Annual report 2023: Ewa L. Łokas

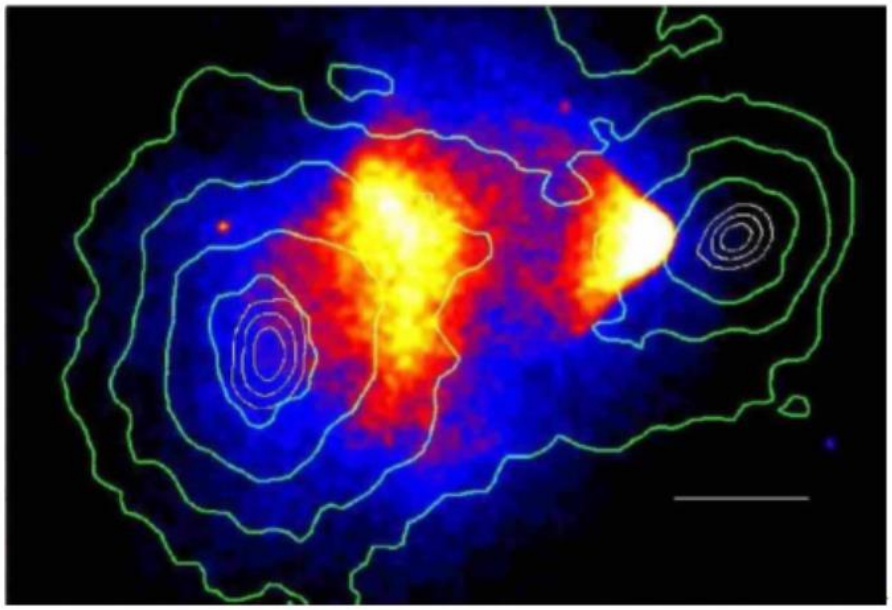
Published refereed papers:

- Łokas, E. L. "Merging galaxy clusters in IllustrisTNG" 2023, A&A, 673, A131

- Łokas, E. L. "Preprocessing in small groups: Three simulated galaxies interacting prior to cluster infall" 2023, A&A, 678, A147

- Martínez-García, A. M., del Pino, A., Łokas, E. L., van der Marel, R. P., Aparicio, A. "Internal kinematics of dwarf satellites of MW/M31-like galaxies in TNG50" 2023, MNRAS, 526, 3589

Bullet cluster

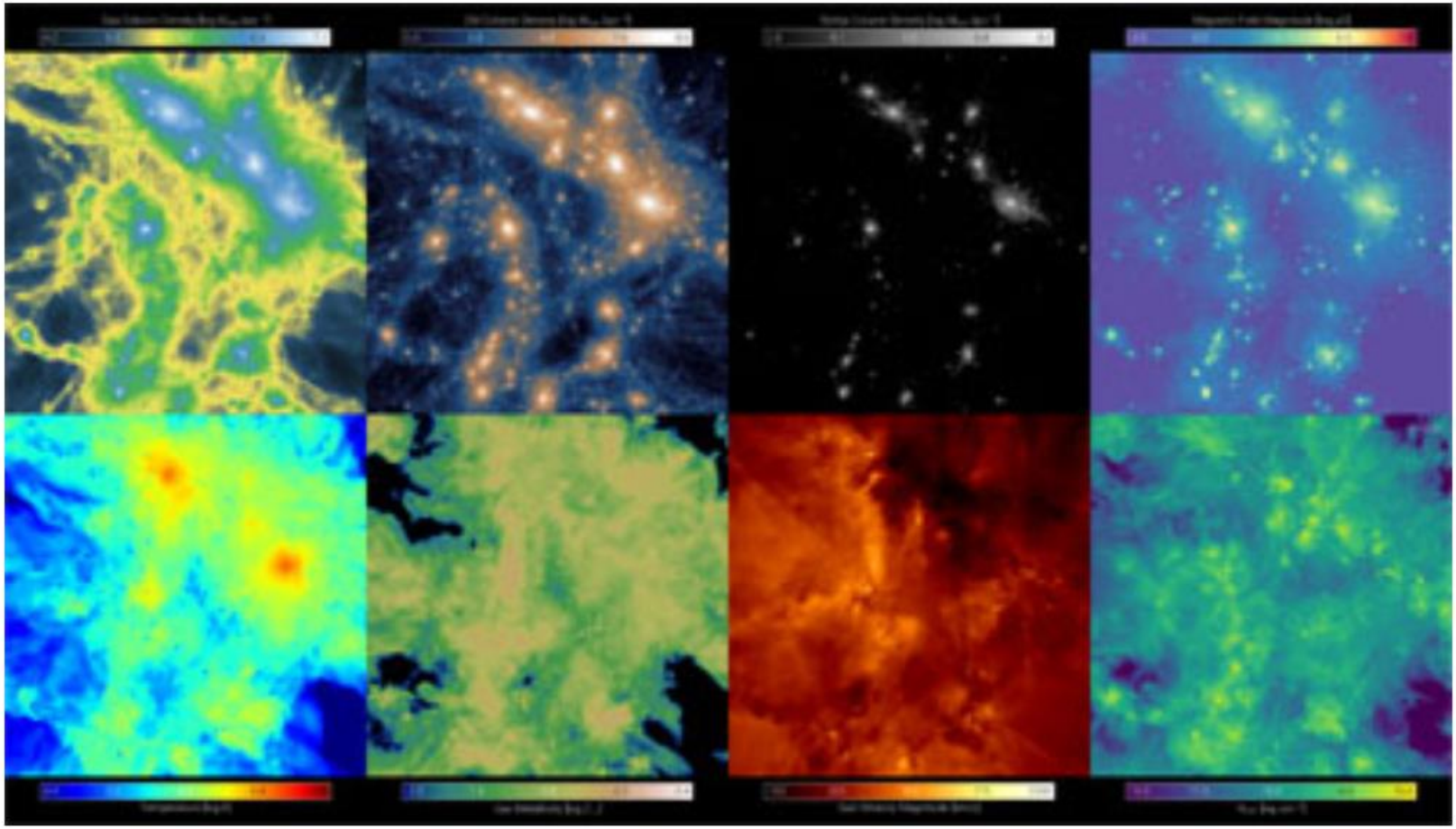


1E 0657-56 - first clear example of a merging galaxy cluster showing a bow shock associated with a subcluster that recently passed through a bigger cluster

- It was claimed to provide good evidence for the presence of dark matter in galaxy clusters
- The distribution of the total mass inferred from gravitational lensing was found to coincide with the one of galaxies but not with the gas
- The inferred velocity of the bullet ~4500 km/s was difficult to reconcile with LCDM theory

IllustrisTNG simulations

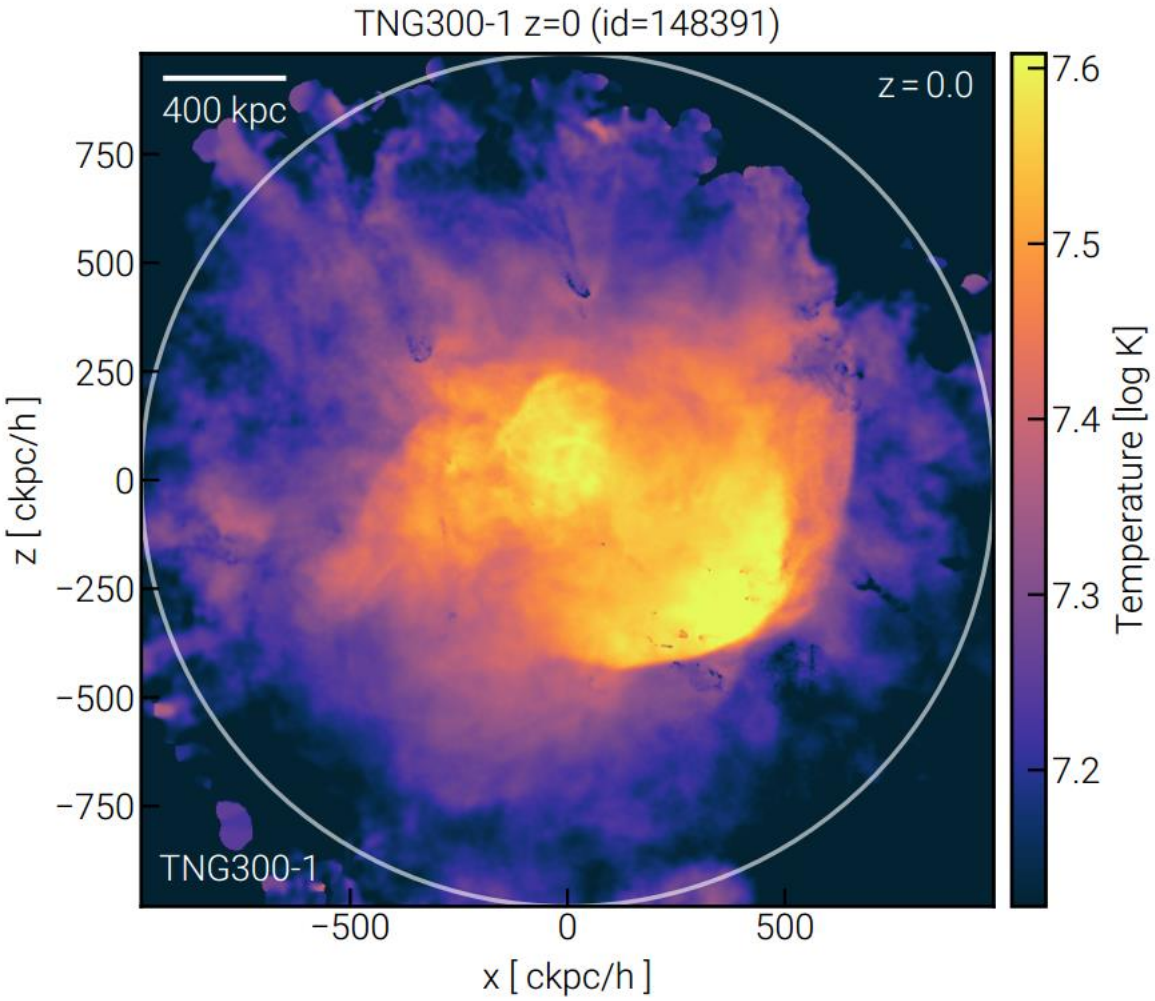
gas density | dark matter density | stellar mass | magnetic field strength



gas temperature | gas metallicity | gas velocity | column density of OVI

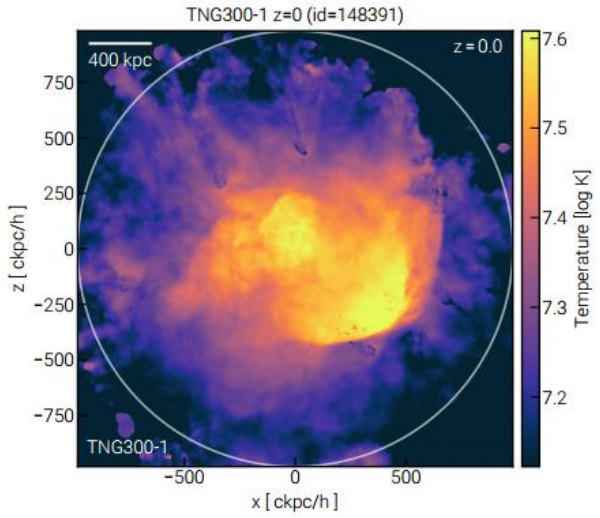
10 Mpc region from IllustrisTNG-100

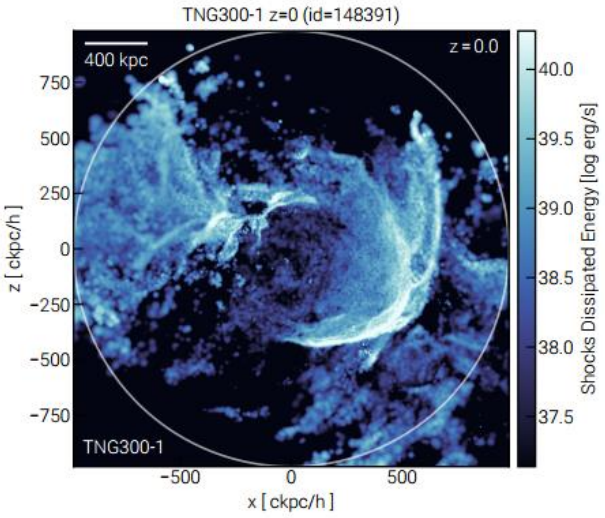
Example of merging clusters

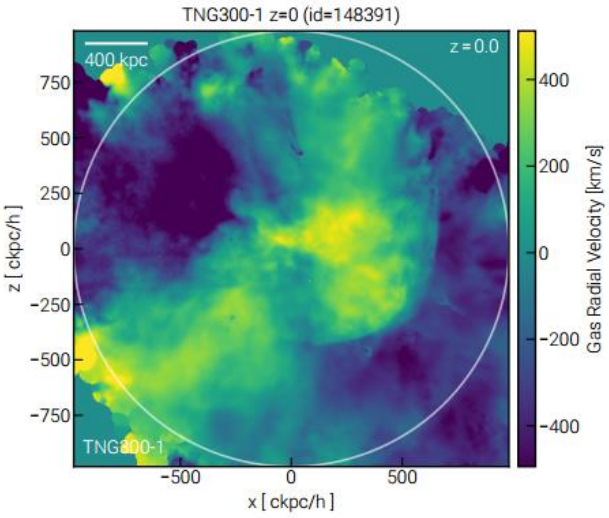


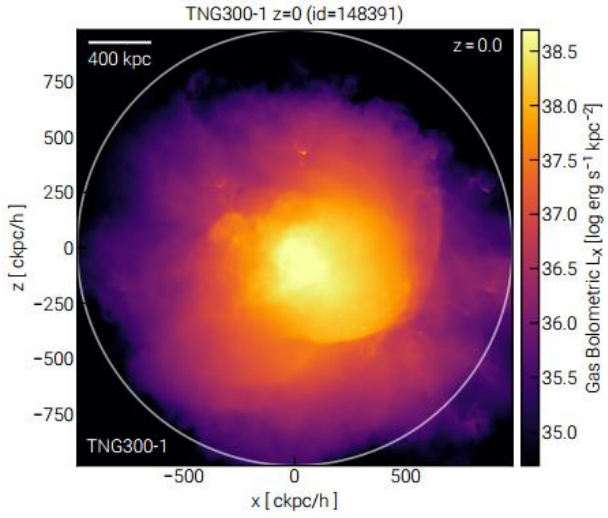
The smaller cluster (of maximum mass 3.1×10^{13} M_{sun}) passed close to the center of the bigger one (of mass 3.2×10^{14} M_{sun}) 0.5 Gyr ago with a pericenter of about 190 kpc and with velocity of 1670 km/s

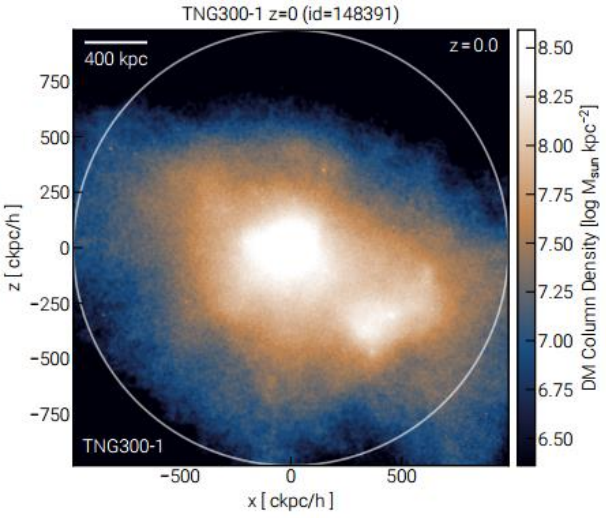
Properties of merging clusters

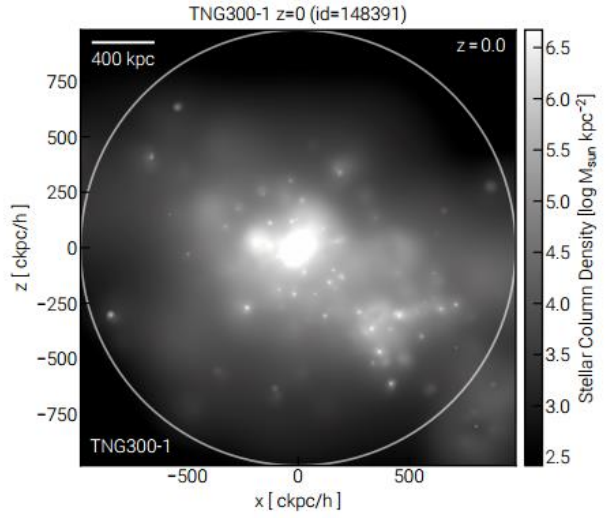




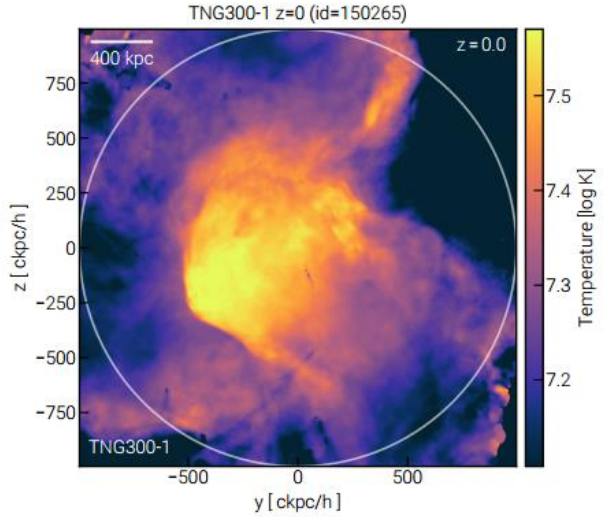


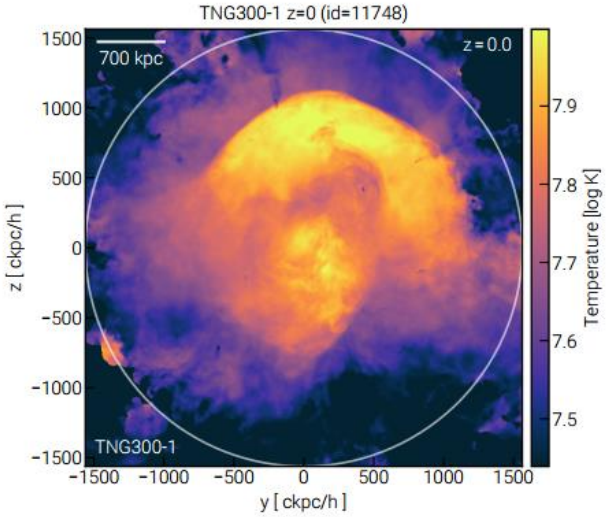


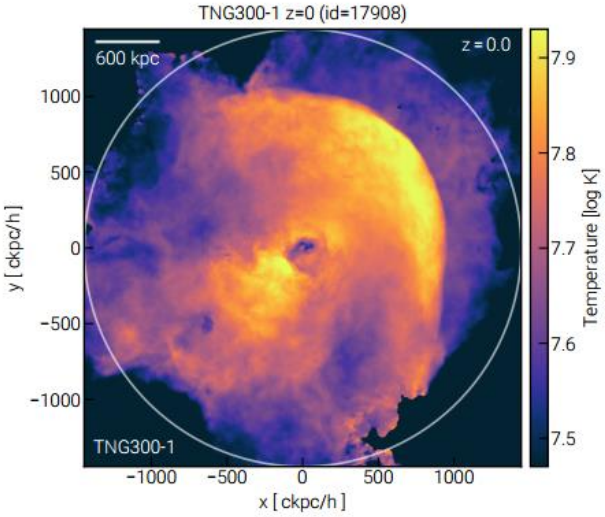


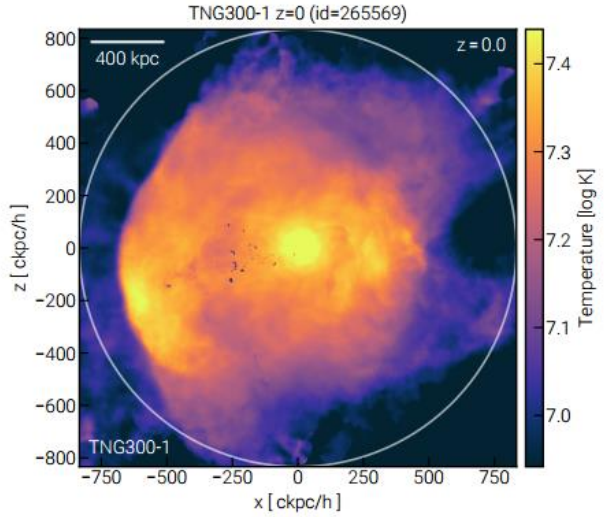


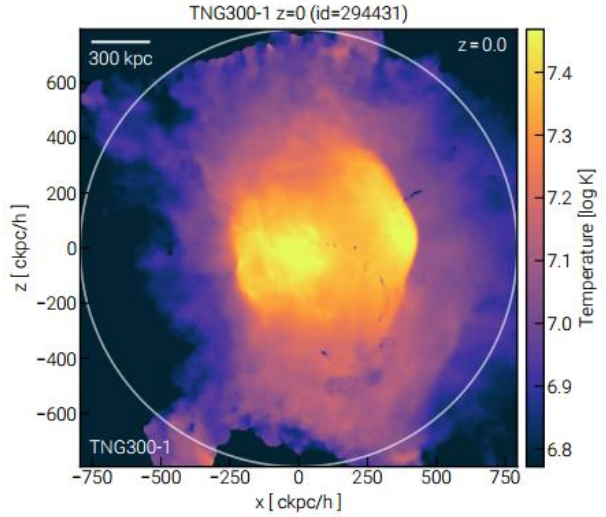
Other examples of merging clusters

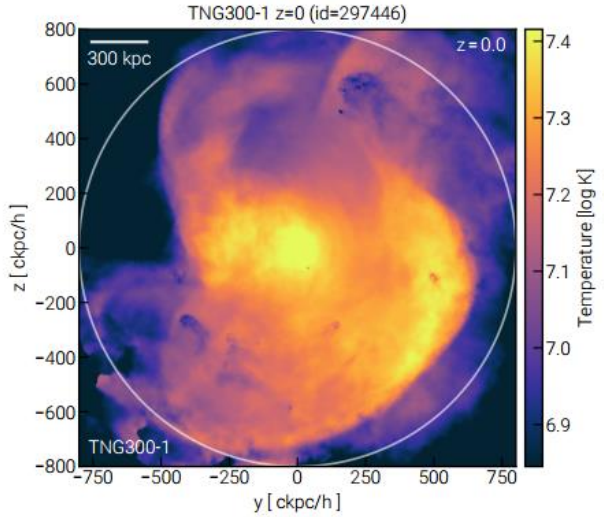




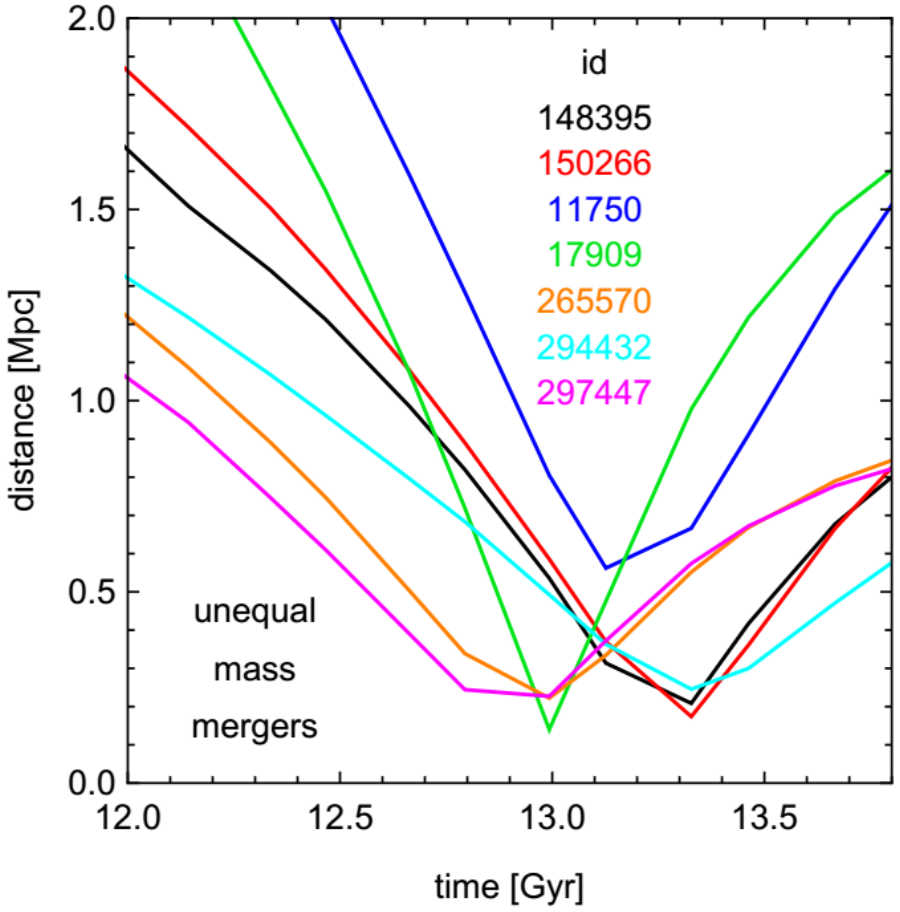








Orbits of subclusters



- The companion cluster passed close to the main one only once, between 0.9 and 0.3 Gyr ago, with the pericenter distance of 100-530 kpc and a velocity of up to 3400 km/s
- The subcluster is typically an order of magnitude smaller in mass than the main cluster before the interaction

Invited talk on tidally induced bars

- Meeting organized to celebrate Lia Athanassoula's career and her pioneering contributions to the field of bar dynamics

- Presentation files are available here: https://zenodo.org/communities/bars2023/