Summary

Dwarf galaxies are the most numerous type of stellar systems in the Universe and due to their low mass, they are very sensitive to the surrounding environment. Because of this, they offer a privileged platform to study and isolate the different physical phenomena affecting galaxy observables. They can be used as probes to characterize the complex interplay between internal processes and the environment in which galaxies evolve.

We carried out simulations of the evolution of dwarf galaxies falling into a Fornax-like Cluster. We selected prototypical dwarf galaxies from the MoRIA suite of simulations and injected them one by one on different orbits. We were interested in following the journey of the galaxies into the cluster and characterize their size, star formation rate, gas and dark matter content, stellar dynamics and evolution, depending on the orbit and the initial mass at the time of orbital injection. To do so, we implemented the Moving Box simulation technique in our in-house simulation code. This allows us to simulate the dwarf-cluster interaction at high resolution while keeping an affordable run time.

We found that during infall, generally, galaxies undergo some "phase transition" happening mainly around pericenter passages. Some of the galaxies are effectively transformed into Ultra Diffuse Galaxies (UDG) while some others are allowed to be briefly identified as "jellyfish". It is therefore possible to hypothesize that the jellyfish phenomenon is a relatively short transitory phase of a dwarf galaxy along its orbit, and it's likely a precursor of the transformation of a dwarf galaxy into an UDG.

Serendipitously we realized that our simulations produce galaxies whose morphology is similar to a galaxy in the Fornax Cluster with a peculiar HI tail and an arrow-shaped stellar body oriented in different directions: NGC 1427A. Multiple formation scenarios have been proposed for this galaxy, but a consensus was still lacking in the literature. We identified that gaseous and stellar tails pointing in different directions are explainable given that they are subject to different environmental effects (ram-pressure stripping and tidal forces). This idea finds support in our simulations and we developed a procedure to quantitatively assess the properties of simulated galaxies from a catalogue of simulations. We were also able to provide some falsifiable predictions on the position of the galaxy with respect to the center of the Cluster and its projected orbital direction.

Finally, we have contributed to the development of a technique to study low dimensional-manifolds in the simulations. We found that the technique can be very useful to isolate the physical properties of filaments

in N-body simulations. In particular we concentrated on the analysis of gaseous tails of simulated jellyfish galaxies with the aim of investigating regions of recent star formation and mixing between the galactic gaseous material and the hot gas of the cluster.