

# Frequency of Dwarf Galaxy Pairs Throughout Cosmic Time

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## Introduction:

Dwarf galaxy pairs have been found with large reservoirs of gas out to large distances (~50 kpc). Orbital models of the Magellanic Clouds (MCs) [1] and the NGC 4490/4485 dwarf pair [2] indicate highly eccentric orbits are necessary to match observed kinematics and the gas extent. If gas-rich dwarf pairs are common across time, they may play an important role in the supply of gas to the CGM of nearby massive galaxies, (re)igniting star formation. I will quantify the frequency of dwarf pairs throughout time using the *Illustris-1* dark matter only simulation.

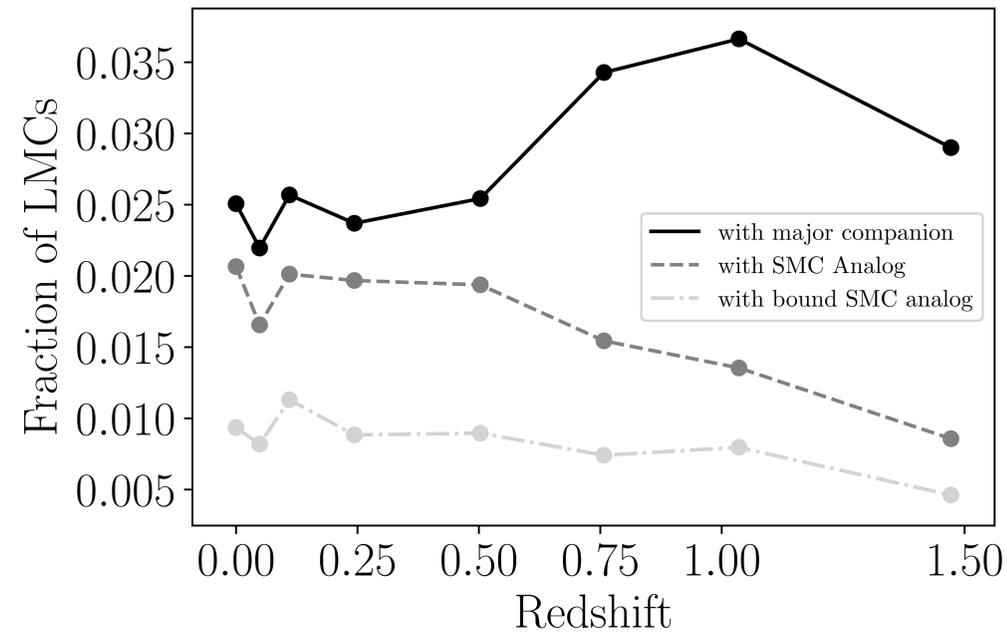
## Future Directions:

Informed of the abundance of dwarf pairs throughout time, I will trace their orbits to identify pairs with high orbital eccentricity that could play a role in CGM gas supply and the baryon cycle. I will then calibrate observability timescales for dwarf galaxy mergers to calculate merger rates from pair fractions that will be seen by JWST. These analyses will be done jointly with the full hydrodynamic Illustris simulation suite.

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[1] Besla, G., Kallivayalil, N., Hernquist, L., et al. 2012, MNRAS, 421, 2109

[2] Pearson, S., Prigon, G. C., Besla, G., et al. 2018, MNRAS, 480, 3069

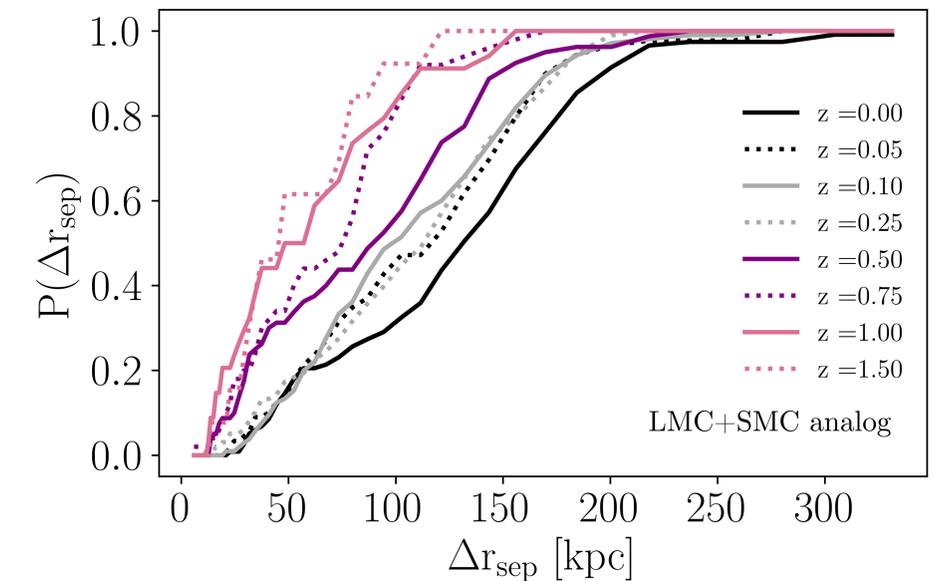


The fraction of LMC analogs that have different types of companions. We find that the **fraction of bound LMC/SMC analogs is approximately constant throughout time**, and that the **fraction of LMCs with a major companion decreases with time**.

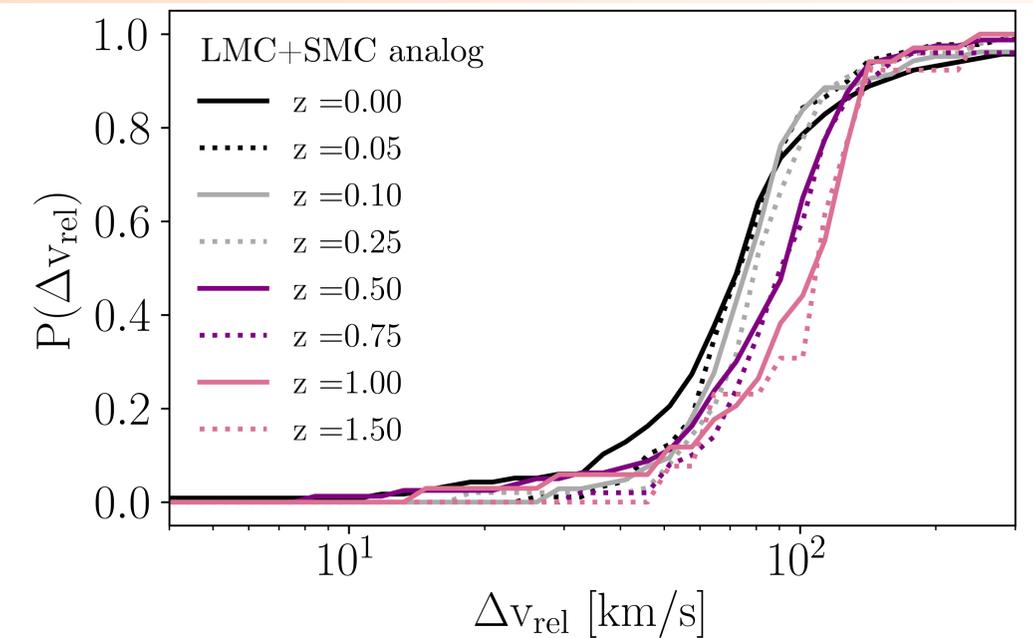
Number of dwarf pairs by category:

Z	LMC Analogs	MC Mass Analogs	Bound MC Analogs	Major Pairs
0	5664	117	53	142
0.05	5374	89	44	118
0.1	5217	105	59	134
0.25	4980	98	44	118
0.5	4129	80	37	105
0.75	3238	50	24	111
1	2511	34	20	92
1.5	1517	13	7	44

- ▶ LMC analogs chosen by stellar mass:
  - $10^9 < M_{*,\text{LMC}} < 5 \times 10^9$
- ▶ SMC analogs chosen by stellar mass:
  - $10^8 < M_{*,\text{SMC}}$  and mass ratio between 1/5 and 1/15
- ▶ Bound pairs have  $r_{\text{vir}} > r_{\text{sep}}$  &  $v_{\text{esc}} > v_{\text{rel}}$
- ▶ Major pairs have LMC analog *and* secondary with stellar mass ratio  $> 1/4$



Cumulative probability distribution of the relative separation between an LMC and SMC analog. The separation between the LMC and SMC analogs **increases with time**. We know it's rare to see Magellanic Cloud analogs (< 20 kpc separation) today!



Cumulative probability distribution of the relative velocities between an LMC and SMC analog. The velocity between the LMC and SMC analog **decreases with time**. Does this mean that **late-time analogs are exhibiting more elliptical orbits?**