Comparisons of the Distribution of Dark Matter Across Different Galaxy Types

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Research Question

This study aims to find the distribution of dark matter in a galaxy based on the radius, and then compare the distributions for spiral, elliptical, lenticular, and irregular galaxies. We also want to compare the dark matter distributions in field galaxies to those in a cluster.

Data Sources

For this project, our primary data source will be the SPARC (Spitzer Photometry and Accurate Rotation Curves) database. We plan to use the Basic SPARC Data and Early-Type Data to get data about spiral, elliptical, lenticular, and irregular galaxies. From those datasets, we plan to use the distance, effective radius, surface brightness (mu), rotational velocity, and radius. Using these points, we can calculate mass and luminosity of a galaxy within a specific radius.

Planned Research Process

We would get data of the galaxies' masses and surface from the database SPARC's Photometric Profile and Newtonian Mass Models. We plan to use the formula $M = \dfrac{rv^2}{G}$ to graph the relationship between the radius and the mass of the galaxy within that radius.

The mass-luminosity ratio can then be calculated by dividing the mass (M_{n}) by the luminosity (L_n) as follows:

$$\text{Mass-Luminosity Ratio} = \frac{M_{\text{n}}}{L_n}$$

Where M_{n} is the mass at radius n and L_n is the luminosity at radius n.

Then, we plan to graph the relationship between the radius and the luminosity of the galaxy within the radius. Finally, we would graph the relationship between the radius and the mass-light ratio within that radius. We would compare the relationship between nearby galaxies, and compare the graphs between spiral, elliptical, irregular, and lenticular galaxies.

References

[1] Newman, A. B., Treu, T., Ellis, R. S., et al. 2009, The Astrophysical Journal, 706, 1078

[2] Wechsler, R. H., & Tinker, J. L. 2018, Annual Review of Astronomy and Astrophysics, 56, 435 fbzfx