ASSEMBLY HISTORY: THE KEY TO PREDICTING GALACTIC PROPERTIES

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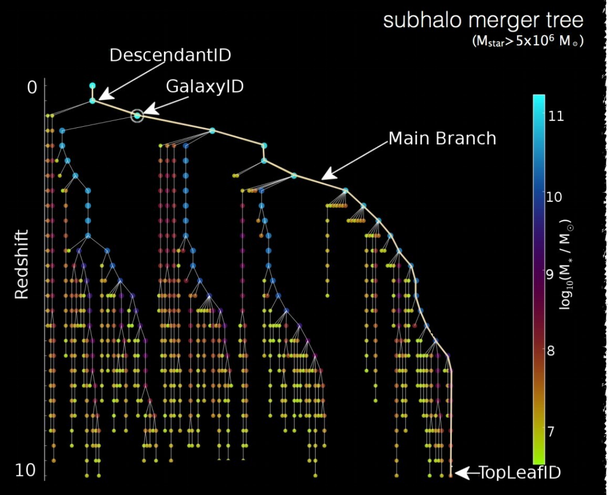
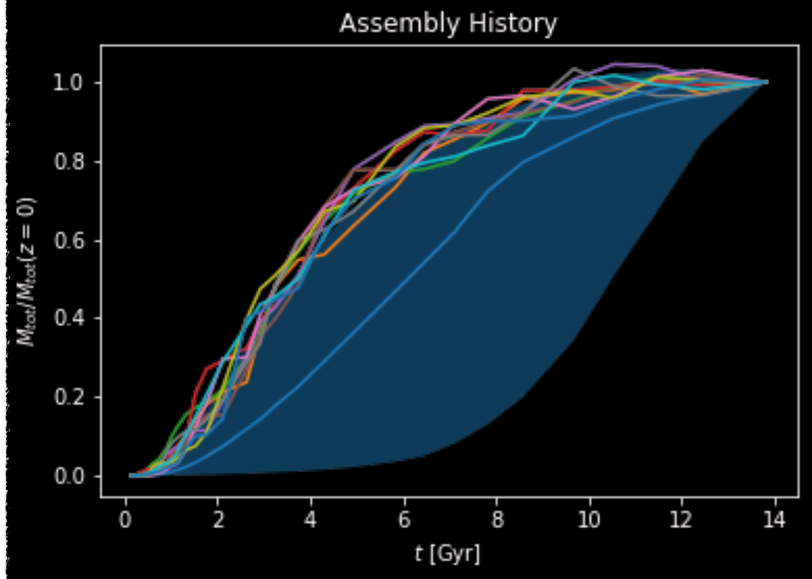
Introduction



A sample merger history of a galaxy with stellar mass around 1010 M⊙ and redshift z=0.18 . Each node represents a particular galaxy, and each intersection shows a merger. The EAGLE database includes relevant information on about a million galaxies, including their assembly. (McAlpine et al. 2016)

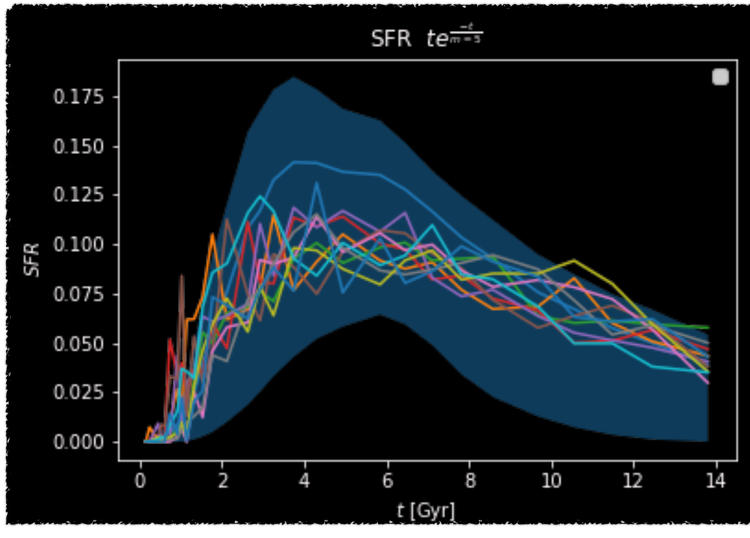
Using the EAGLE database, we have grouped galaxies with similar assembly histories to predict their various properties, which complements existing literature based on the reverse. Furthermore, as part of our analysis, we have matched galaxies corresponding to exponential curves with different parameters based on their SFR, and isolated galaxies that do not fit any parameter in order to draw conclusions and patterns about their assembly history, and other key characteristics.



Assembly history refers to the mass accumulation of galaxies over time. Mass can be accumulated through processes such as mergers.

We utilized different assembly history (e.g linear or different percentiles) to predict other properties.

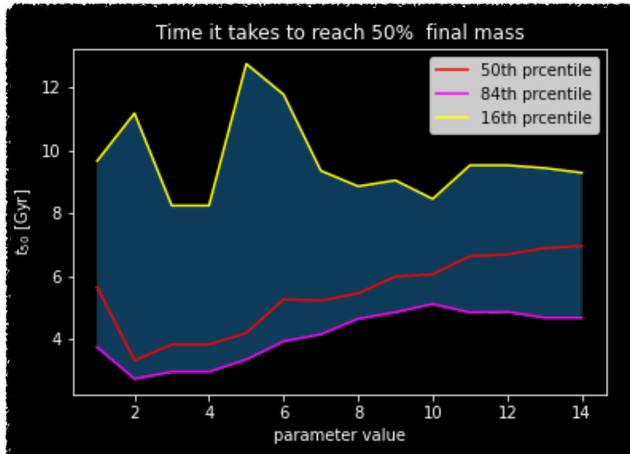
The plot to the right shows the assembly history as the fraction of final mass for 10 galaxies near the 84th percentile of the data base.



Another way we attempted to predict properties was to group galaxies based on their star formation rate (SFR) similarity to different exponential functions governed by a parameter tau

With the form $\mathrm{SFH} \propto t\exp(-t/\tau)$.

The plot to the right shows a sample of galaxies with similar SFR to tau 5 and the dark blue line above everything shows tau 1 . Galaxies that do not correspond to any tau, are usually the ones with big initial spikes.



A key result of our project was showing a positive correlation between the time it takes for a galaxy to accumulate 50% of its mass, and the value of the tau parameter. This surprising result may be understood by connecting the fact that higher tau parameters enforce the SFR to be shorter which may lead to more rapid growth. Similar observations were present in other percentiles.

The plot above visualizes the relationship between Tau and the *distribution of assembly times* of its related galaxy groups.

Future

The next step in our project would be to compare and contrast other measures other than t50, such as t75 - t25, and analyzing more properties in connection to the assembly history groups.

A particular end goal of our project is to be able to predict future properties of local galaxies including our own Milky Way based on their current SFR, and assembly history.

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