Modeling the Source of Ionizing Radiation in the Circumgalactic Medium

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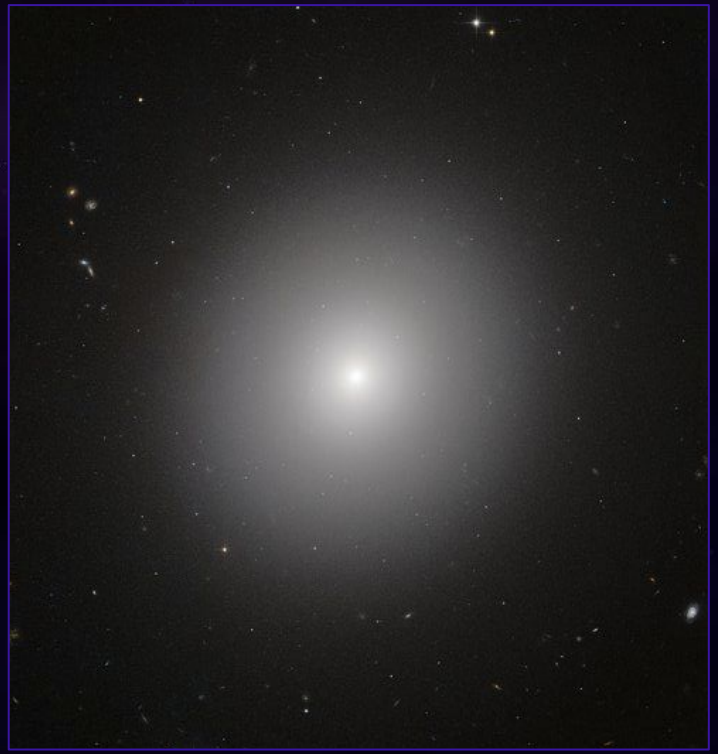
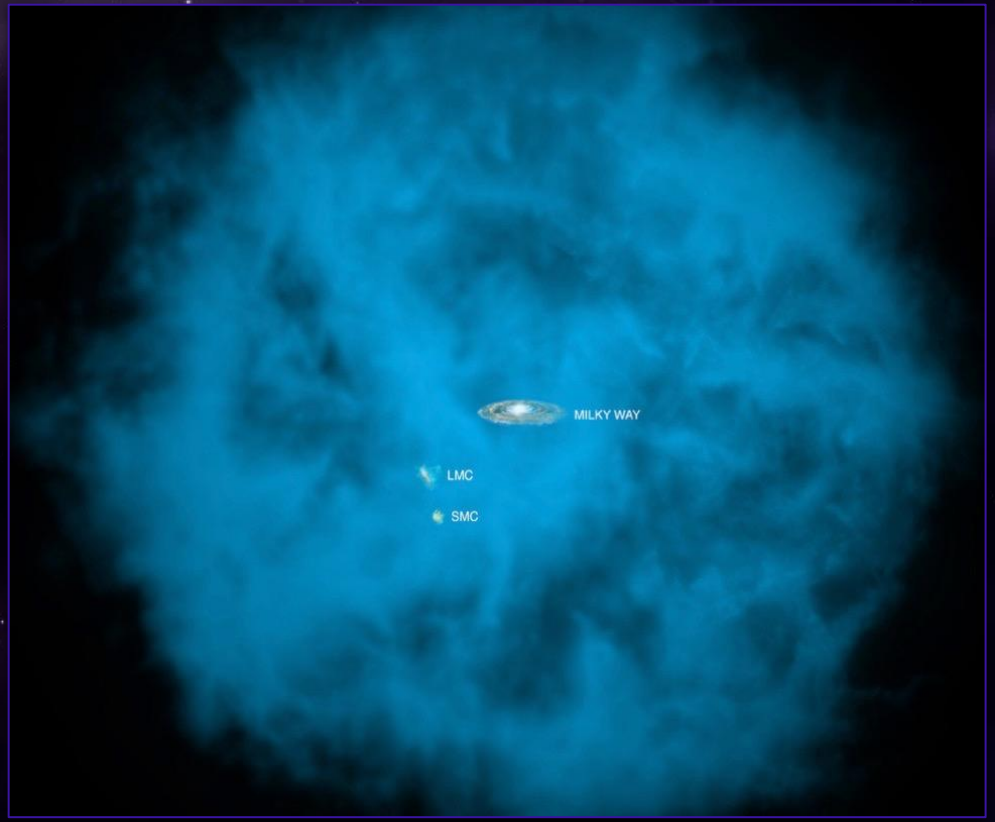
What is a Galaxy?



What is a Galaxy?



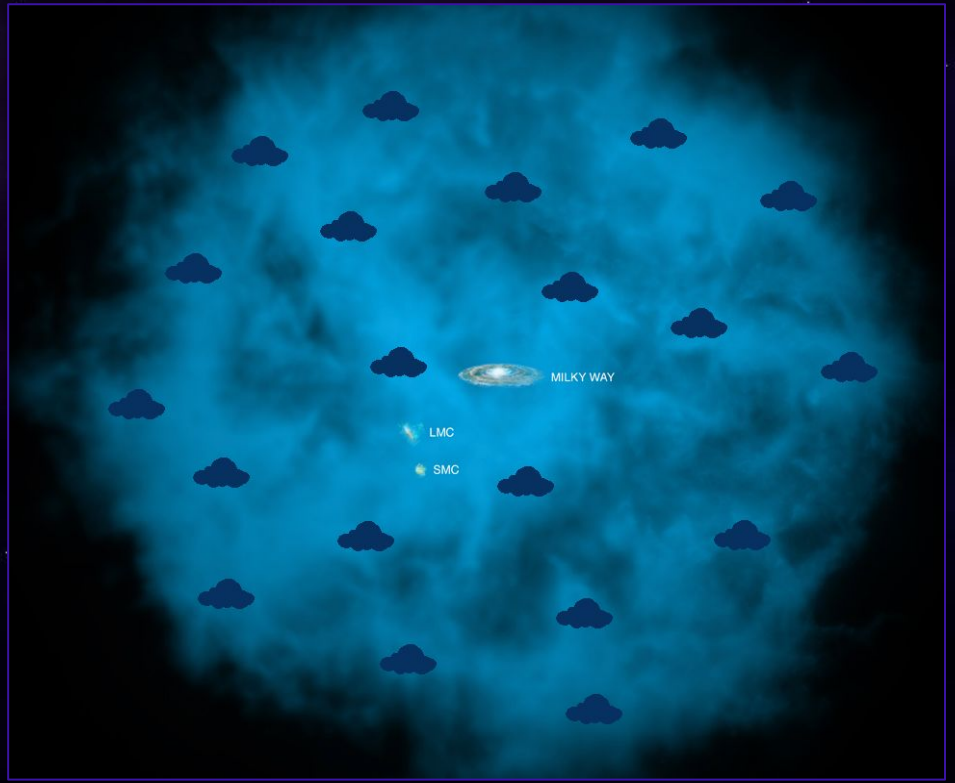
- The Circumgalactic Medium (CGM) is a non-uniform cloud of gas surrounding a galaxy

- Much larger than the central galaxy:
  - Milky Way Diameter: 100,000 ly
  - CGM Diameter: 2 million ly

Why is the CGM Important?

- CGM interfaces between gas *within* galaxies and gas *between* galaxies
  - Gas condenses and cools into clouds, accreted into the central galaxy to form stars

- Could possibly shed light on the transformation from star-forming to quiescence.



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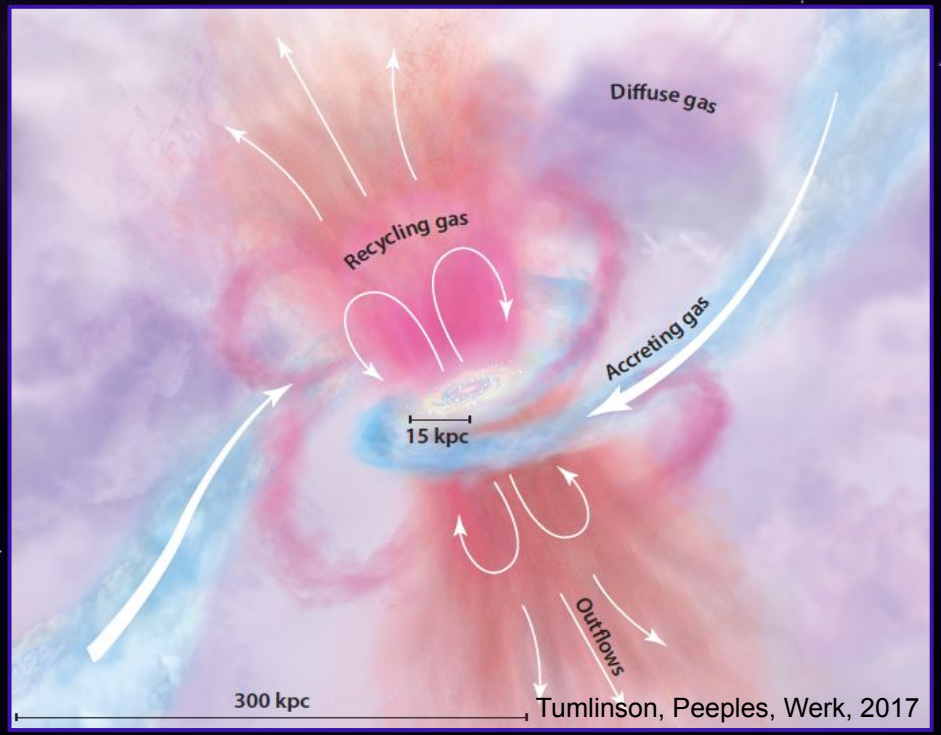
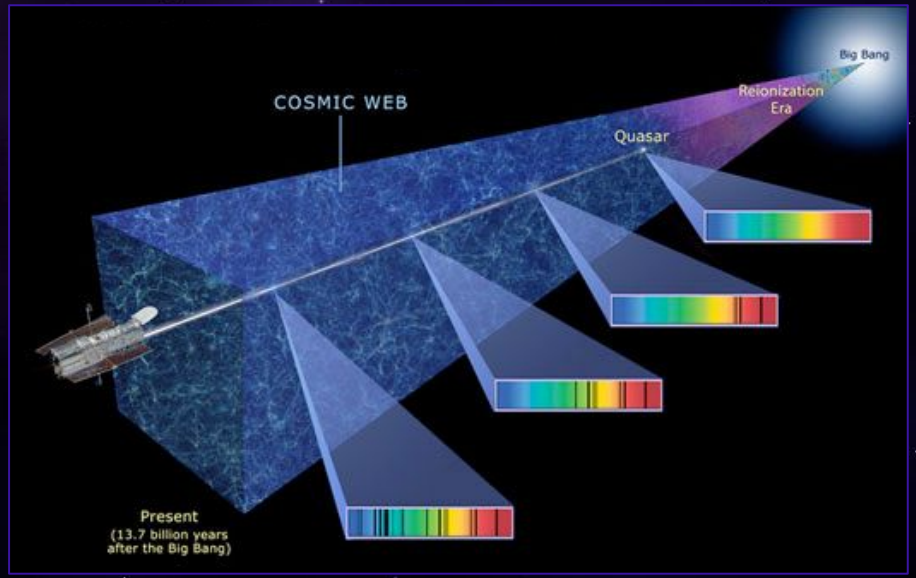


Tumlinson, Peeples, Werk, 2017

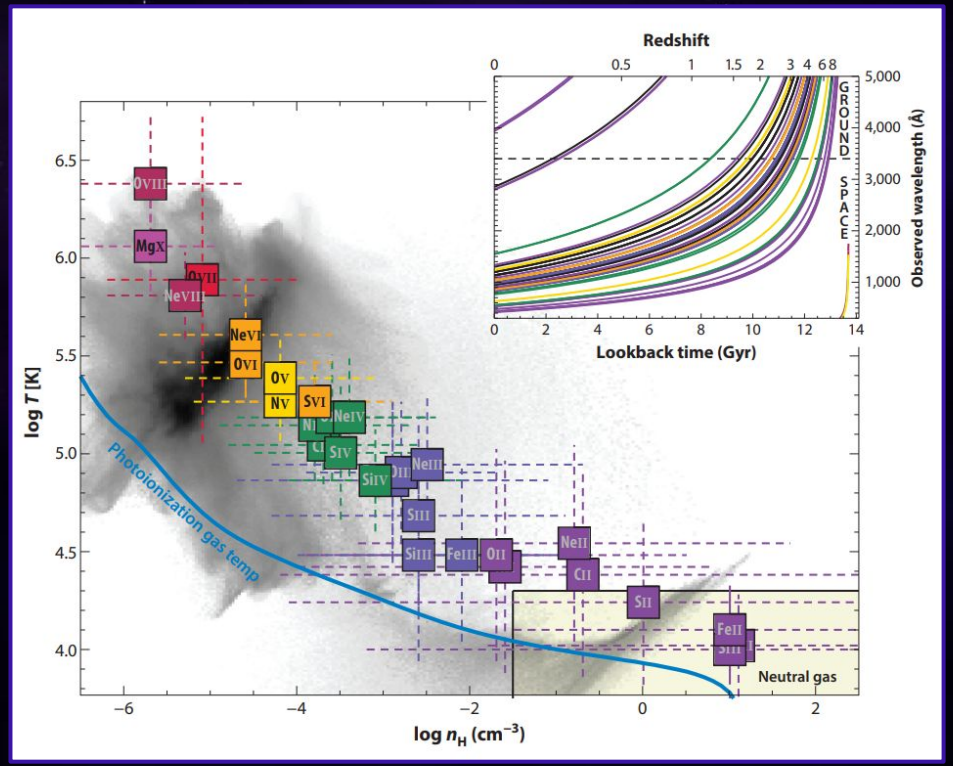
How is the CGM Observed?

- Emission Spectra & Absorption Lines
  - Atoms and molecules absorb light in distinct and detectable ways
  - Can determine which elements are present along a line of sight



How is the CGM Observed?

- Ionizing Radiation
  - Atoms/Molecules lose electrons when struck by high energy radiation, becoming ionized
  - Can be ionized many times in a row, each with distinct absorption features
- By determining the composition of gas clouds, the conditions can be determined
  - Cold clouds in thermal equilibrium



How is the CGM Observed?

$$U \equiv \frac{\Phi}{nc}$$

$$\Phi \propto U \times n$$

Radiation Flux

Ionization State

Gas Density

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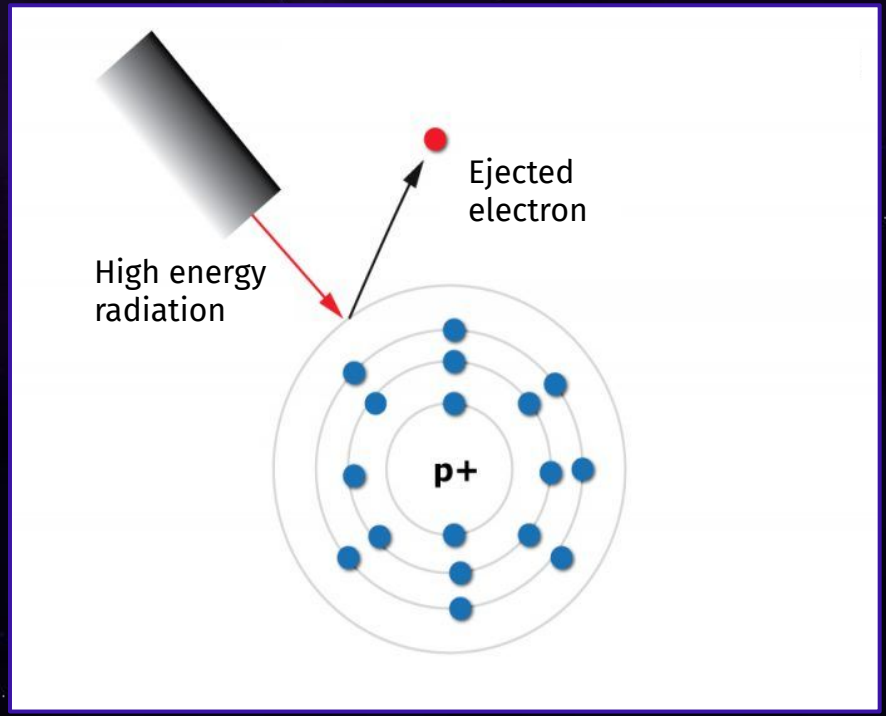
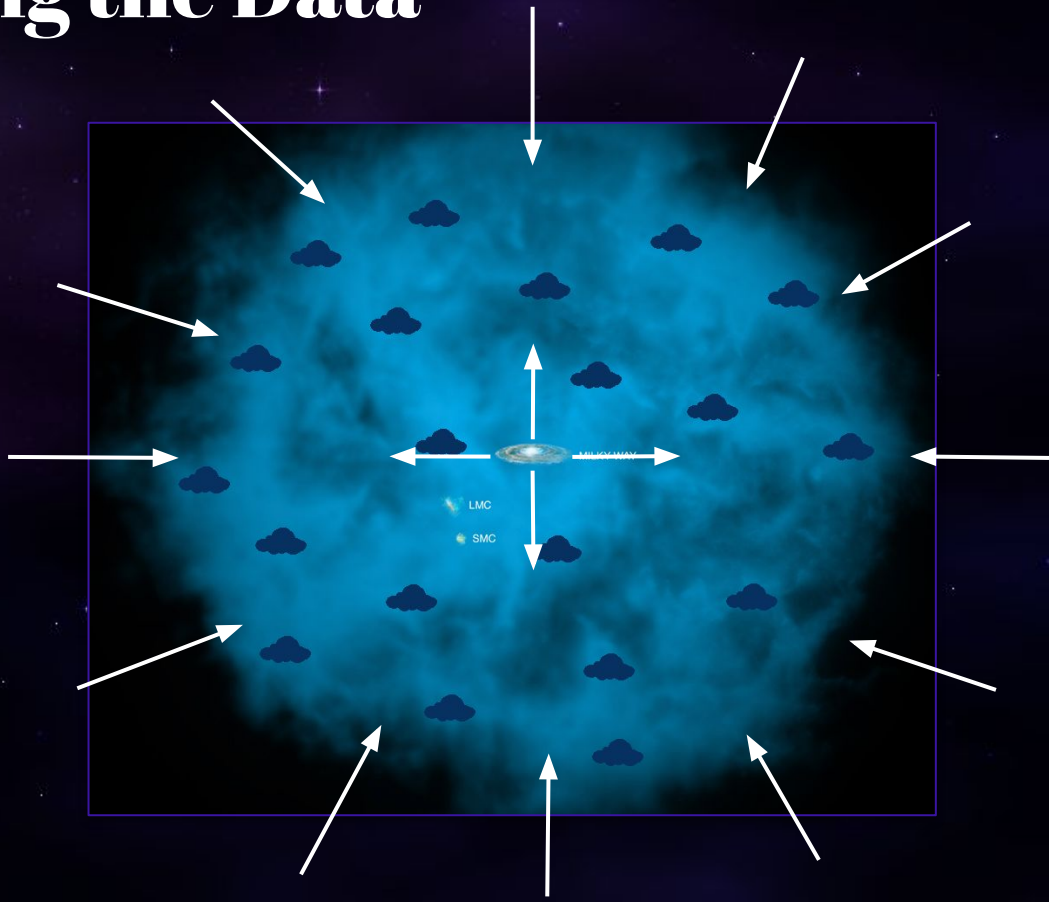


Plotting the Data

$$\Phi_{tot} = \Phi_{UVB} + \Phi_{gal}$$

$$\Phi_{tot} = \Phi_{UVB} + \Phi_0 \times SFR$$

$$y = b + m x$$



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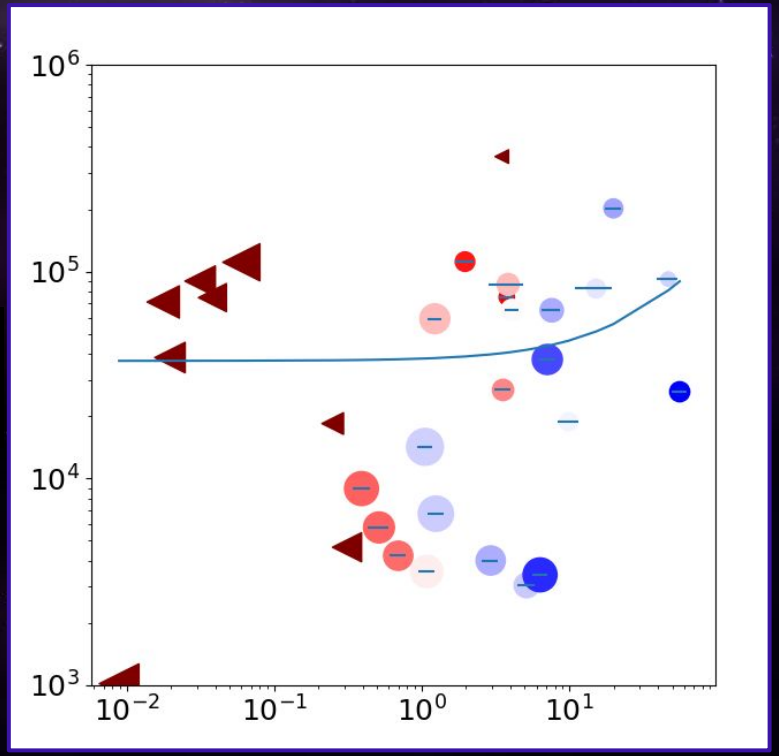

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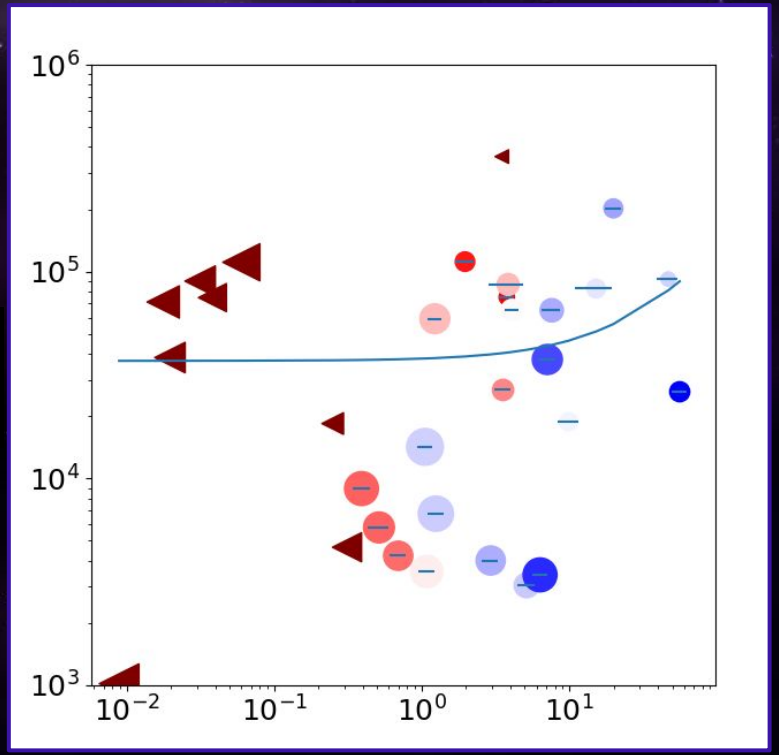
Gas Density Profiling



- Using same scaling for gas density across all galaxies doesn't make much sense
  - Galaxies with high SFR should need more gas

$$\Phi \propto U \times n$$

$$\Phi \propto U \times n \times SFR^{\beta}$$

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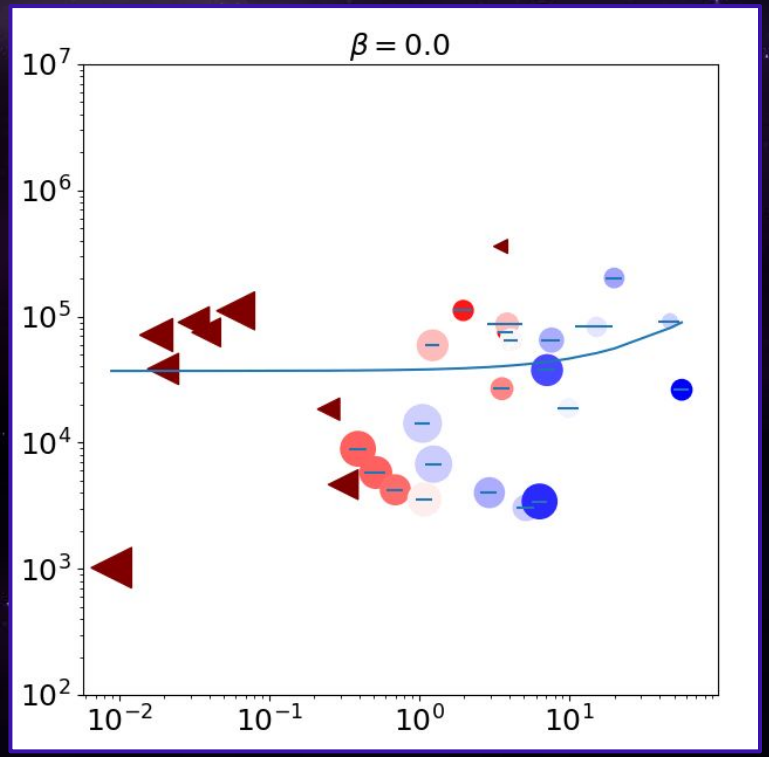

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Further Research + Q&A

Further Research:

- Fitting power law to the data
- Statistical analysis
  - Different ways of choosing best fit
  - Finding optimal value of β
- Investigate the behaviors of quiescent vs. star-forming galaxies
  - Other factors in gas density