Astronomers determine the fate of a compact dwarf galaxy

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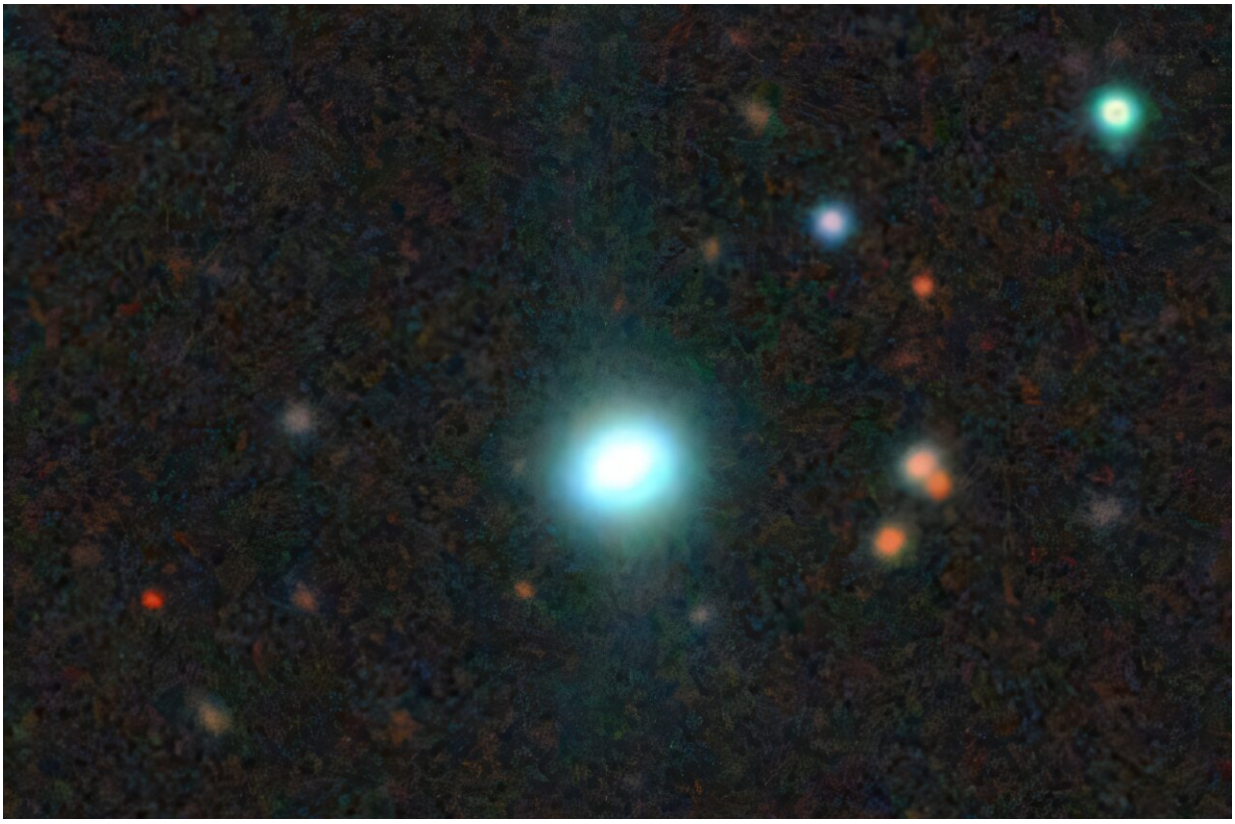

Optical images of J1343+3644. The field of view of the image is 1 × 1 arcmin, where north is the top and east is left. The image is obtained from the Legacy survey sky-server. Credit: *arXiv* (2025). DOI: 10.48550/arxiv.2504.09801

By analyzing the available observational data, astronomers from the Tribhuvan University in Nepal and elsewhere have investigated the

properties of a compact dwarf galaxy designated SDSS J134313.15+364457.5 (or J1343+3644 for short). As a result, they found that J1343+3644 will evolve into a compact elliptical galaxy.

The new finding is reported in a paper published April 14 on the *arXiv* pre-print server.

In general, dwarf galaxies are the most numerous in the universe when compared to other galaxies but are difficult to detect due to their low luminosity, low mass and small size.

J1343+3644 is a compact dwarf galaxy in the process of merging, at a redshift of approximately 0.02, with an r-band absolute magnitude of -19.17 mag. The galaxy has an overall fairly round shape and hosts an elongated low surface brightness tidal tail along the north direction.

Recently, a team of astronomers led by Tribhuvan University's Daya Nidhi Chhatkuli decided to inspect this galaxy in detail in order to explore its possible evolutionary scenario. Observational and theoretical evidence suggests that compact galaxies like J1343+3644 follow diverse evolutionary paths, often involving central starbursts or tidal stripping.

"Early-formed galaxies are notably more compact than those formed later, evident from the smaller sizes of high-redshift galaxies compared to their local counterparts. This raises intriguing questions about the formation and evolution of compact galaxies in the early universe, a significant mystery in modern cosmology," the researchers write in the paper.

The study found that J1343+3644 has a half-light radius of 1,570 light years, a neutral hydrogen mass of about 7.9 billion solar masses, and its star-formation rate is estimated to be at a level of 0.87 solar masses per year. Therefore, J1343+3644 is significantly smaller than other galaxies

with the same brightness and appears to be the most compact early-type galaxy.

Furthermore, it was found that the star-formation activity in J1343+3644 is recent and has a notable portion of the old stellar population. The astronomers suppose that the merger with a satellite galaxy has contributed to the old stellar population and eventually perturbed the primary gaseous disk, leading to a burst of star formation at the center of J1343+3644.

The color profile revealed that the inner part of J1343+3644 is significantly bluer than its outer tidal tail. This difference in color suggests that J1343+3644 may have accreted a non-star-forming dwarf galaxy.

Based on the obtained results, the authors of the paper conclude that when the cessation of star formation occurs in J1343+3644, which is usually expected over a timescale of several hundred million years, the system will most likely evolve into a compact elliptical galaxy.

More information: Daya Nidhi Chhatkuli et al, SDSS J134313.15+364457.5: Forming Compact Elliptical through the Merger, *arXiv* (2025). DOI: 10.48550/arxiv.2504.09801