Chance of Non-Nucleated Light Source Superposition on Ultra-Diffuse Galaxy Centers

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This project sought to determine whether Dark Matter dominated galaxies are nucleated. In January of 2015, an article was published that sparked interest in the scientific community. The scientists noticed unusual qualities about 47 galaxies of ~1.5kpc in the Coma cluster, one of the two major clusters in the Coma supercluster. These galaxies display surprising dichotomies that exist among their distinguishing characteristics: they possess high volume while simultaneously having low metallicity, stellar formation rates, and energy radiation. Most resemble red sequence late-type galaxy analogues with low mass, suggesting that they are dark matter-dominated and therefor of great interest to the scientific community. Because of these properties, the 47 objects were made a new classification of galaxies: Ultra-Diffuse Galaxies (UDGs). This project analyzed 275 UDG images that were “the result of automated post processing of data from the Legacy Surveys, a three-band imaging survey covering 14,000 square degrees of the intergalactic sky.” 17 objects in the sample appeared to have nucleated centers, and the focus of this project became to understand if that were true. By first finding out the chance percentage of a superpositioned light source being anywhere on the image, the binomial distribution theorem was used to determine the likelihood of the galaxies identified with a central light source being actually nucleated. The data analysis demonstrated a 79% certainty that the 17 UDGs are nucleated, which is not enough to make the claim that every galaxy possessing a central light source within this project’s criteria is nucleated. Knowing whether or not these DM-dominated objects are nucleated would give insight into the nature of dark matter interactions with itself.

Awards Won:

University of Arizona: Renewal Tuition Scholarship