RevMexAA (Serie de Conferencias), **00**, 1–1 (2007)

ABSTRACT

FORMATION OF GLOBULAR CLUSTERS FROM TIDAL STREAMS

J. C. Muñoz-Cuartas[1] and D. Noreña[1]

In this work we explore the idea that globular cluster can be formed from the material left in the tidal streams produced in galaxy minor mergers. We use a series of N-body+SPH+star formation simulations of satellite galaxies undergoing minor mergers with a larger host galaxy, looking for the formation of globular cluster-like systems in the tidal stream formed by the tidally stripped material from the satellite.

We used the information from the phase space of the particle distribution in the simulations to identify the streams and the possible globular cluster candidates inside it. The two approaches adopted to identify candidates were the estimation of the gravitational potential in order to found potential wells generated by cluster-like structures and the estimation of the phase-space density which will reveal the presence of cluster-like candidates as density peaks.

The analysis with the gravitational potential does not reveal very deep potential wells apart from the potential of the satellite itself. By contrast, the density estimation clearly identifies overdensity regions in which a cluster-like structure could be formed. As a first conclusion we argue that without gas, no cluster-like candidate could be formed as none of the overdensities show a definite morphology or stability over time.

Including gas dynamics and star formation results are remarkably different. First of all several well resolved cluster-like clumps appear in the simulations. The candidates obtained proved to be real physical structures that lived for a considerable amount of time ($\geq$ 1Gyr) and whose orbital evolution leads them to be objects in the surroundings of the galactic disk. Nevertheless, there was complete absence of stars formed within the clumps, we estimate this is due to several reasons. First, due to the very high temperature imposed to the gas as in the initial conditions. Second, due to the effect of the model parameters that control star formation, that where chosen to make start formation a difficult process. Even with these hostile conditions, we found that conditions for collapse are fulfilled. Examining the thermodynamic evolution of the clump, the probability of a collapse under real physical conditions seems plausible since quantities as the pressure and the Jeans mass within the candidates could favor cluster formation.

The previous result, complemented with a detailed study of the orbital structure, ages and masses of the globular-cluster candidates found in our simulations lead us to conclude that globular clusters can be formed in tidal streams of minor mergers of gas rich satellites. We performed a detailed numerical convergence study. With this we show that our findings are not numerical artifacts. We found in our simulations evidence favoring the presence of dark matter left over in the globular cluster candidates after the formation process. This adds to the discussion about the formation process of globular clusters and provides an observational mechanism to verify the reliability of the model.

[1] Grupo de Física y Astrofísica Computacional FACom, Universidad de Antioquia, Apartado Aéreo 1226, Medellín, Antioquia, Colombia (david.norena@udea.edu.co).

This work is presented as an Oral Contribution