GALAXY CLUSTERS

Delayed environmental quenching of star formation

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Understanding the molecular gas properties of galaxies at high redshifts, especially in the dense environments of galaxy clusters — clusters are known to accelerate galactic evolution — is crucial in understanding how today's massive galaxies grew to become what they are now. Tao Wang and collaborators show that while galaxies found within the core of a high-redshift cluster have a deficit of molecular gas, counterintuitively, their star formation efficiency is high.

Wang et al. use the Karl G. Jansky Very Large Array and other radio observing facilities to measure the CO content of cluster galaxies at $z = 2.51$. Translating CO to a total molecular gas content and having also measured the total far-infrared luminosities of these galaxies, the authors are able to constrain the star formation efficiency of cluster members as a function of their distance to the cluster centre. They find a clear trend: galaxies closer to the cluster core have less molecular gas than field galaxies with similar star formation properties (selected using the 'main sequence' of star forming galaxies at this redshift), but, intriguingly, higher star formation efficiency.

This study helps pinpointing how environmental effects can lead to the accelerated evolution of cluster members into passive galaxies. Candidate mechanisms include tidal stripping, gas strangulation and ram pressure stripping. The delayed quenching of star formation implied by the results of Wang et al. — molecular gas seems to have been removed but star formation has not yet stopped — combined with the short gas depletion timescales calculated by the authors, lend support to ram pressure stripping driving the transformation of these galaxies.

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