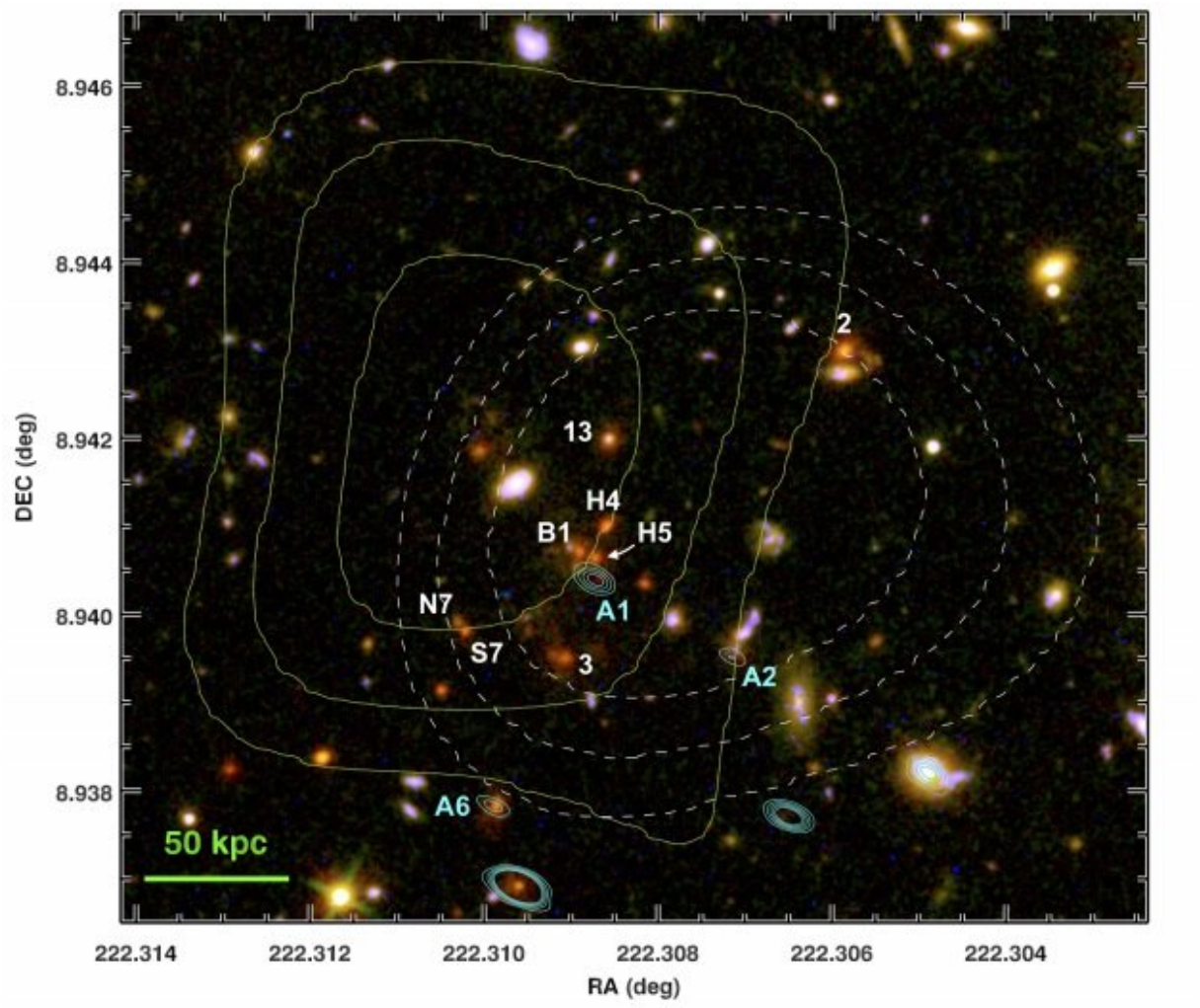
Astronomers identify faint radio-jets in the galaxy cluster CLJ1449+0856

March 2 2021, by Tomasz Nowakowski



HST/WFC3 color composite image of CL J1449+0856. Credit: Kalita et al., 2021.

Using ground-based facilities and space telescopes, an international team of astronomers has conducted multiwavelength observations of a galaxy cluster known as CLJ1449+0856. The observational campaign detected multiple faint radio-jets, what could shed more light on the nature of this cluster. The finding is reported in a paper published February 23 on the arXiv pre-print server.

Galaxy clusters consist of up to thousands of galaxies bound together by gravity. They are the largest gravitationally bound structures, and could therefore be crucial in improving the knowledge about large-scale structure formation and evolution of the universe.

At a redshift of 1.99, CLJ1449+0856 is a cluster in a phase of galaxy assembly and star formation quenching which is expected to create a dominant population of massive and passive galaxies. However, unlike the less evolved protoclusters, this one features an extended X-ray emission originating most likely from its hot intra-cluster medium (ICM) plasma.

In order to get more insights into the properties of CLJ1449+0856, a team of astronomers led by Boris S. Kalita of the University of Paris, France, has carried out a multiwavelength study of this cluster. For this purpose, they combined 3.0 GHz data obtained by the Very Large Array (VLA) with Atacama Large Millimeter/submillimeter Array's (ALMA) sub-millimeter and Hubble Space Telescope's (HST) near-infrared observations. The study was complemented by datasets from the Giant Metrewave Radio Telescope (GMRT), XMM-Newton telescope and Chandra X-ray observatory.

As a result of this observational campaign, the researchers have identified multiple radio emission regions in CLJ1449+0856 without any counterparts in the HST near-infrared as well as 870 μm continuum data.

"Detection of multiple radio-jet sites in a cluster core is in stark contrast to low redshift counterparts, which predominantly feature centrally placed radio AGN-jets [active galactic nuclei-jets]," the authors of the paper explained.

The possible association of these radio sources with known galaxies due to physical proximity for four out of six of these objects without any overlap allowed the astronomers to conclude they are indeed AGN radio-jets. The total flux from all the detected jets was measured to be at a level of about 30.6 μJy.

Their power contribution of the six newly detected jets was estimated to be at least 120 tredecillion erg/s. This is approximately 25% of the previously estimated instantaneous energy injection into the ICM of CLJ1449+0856 from AGN outflows and star formation.

In general, the researchers noted that the results point out to accretion of gas into the cluster center of CLJ1449+0856 and also suggest a "steady state" of the cluster featuring non cool-core like behavior.

"We are possibly witnessing a 'steady state' of the cluster ICM due to a rather constant version of the AGN feedback driven loop," the scientists concluded.

More information: Feedback Factory: Multiple faint radio-jets detected in a cluster at z=2, arXiv:2102.11752 [astro-ph.GA] arxiv.org/abs/2102.11752

https://phys.org/news/2021-03-astronomers-faint-radio-jets-galaxy-cluster.html