
Why do massive disc galaxies exist?

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Abstract

In the LCDM paradigm, galaxy merger histories are strongly correlated with their stellar mass, regardless of morphology. Thus, at fixed stellar mass, spheroids and discs share similar merger histories, both in terms of the frequency of mergers and the mass-ratio distribution of these events. Since mergers are the principal drivers of (disk-to-spheroid) morphological transformation, and the most massive galaxies have the richest merger histories, it is surprising that disc galaxies exist at all at the highest stellar masses. We show that the existence of disk galaxies in this mass regime is due to recent gas-rich mergers, which act to spin massive galaxies up, turning them into objects with significant rotational components. The role of gas is therefore crucial in enabling (and determining) the fraction of objects at the high-mass end that are discs at any epoch.

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