GALAXIES

Cracking stellar shells

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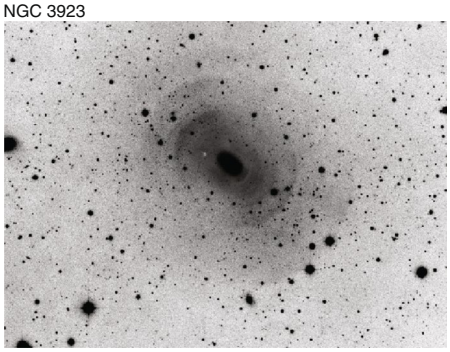
NGC 3923



Credit: Oxford Univ. Press

Galaxies come in all shapes and sizes. Astronomers use a galaxy's morphology to deduce its evolutionary history. Some galaxies show distinct shells of stars (pictured), that can often be multiple, symmetric and emanating from the centres of the galaxies outward. As the origins of these shells are under debate, Ana-Roxana Pop and collaborators dive into the rich Illustris cosmological simulations and find that the majority of these shells are products of relatively recent major galaxy mergers.

Illustris is a suite of hydrodynamical simulations that trace the evolution of tens of thousands of galaxies. Pop et al. selected the ~200 most massive simulated galaxies at a redshift of $z = 0$ and identified those with shells. The selection was achieved by studying the history of individual star particles in each galaxy and tracing their origins back to satellite galaxies that had been accreted onto the main galaxy. The authors find that ~18% of their sample of galaxies have stellar shells. This fraction goes up for more massive galaxies and down when considering galaxies at higher redshifts.

By comparing the shell-forming accreted satellites to the general satellite population, the authors found that the mass ratio between shell-forming satellites and the main galaxy is preferentially larger than 0.1, implying a major merger. Moreover, these satellites were accreted 5–8 Gyr ago (and hence the shells have not had time to mix and therefore dissipate) and were mainly on radial orbits. While these conditions are sufficient, they do not appear to be necessary and 'pathological' shells that do not fit this mould were also identified by the authors. Nevertheless, this study showcases the power of Illustris in understanding the morphology of galaxies in a physical rather than a phenomenological way.

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