Galaxy evolution in compact groups

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Credit: NASA

WED 19/03/2025 -14:00

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Abstract

Compact groups (CGs) provide a valuable opportunity to study how galaxy interactions influence physical and structural parameters due to their high density and low-velocity dispersion. We investigated a sample of 340 CGs, including 1,092 galaxies, and compared it with a control group of 2,300 field galaxies to explore these effects. Our analysis of the Effective Radius–Sérsic Index (Re-n) plane revealed a bimodal distribution among transitioning galaxies in CGs. We define the transition galaxies as those with redder colors ($u-r > 2.3$) and Sérsic indices ($n < 2.5$). This suggests the presence of a distinct population of smaller, more compact galaxies in CGs, a population that is absent in the control sample. This observation indicates that galaxies in CGs may undergo significant morphological changes. Around 27% of the CGs are part of larger groups, which we classify as non-isolated CGs. Transition galaxies in isolated CGs are more likely to cluster in a denser region of the Re–n plane when $n < 1.75$. In contrast, transition galaxies in non-isolated CGs show a more gradual increase in n values, indicating that these galaxies have experienced morphological transformations and are the main contributors to the distribution of more compact galaxies in the Re–n plane among all transition galaxies in CGs. Moreover, galaxies in non-isolated CGs display lower specific star formation rates and a higher proportion of quenched galaxies compared to their isolated counterparts. From these findings, we propose an evolutionary scenario where larger structures accelerate morphological transformations and promote preprocessing. In conclusion, our results highlight the importance of considering the broader environment in which CGs are situated, as this can have a significant impact on the evolutionary paths of their galaxies.

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