Radio halo detected in the galaxy cluster
PSZ2 G099.86+58.45
31 July 2019, by Tomasz Nowakowski

With the capability of obtaining deep, high-resolution, high-fidelity and low-frequency radio images, LOFAR is an excellent tool to study radio halos at low frequencies with unprecedented detail and sensitivity. So a group of astronomers led by Rossella Cassano of Institute for Radio Astronomy of Bologna, Italy, employed LOFAR for the observations of the galaxy cluster PSZ2 G099.86+58.45.

At a redshift of approximately 0.62, PSZ2 G099.86+58.45 (PSZ2G099 for short) is a massive and hot galaxy cluster of about 684 trillion solar masses. Observations have shown that the cluster resides in a high-density environment, about six times denser than the average Lambda cold dark matter (LCDM) model prediction at this redshift.

Cassano's team investigated PSZ2G099 with LOFAR as part of the LoTSS (LOFAR Two-meter Sky Survey) program. They also conducted follow-up observations of the cluster using the Karl G. Jansky Very Large Array (JVLA). All in all, the observational campaign resulted in the detection of a radio halo in this object.

"In this letter, we report the discovery of a radio halo in the high-redshift galaxy cluster PSZ2 G099.86+58.45 (z = 0.616) with the LOw Frequency ARray (LOFAR) at 120-168 MHz," the astronomers wrote in the paper.

In particular, LOFAR observations at medium resolution revealed extended diffuse emission at the center of PSZ2G099, with dimensions measured at around 3.9 by 1.95 light years. As expected, this emission is very faint at higher frequencies and therefore was barely detected by JVLA.

The astronomers added that the morphology of the observed radio emission resembles that of the X-ray emission as seen on images provided by ESA's XMM-Newton spacecraft.
Taking into account the emission's extension, morphology, and location in the cluster, the researchers classified it as a radio halo. Moreover, the cluster's redshift places it among the most distant radio halos discovered so far, and the furthest away detected by LOFAR.

In concluding remarks, the authors of the paper report that the study shows LOFAR's potential as a unique system to discover radio halos at high redshift. Given that the fraction of clusters with radio halos at high redshift and their luminosity depend on the magnetic field, the scientists hope that LOFAR statistical studies of such halos could deliver essential information on the origin of magnetic fields in galaxy clusters.


© 2019 Science X Network

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.