DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

With the change of the seasons, stars appear and disappear in the sky, with around 6000 total visible throughout the year. The stars are very different in color, brightness, and age. Some are yellow, some are red (cooler), some are blue (hotter). Some shine intensely and others shine so tenuously that we do not see them from the earth's surface. Some are young, some are adults and others are elders. Anyhow, a star evolves and changes its structure, from its birth until its death. For some stars like the sun, the final stage of their evolution is a white dwarf.

White dwarfs are, in general, the remnants of ancient stars that exhausted their nuclear furnaces, cooling and losing most of their masses at the end of their active lives, and they have usually the size of the earth. They can be gravitationally bound to another star. When a binary system contains a compact star such as a white dwarf, gas from the other star can be attracted toward the compact object, releasing gravitational potential energy and making the gas become hotter and emit radiation. Such binary systems composed of a white dwarf are known as accreting white dwarf binary systems.

Some of them, called cataclysmic variables, are typically small (usually the size of the Earth-Moon system) with an orbital period of 80 minutes to 10 hours. Others, known as symbiotic stars, are very large systems with orbital periods of the order of years. Others, known as AM CVn systems, consist of a white dwarf which is devouring another white dwarf and their orbital periods are less than 1 hour. Accreting white dwarf binary systems (AM CVn, cataclysmic variables, and symbiotic stars) are prized by astronomers, as they could hold the key to one of the mysteries in contemporary astrophysics: what causes type Ia supernova explosions? This type of supernova, which occurs in binary systems, is important in astrophysics as their extreme brightness makes them an important tool to measure the expansion of the Universe.

In accreting white dwarf binary systems, the white dwarf is often referred to as the "primary" star and the other star as the "companion" star. The companion star loses material onto the white dwarf via accretion. There are probably more than a million of these systems in the Milk Way, but only those near our sun (within several hundred parsecs) have been observed so far. Some of them have also been observed in globular clusters.

Globular clusters have been considered ideal astrophysical systems to explore various aspects of the stellar dynamics and stellar evolution since they are associations from tens of thousands to millions of gravitationally bound stars. They are among the oldest components of the Milky Way and have approximately spherical shape, and they are natural laboratories for studying stellar dynamics and stellar evolution.

In this project, we intend to study accreting white dwarf binary systems in globular clusters. Following the evolution of a globular cluster is a delicate and costly problem. The main challenges are associated with the extreme discrepancy in length and time scales, and the necessity to resolve many different physical processes that act on different timescales. Additionally, the stars evolve with time: they are born, they evolve changing their structures, and they die.

The code that will be used in this project to deal with all these complexities intrinsic to globular clusters is the MOCCA code. MOCCA, additionally to dynamics, can effectively study the evolution of different populations of peculiar objects, including accreting white dwarf binary systems, in an evolving star cluster environment. The high speed of the code and the very detailed information provided by the code about each and every object in the system make the code ideal for simulating thousands of star clusters in a short time.

The demand for such a project concerns the discrepancies between what theory predicts and what is observed. Firstly, the number of predicted cataclysmic variables is extremely large compared with the number of observed ones, and secondly, symbiotic stars and AM CVns are predicted, although they have never been observed. Finally, observational limitations are extremely important and have not been fully taken into account.

In this project, we propose to analyse thousands of globular clusters simulated by MOCCA in order to understand better the properties of the accreting white dwarf binary systems in globular clusters. This will for the first time allow us to predict the properties of these systems in globular clusters; compare whether such population is similar or not to the population close to our solar system; infer how the observational limitations can hide the real population of accreting white dwarf binary systems in globular clusters; and check the relations between the cluster global parameters and the accreting white dwarf binary system properties.