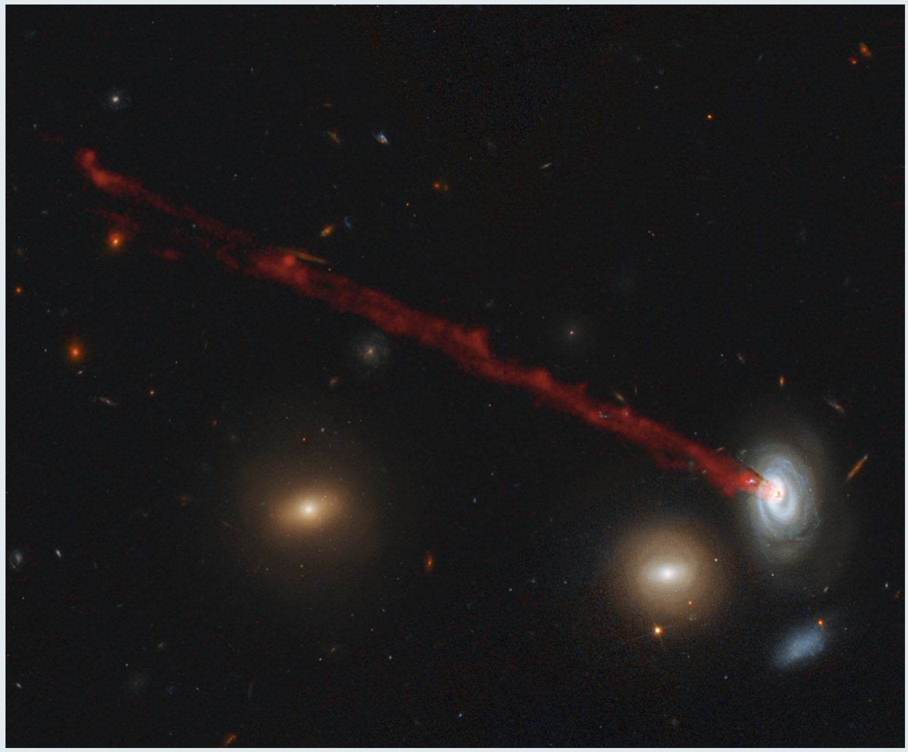
GALAXY CLUSTERS

Under (ram) pressure

Galaxy clusters are considered to be galactic incubators that accelerate the evolution of galaxies within them. One of the effects that might induce such an accelerated evolution is ram-pressure stripping. A galaxy falling into a cluster's gravitational potential feels pressure due to interaction with the intracluster medium. This ram pressure can lead to gas from the infalling galaxy being stripped, potentially leading to depletion of its gas reservoirs and hence limiting its capacity to form stars. William Cramer and collaborators used very sensitive Hubble Space Telescope (HST) observations to constrain the gas and star formation properties of such a galaxy undergoing ram-pressure stripping within the Coma cluster (preprint at https://arxiv.org/abs/1811.04916; 2018).

The Coma cluster contains more than a thousand confirmed galaxy members and is at a distance of roughly 0.1 Gpc from Earth. D100 is a spiral galaxy at approximately 240 kpc from the cluster centre that shows a 60-kpc-long and 1.5-kpc-wide tail (long bright-red plume, pictured) that was originally observed in ionized Hα emission. The new HST observations in the ultraviolet and optical allowed the identification of star-forming regions within the tail, as well as the mapping of its dust content and structure. The authors identified young (<100 Myr) stellar complexes within the tail and concluded that the star formation rate of the tail is no more than 0.01 $M_{\odot}$ yr^{-1}. This rate is considerably lower than that anticipated based on the ionized Hα emission from the tail. Together with a spatial displacement between the Hα and HST ultraviolet flux peaks in the tail, this result implies that something else is responsible for the ionization of the gas other than young stars.



Credit: STScI/J. DePasquale

The authors also looked at star formation in the main body of the galaxy D100 itself. They find evidence for outside–in quenching of star formation, supported by gradients in the HST colours and strong dust absorption in the inner regions of the galaxy. Such a pattern is expected since ram-pressure stripping mainly affects the outer parts of a galaxy's disk. Intriguingly, the authors also find tendril-like structures — thin, long and obliquely curved — in the outskirts of the galaxy disk containing, potentially, young stars. While their origin remains unclear, a potential scenario involves stars being formed in the tail and then falling back onto the galaxy, a process that has already been seen in simulations of similar systems. ❐

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