



Linking Dark and Stellar Substructure in the Illustris TNG50 Simulation

Emmy Bursk [1], Dr. Austin Hinkel [2]

[1] University of Cincinnati, [2] Thomas More University

Galaxy Evolution and the Illustris TNG50 Simulation

Dark matter constitutes a significant portion of the universe's mass and plays a crucial role in shaping the large scale structure of the universe, known as the "cosmic web". This structure channels gas toward galaxies, fueling star formation. The IllustrisTNG project is a cosmological simulation aimed at advancing our understanding of galaxy formation processes.



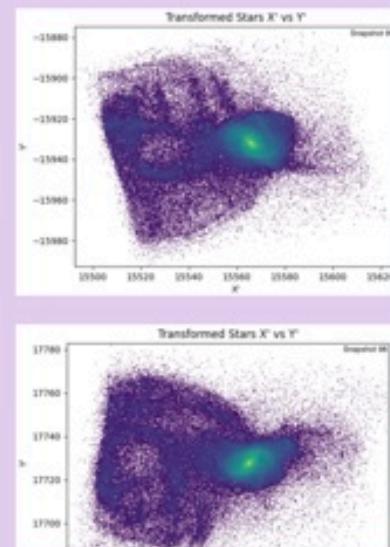
Methodology



Transformed Coordinates of Stars and Misalignment

Galaxy 521429

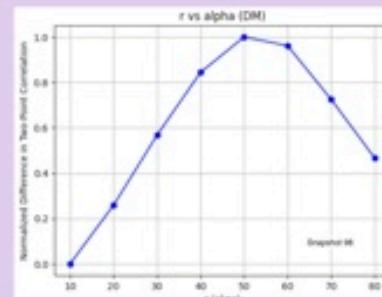
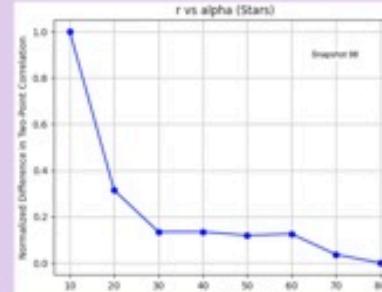
The five figures below illustrate the evolution of a galaxy over a relatively short timescale. Starting with the present day at snapshot 99 (corresponding to a redshift of $z = 0$), we trace the galaxy's history back to snapshot 95 ($z = 0.05$) within a transformed coordinate system. Along this timeline, a merger event becomes evident around snapshot 97 ($z = 0.02$).



Two-Point Correlation Function

Galaxy 521429

The r versus α plot for stars and dark matter from snapshot 99 ($z = 0$) to snapshot 95 ($z = 0.05$) shows the spatial distribution of stars and dark matter within the galaxy. By analyzing the two-point correlation function, we can quantify the clustering of stars and dark matter particles to assess how the galaxy's structure evolves over time.



Future Work

As we continue this study, we will ultimately create tools to analyze spatial structures at specific length scales, aiming to uncover how dark matter shapes the stellar distribution. A key component of this work involves studying the connection between structural characteristics and scale, starting with analyses like the r vs. α relationship. Furthermore, we plan to investigate the alignment between the principal axes of stellar distributions and dark matter, offering deeper insights into their evolution.

Acknowledgements and References

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References

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