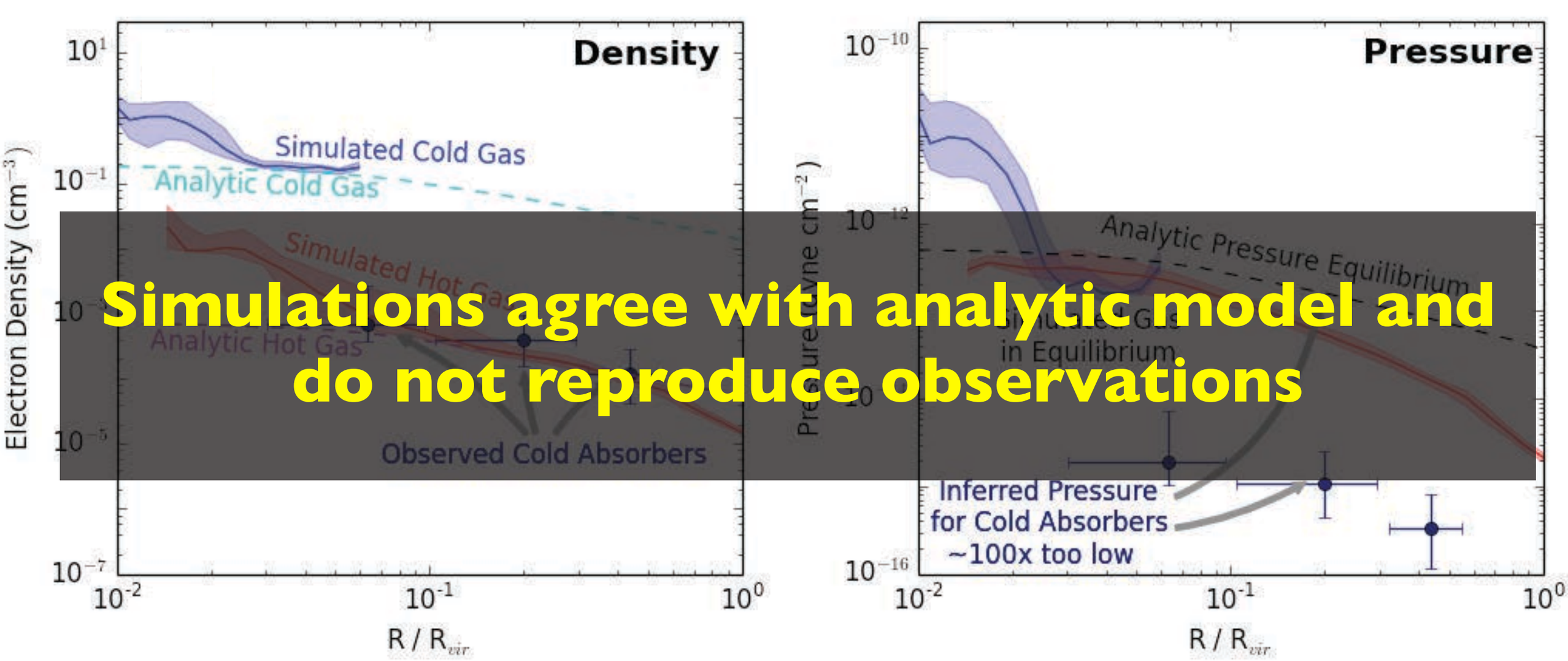




Hummels+ in prep

The pressure support of cold CGM absorbers



Simulations agree with analytic model and do not reproduce observations

Hummels+ in prep

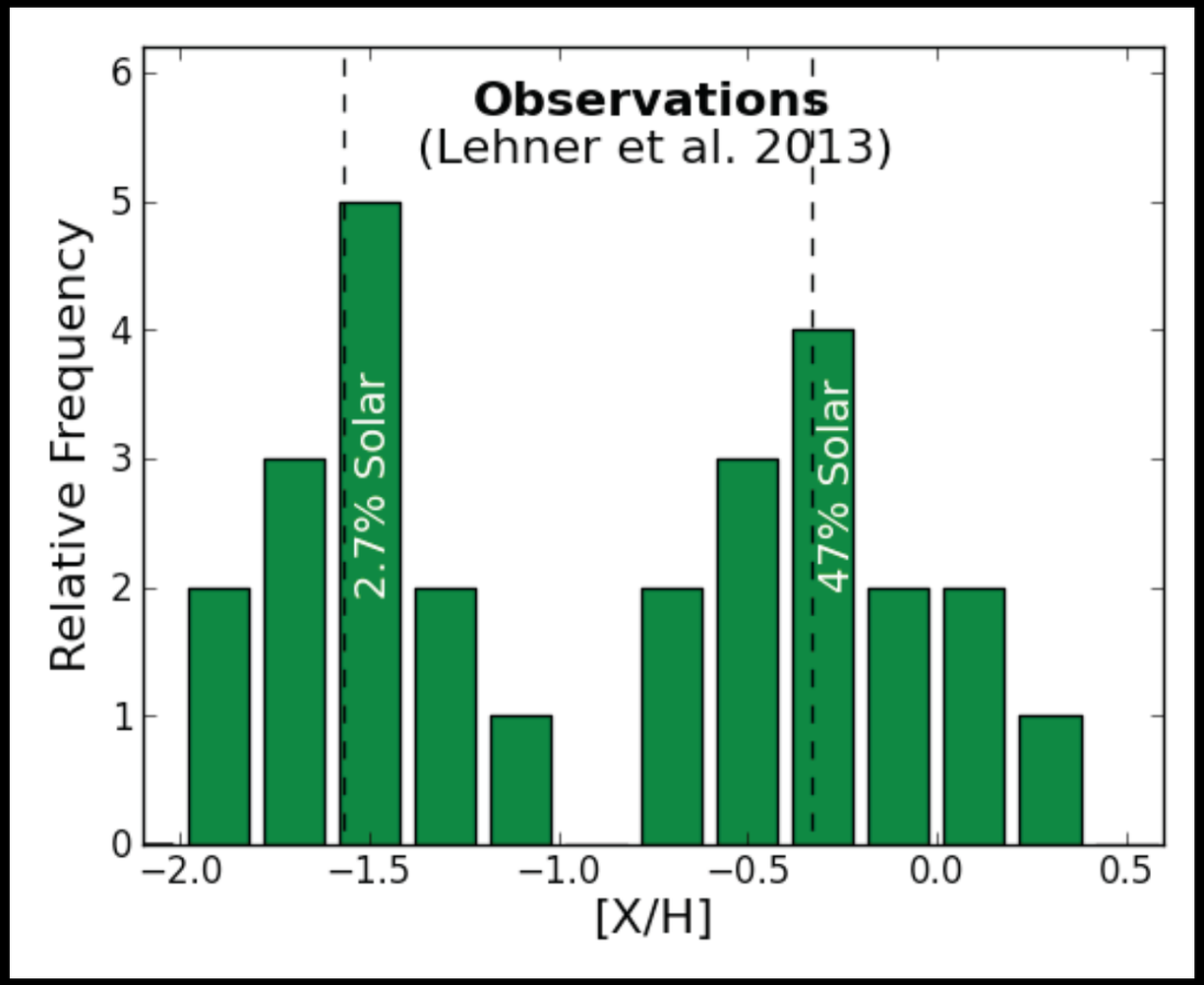
The pressure support of cold CGM absorbers

Alternative Explanations:

- Something wrong in analysis of observational data
- Cold and hot gas not in pressure equilibrium (transient feature)
- Cold and hot gas not co-located
- Pressure equilibrium between two gas phases but no hot halo
- Additional pressure support (B-fields, turbulence)

HST Theory Proposal (PI Hummels) AR-13917

The metallicity bimodality of Lyman Limit Systems



Lehner+ 2013

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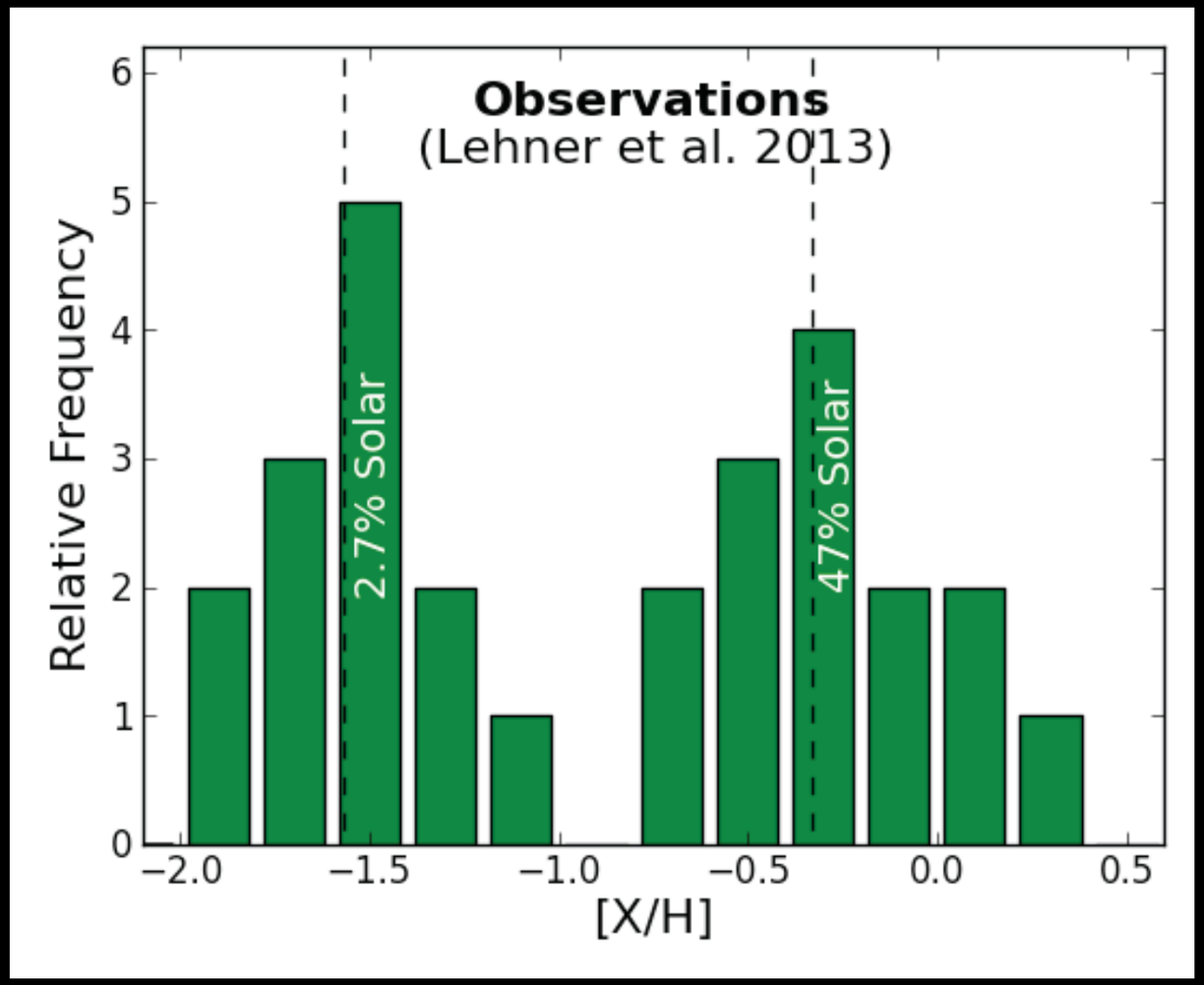

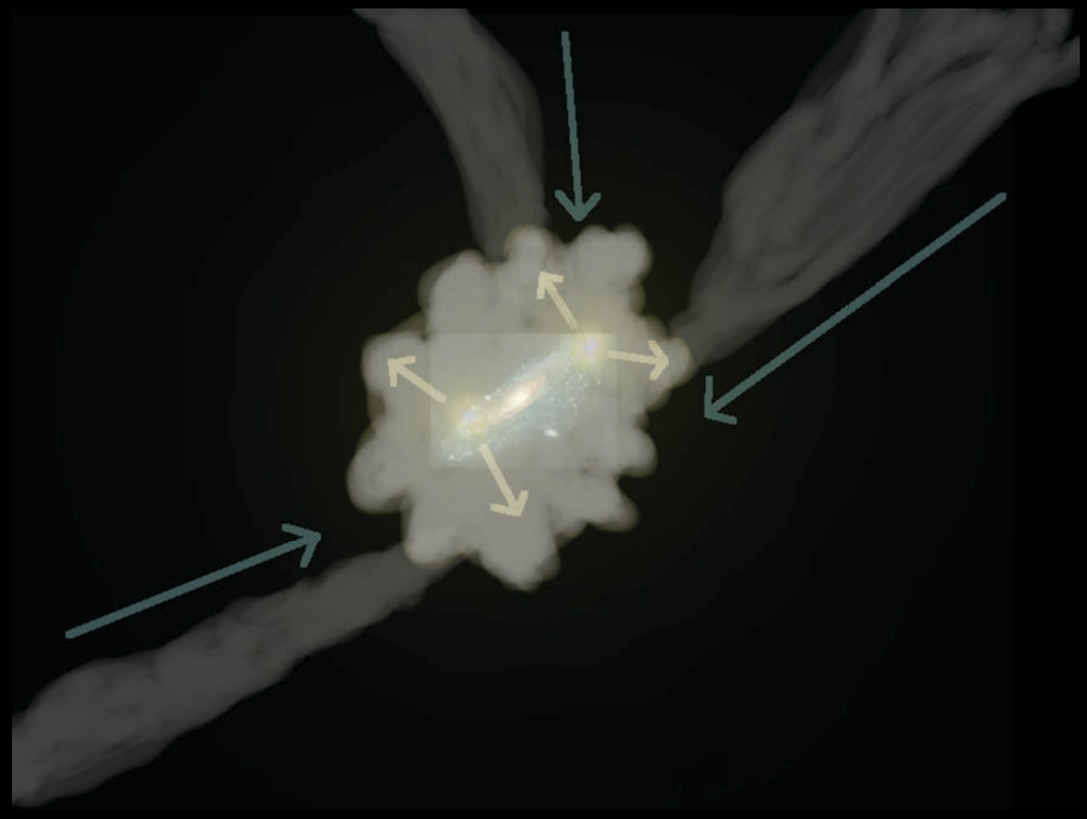

Lehner+ 2013

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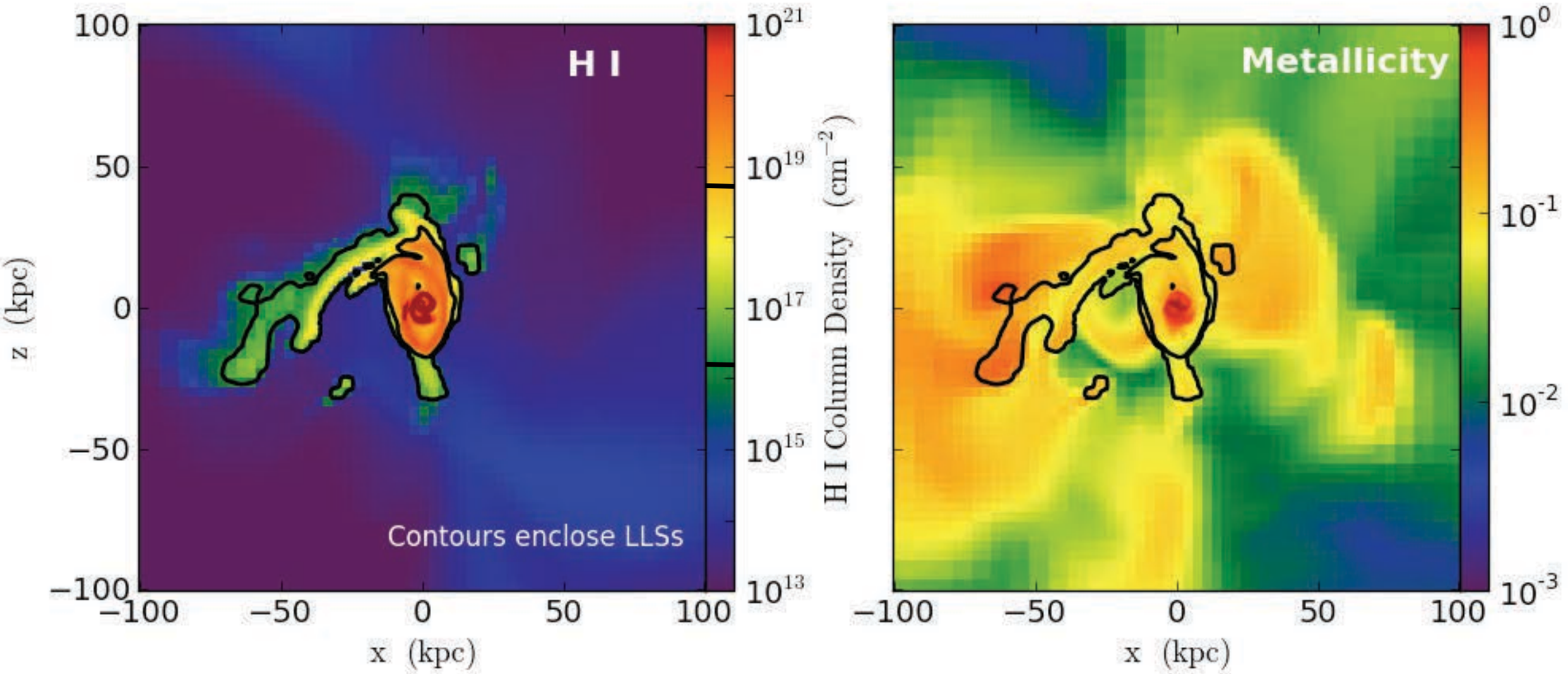

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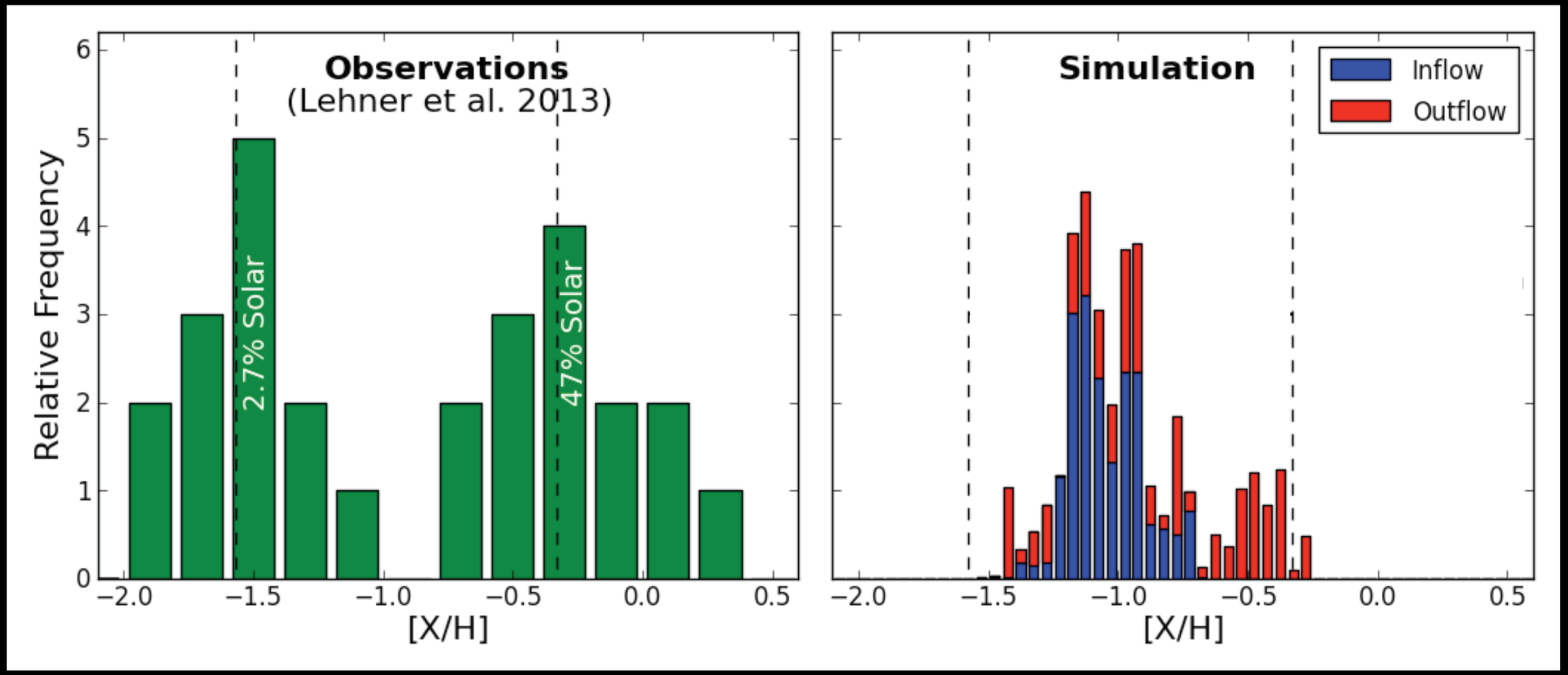

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Hummels+ in prep

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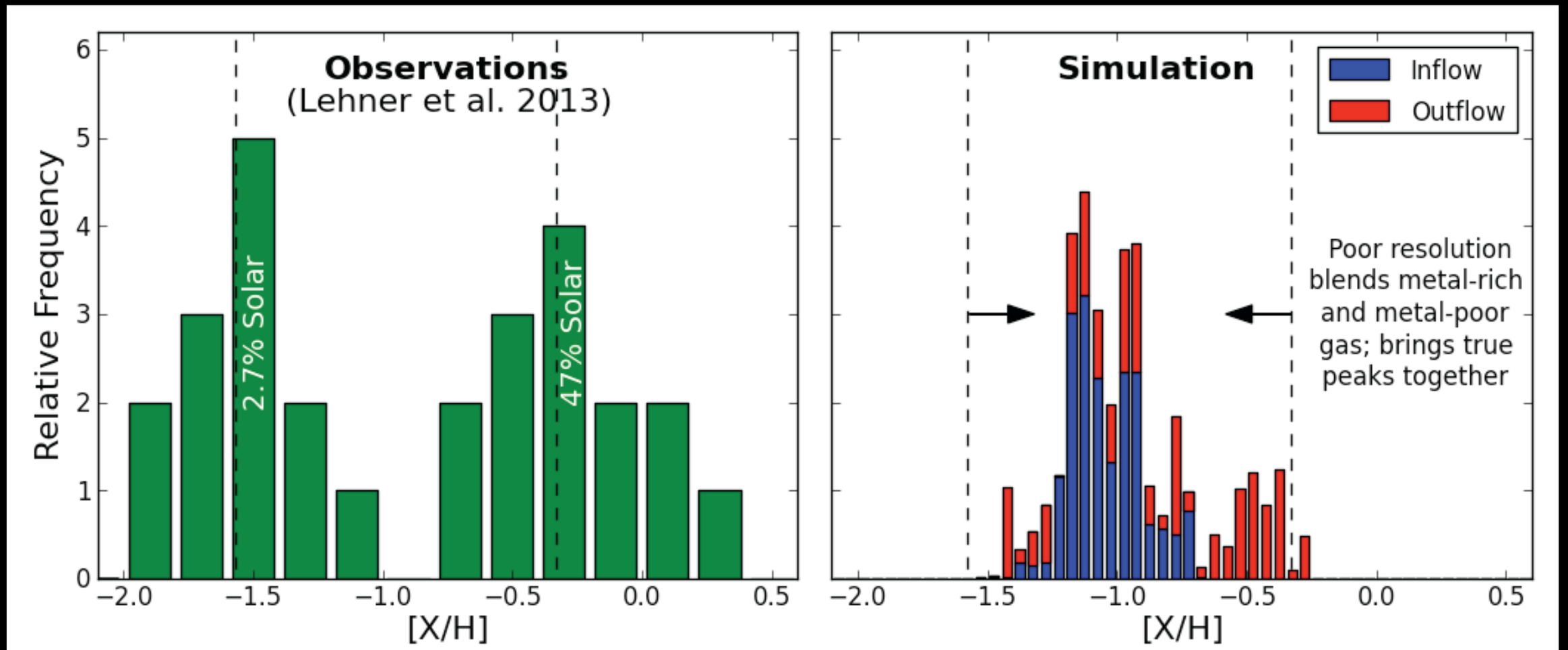

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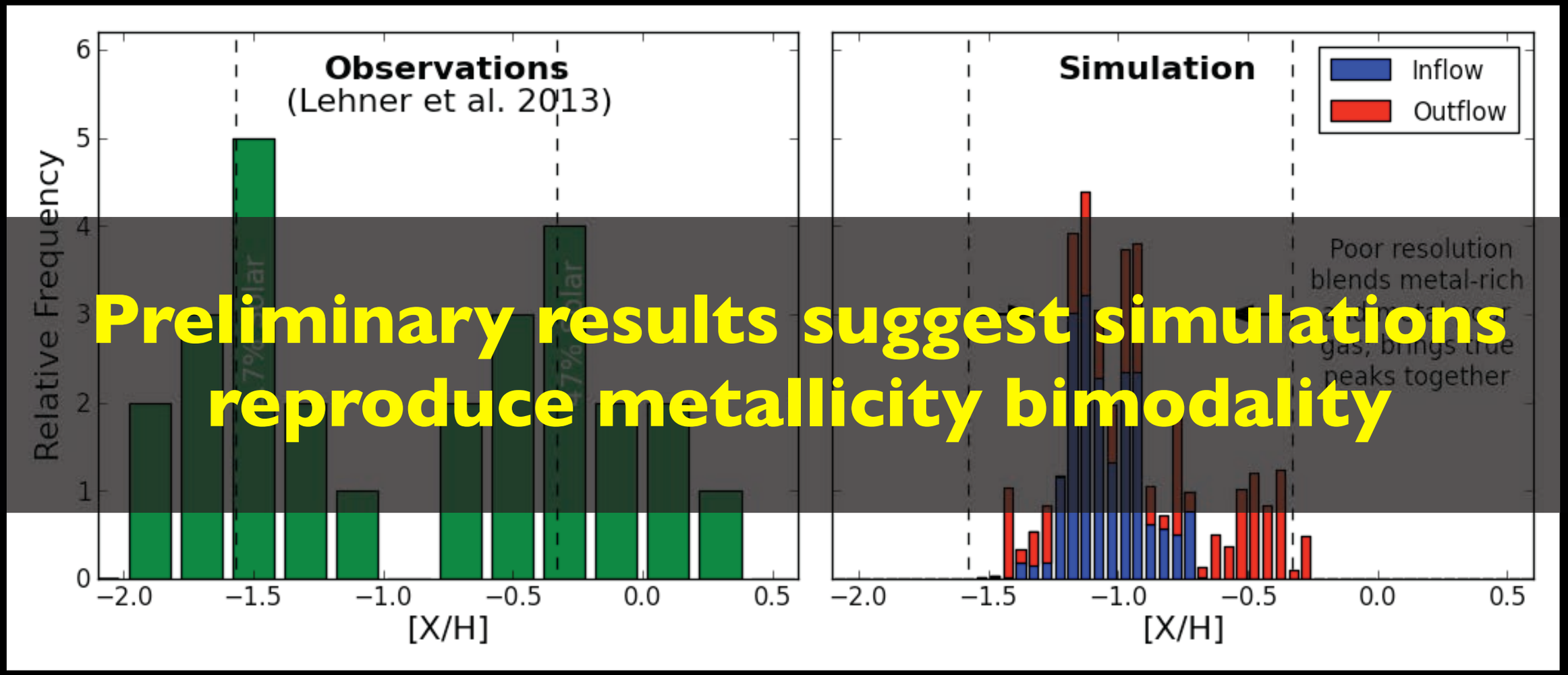

Preliminary results suggest simulations reproduce metallicity bimodality

Lehner+ 2013

Hummels+ in prep

HST Theory Proposal (PI Hummels) AR-13917

Conclusions

- Synthetic spectra can be used to directly compare simulations to CGM observations

- Different feedback models predict different CGM distributions

- Simulations do not reproduce observations of cold CGM volume density (Werk+ 2014 result)

- Simulations reproduce metallicity bimodality of LLSs (Lehner+ 2013 result)