Understanding Satellite Galaxies

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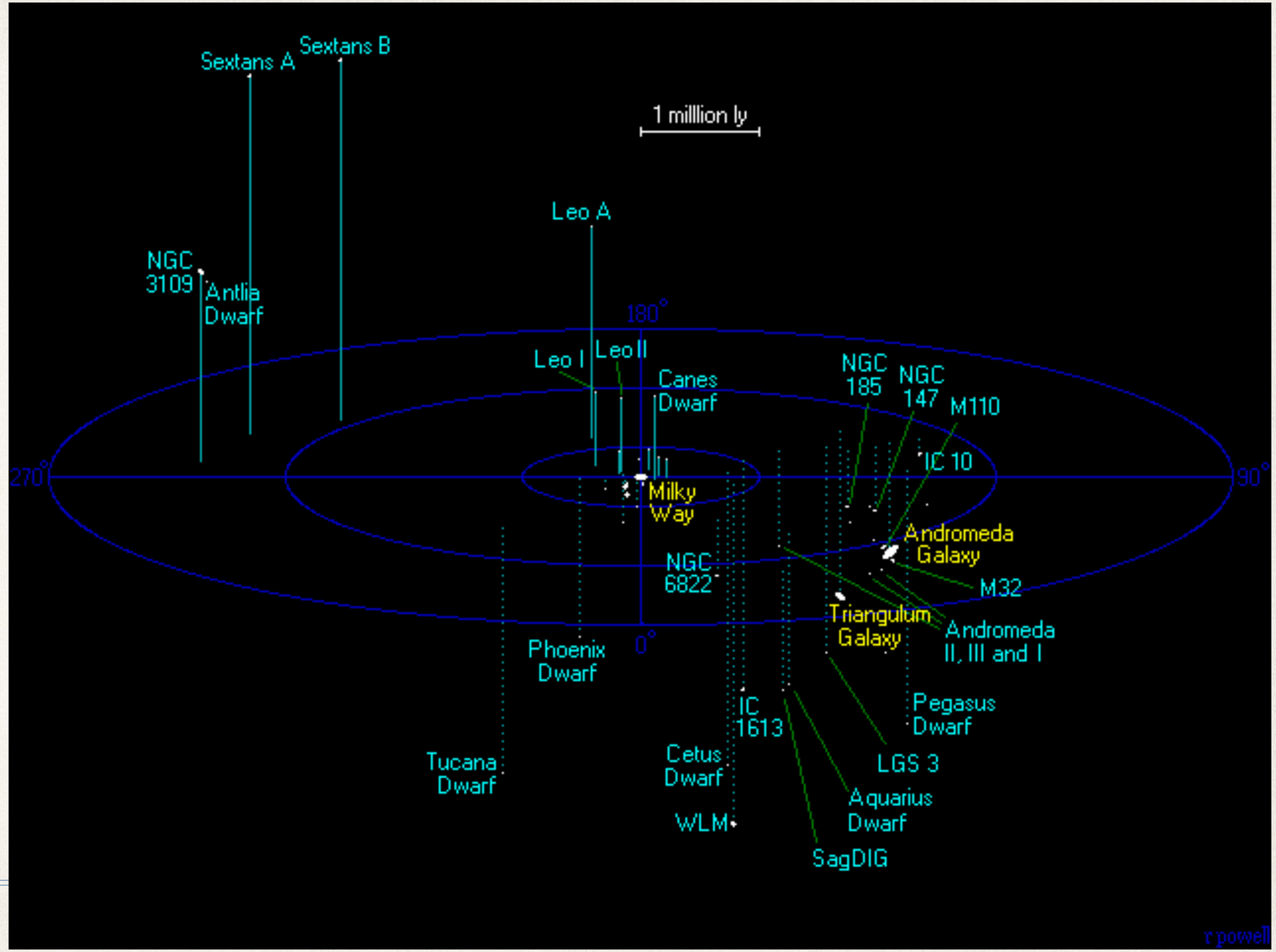
Date



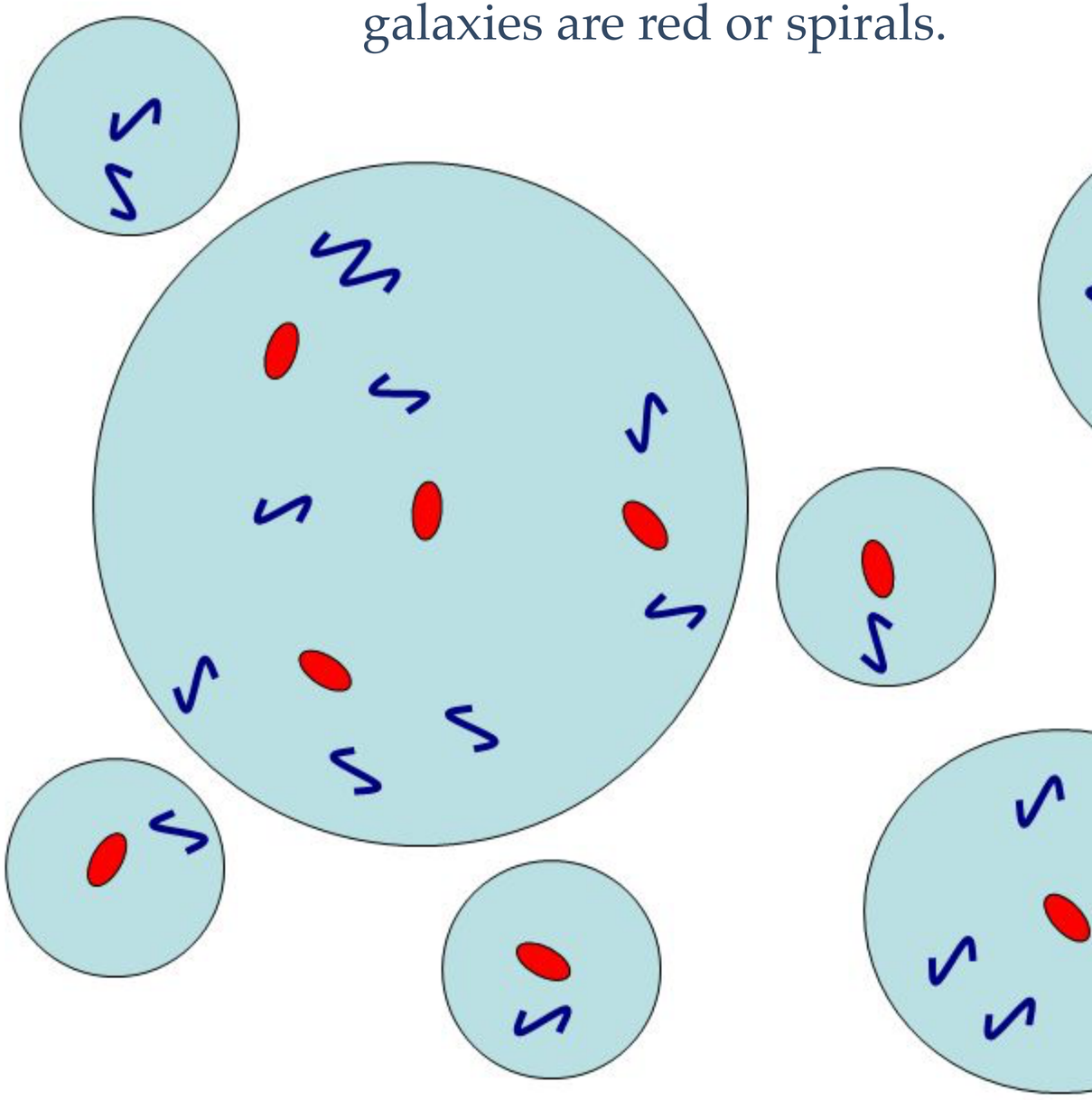
Central / Satellite Galaxies

- It is useful to divide galaxies into central galaxies, who are at the bottom of their potential well and satellite galaxies, who orbit central galaxies in some fashion.
- The main reason for this is we might expect central and satellite galaxies to have different physics operating on them.
- For example, new gas may only fall onto the central galaxy, while satellite galaxies may feel tidal forces unlike the central.

Halo Occupation Distribution

- Observationally the distribution of satellite galaxies is actually pretty well measured using ideas like the halo occupation distribution.
- In this approach one models the distribution of satellites in dark matter halos and then calculates how galaxies would correlate spatially.
- One then optimizes the model to find the distribution of satellites consistent with the spatial correlation of galaxies.

This HOD also examines if the galaxies are red or spirals.



Numerical Simulations of Galaxies

- Interestingly, numerical simulations of galaxy formation show rather large differences, ~2, in the number of satellite galaxies at a given mass.
- Understanding why this happens could give us key insights into galaxy formation physics, at the very least for satellites, but maybe for all galaxies.
- *The goal of this project is to understand why satellite number varies between different large volume hydrodynamical simulations (Eagle, TNG, Simba) and what physics would lead to the values observationally measured using the halo occupation distribution method.*

Work Plan

- Measure the halo occupation distribution and its variance on 3 large volume cosmological simulations, Eagle, TNG and Simba. Also, explore if the variance correlates with other galaxy properties.
- Explore different scenarios of what might be going on:
  - Are the galaxies more or less massive before they become satellites?
  - Do satellites galaxies grow or shrink at different rates once they are satellites?
  - Do satellites survive for a different period of time in different simulations and can we understand why?
- These concepts can be tested as simple models on N-body simulations to see if we can recover the differences between simulations and then explored in their ability to fit the observational data.