

## research highlights

### GALAXY CLUSTERS

#### Seeds of change

*Astrophys. J.* (in the press); preprint available at <https://arxiv.org/abs/1611.07976>

At redshift  $z = 2$ , Cl J1449+0856 is the most distant confirmed galaxy cluster. It has a heterogeneous population of densely packed galaxies and is an ideal candidate for studying the evolution of protoclusters to massive clusters around ten billion years ago. Veronica Strazzullo and colleagues use Hubble Space Telescope observations (Wide Field Camera 3) to investigate the optically red galaxies. This 'red population' lies near the core of the galaxy cluster and has been shown to contain both passively evolving (lying along the 'red sequence' of galaxy evolution) and actively star-forming galaxies.

In addition to the Hubble images, the authors include their previous optical/near-infrared observations to distinguish the red galaxies in the central region of the cluster from interlopers and possible members. The latest study confirms a mixture of quiescent and star-forming populations. But the team also noted a dominance of red galaxies with suppressed star formation. They suggest the presence of a 'seedling' of a future red sequence, which may signal a transition phase between active star formation and quiescent, passive evolution.

As Cl J1449+0856 has the mass of an average progenitor of today's average massive cluster, further studies will help to shape the debate on the formation and evolution of galaxy clusters.

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