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Tidal Transformation of Satellites (M33: Stellar Structure)

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1. INTRODUCTION

The proposed topic is the tidal transformation of satellites in relation to the stellar structure of a galaxy. The evolution happens due to the tidal forces of a massive host galaxy close to many satellites (e.g. dwarf galaxies). The massive host then induces variation in the stellar structure of the galaxy, including the central bar and halo of the satellites. Many times in galaxy groups there is an offset of the bar in the main host galaxy compared to its satellites.

It matters because the same principle applies to bigger galaxy pass-by's. In so much as, how galaxies evolve as they merge or pass by each other, and how this affects the evolution both the galaxies and smaller satellite galaxies. The physics and simulations can then predict how galaxies evolved in the past to the present day and the future of the said galaxies' internal structure. Resonant effects on the orbital motion of satellites and the orientation of their angular momentum are strong indicators of how satellites will evolve as it merges with other satellites outside the host galaxy. It can also help to describe the offset of stellar and gaseous disks in galaxies. Lastly, it can help predict where star formation will occur in galaxies and potentially at what rate. Disc galaxies commonly show asymmetric features in their morphology, such as warps and lopsidedness.

Our current understanding of galaxy evolution as it pertains to internal stellar structure is as follows. The bar center of galaxies is coincident with the dynamical center of the said galaxies. This can mean that the bar is not displaced and the stellar disks are instead from the dynamical center. The gas disk, too, moves in conjunction with the stellar disk because of gravitational tidal effects during merges and pass-byes. In addition, tidal interaction effects are strongest for the exact pro-grade orientation in the disk of the dwarf galaxies. In turn, there is a decrease in the satellite's orbital velocity. In the case of exact retrograde, it appears there is no strong evolution (e.g. satellite's stellar component does not form a bar and remains a disk). This is due to the switch in the sign of the Coriolis force acting on the satellite from the host galaxy. Tidal stirring is another phenomenon, where during a merger or pass-bye, mass is lost on the satellite, orbital velocity decreases, and stirring occurs when gas is compressed in the galaxy, which in turn triggers bursts of star formation in the satellite. As satellites approach peri-center, low surface brightness satellites lose most of their dark and stellar mass. This is due to their low-density halos and large disks. Thus the bar becoming weakly unstable. High surface brightness satellites undergo some tidal stripping, and their more self-gravitating disks develop strong central bars. There is strong correlation between internal galaxy properties, such as central stellar surface density and disc radial extension with the strength of lopsided modes. The majority of lopsided galaxies have lower central surface densities and more extended discs than symmetric galaxies. Lopsided galaxies tend to live in asymmetric dark matter halos with high spin, indicating strong galaxy–halo connections in late-type lopsided galaxies. For disc galaxies it can induce the redistribution of stellar mass due to angular momentum transport and the modulation of hosts star formation histories. In addition, the internal torques induced by such m = 1 modes can result in the loss of angular momentum by the host gaseous disc, thus affecting the growth of the central supermassive black hole in the center.

There are many open questions to be studied within the evolution of the internal stellar structure. Such examples show how bulge-less galaxies, with nuclear clusters that are off from dynamical center, formed in the past and how they will continue in the future. It is unknown how the population of blue compact dwarfs identified by Guzman et al. (1997) at intermediate redshifts formed and it's speculated that tidal stirring may have needed to occur. It is yet still unknown how up to 30 per cent of late-type galaxies display a global non-axisymmetric lopsided mass distribution.

2. THE PROPOSAL

2.1. *Proposal*

2.2. *Methods*

2.3. *Hypothesis*