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The Number of Tidal Dwarf Satellite Galaxies in Dependence of Bulge Index

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ABSTRACT: We show that a significant correlation (up to 5σ) emerges between the bulge index, defined to be larger for a larger bulge/disk ratio, in spiral galaxies with similar luminosities in the Galaxy Zoo 2 of the Sloan Digital Sky Survey and the number of tidal-dwarf galaxies in the catalog by Kaviraj et al. In the standard cold or warm dark matter cosmological models, the number of satellite galaxies correlates with the circular velocity of the dark matter host halo. In generalized gravity models without cold or warm dark matter, such a correlation does not exist, because host galaxies cannot capture infalling dwarf galaxies due to the absence of dark-matter-induced dynamical friction. However, in such models, a correlation is expected to exist between the bulge mass and the number of satellite galaxies because bulges and tidal-dwarf satellite galaxies form in encounters between host galaxies. This is not predicted by dark matter models in which bulge mass and the number of satellites are a priori uncorrelated because higher bulge/disk ratios do not imply higher dark/luminous ratios. Hence, our correlation reproduces the prediction of scenarios without dark matter, whereas an explanation is not found readily from the a priori predictions of the standard scenario with dark matter. Further research is needed to explore whether some application of the standard theory may explain this correlation.

Summary

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