THE LOCAL GROUP AS A TIME MACHINE

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We can place constraints on the high redshift universe by studying the time evolution of the Local Group, using a combination of simulations and Star Formation Histories.
Star formation histories

- Stellar mass information from SFHs

Weisz +, 2014
What can this be used for?

1. Place constraints on the stellar mass function
2. Identify the descendants of the sources of reionization
Part 1: Constraints on the stellar mass function

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- At \(z = 4\) this increased by \(\sim 10^{2.5}\) to \(34\) Mpc\(^3\)
Part 1: Constraints on the stellar mass function

- The size of the Milky Way is \(~300\) kpc or \(0.11\) Mpc\(^3\)
- At \(z = 4\) this increased by \(~10^{2.5}\) to \(34\) Mpc\(^3\)
- At dwarf scales (\(~10^6\) M\(_\odot\)) this is the difference between 300 and 10!
Part 1: Constraints on the stellar mass function
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![Graph showing constraints on the stellar mass function.](image)
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- Song et al. 2015 ($z = 4$)
- Duncan et al. 2014 ($z = 4$)
- Weisz et al. 2014 ($z = 4$)

$N(>M_*)$ vs $M_*$ formed before $z = 4$
Part 1: Constraints on the stellar mass function

![Graph showing constraints on the stellar mass function at different redshifts (z). The graph plots α_faint against redshift (z) with error bars for various datasets such as Song+15, Duncan+14, Grazian+15, Tomczak+14, Ilbert+13, and This Work.]
Part 1: Constraints on the stellar mass function
Part 2: descendants of the sources of reionization

Part 2: descendants of reionization

- We can see very small galaxies in the Local Group
- possibly generators of reionization?

![Graph showing galaxy constraints in the Local Group at high-redshift (z ~ 7) with a slope of \( \alpha \approx -2.0 \).]
Part 2: descendants of reionization

- Can we see the galaxies responsible for reionization in the Local Group?

![Graph showing cumulative SFH vs lookback time](image1)

![Histogram showing UV magnitude distribution](image2)
Part 2: descendants of reionization

\[ \log_{10}(M_{\text{vir}}/M_{\odot}) \]

\[ z \sim 7 \]

\[ \alpha \approx -2.0 \]

reionization models

MBK, Weisz, et al. 2015

Local Group constraints on high-z galaxies
Part 2: descendants of reionization

$z \sim 7$

MBK, Weisz, et al. 2015

Local Group constraints on high-z galaxies
Future Prospects
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Galaxies cut off by UV-background (Okamoto+, 2008)
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Take Away

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- One of the limiting factors is the sample size of galaxies.
JWST limits

Local Group constraints on high-z galaxies
Constraints on UV LF

Schechter luminosity function:
α = -2.03

Broken luminosity function:
α = -1.2 for $M_{UV} > -13$

Local Group constraints on high-z galaxies