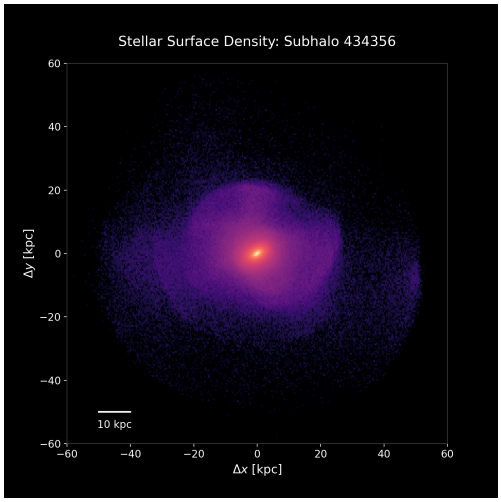

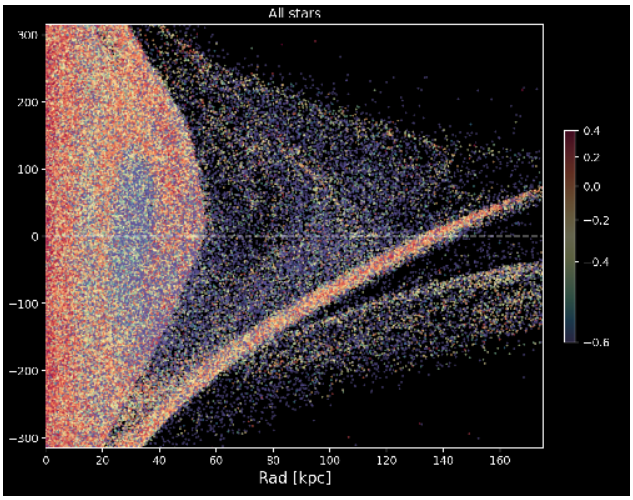

The Galactic Onion: Unwrapping the Accretion History of Galaxies

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Project Background

A central tenet of the ΛCDM cosmological model is that galaxies grow hierarchically through the relentless merging of smaller systems. While the bright central regions of galaxies appear stable, their outskirts often harbor "stellar shells"–faint, concentric overdensities that act as archaeological records of past collisions.

These structures are the "smoking guns" of galactic evolution. When a satellite galaxy is disrupted on a radial orbit, its debris "sloshes" through the host potential, creating sharp caustics at the orbital apocenters. By analyzing these features, we can perform a "galactic autopsy" to determine the mass, timing, and nature of the progenitor galaxies that were consumed billions of years ago.

Project Description

Join this project to pioneer cutting-edge research using high-resolution data from the **IllustrisTNG** supercomputer cosmological simulations. You will treat these "Digital Universes" as a laboratory to decode the signatures of galaxy assembly.

You will:

- **Systematically Survey TNG50/100:** Identify stellar shells in massive galaxies using surface-brightness residual maps, focusing on large-scale features $\geq$ 1 kpc to ensure physical reliability.
- **Map Phase-Space Caustics:** Utilize stellar particle data to plot Radial Velocity (V_r) vs. Galactocentric Radius (r), identifying the unique mathematical fingerprints of shredded satellites.
- **Reconstruct Merger Histories:** Query **Sublink Merger Trees** to pinpoint the exact progenitor subhalo and the **Lookback Age** of the accretion event.

- **Chemical Fingerprinting:** Extract profiles of stellar population prooperties, i.e. Age, metallicity, and $[\alpha/Fe]$, to determine if the shell stars represent a unique stellar population distinct from the host.

Why This Project?

- **Publishable Results:** Contribute to an ongoing collaboration with the potential for journal publication.
- **Skill Development:** Master industry-standard software and Python coding (e.g., HDF5, API calls) to model complex kinematic tracers.

Requirements

- Basic Python skills (or willingness to learn) and enthusiasm for Astrophysics.
- No prior simulation experience needed—comprehensive training provided!