The standard cosmological scenario predicts a hierarchical formation for galaxies. Many substructures have been found in the Galactic halo, usually identified as clumps in kinematic spaces. If they also feature different chemical properties, they are then associated to independent merger debris.

The aim of this study is to explore to what extent we can couple kinematic characteristics and metallicities of stars in the Galactic halo to reconstruct the accretion history of the Milky Way (MW). In particular, we want to understand whether different clumps in the energy-angular momentum space (E âˆ’ Lz) with different metallicity distribution functions (MDF) should be associated to distinct merger debris.

We analysed N-body simulations of a MW accreting a satellite with mass ratio 1:10, with different orbital parameters and metallicity gradients.

We confirm that accreted stars from a âˆ¼1:10 mass ratio merger event redistribute in a wide range of E and Lz, due to the dynamical friction process, thus not being associated to a single clump. Because satellite stars with different metallicities can be deposited in different regions of the E âˆ’Lz space (on average the more metal-rich ones end up more gravitationally bound to the MW), this implies that a single âˆ¼1:10 accretion can manifest with different MDFs.

Groups of stars with different E, Lz and metallicities may be interpreted as originating from different satellite galaxies, but our analysis shows that these interpretations are not physically motivated. In fact, the coupling of kinematic information with MDFs to reconstruct the accretion history of the MW can bias the reconstructed merger tree towards increasing the number of past accretions and decreasing the masses of the progenitor galaxies.