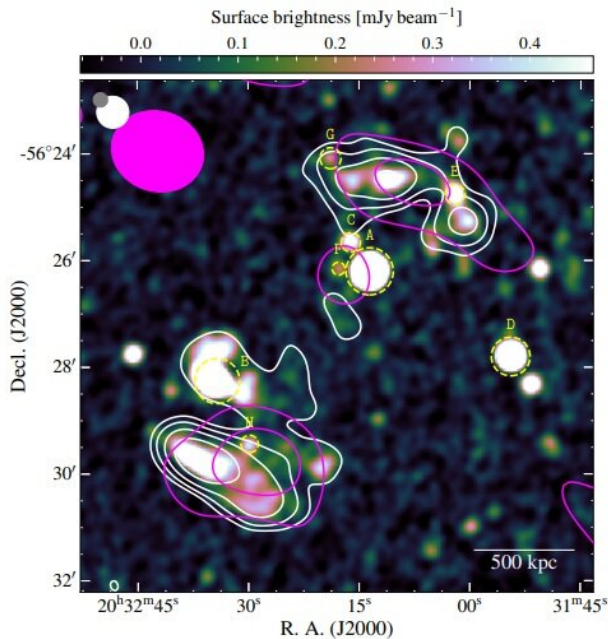


Radio relics detected in the galaxy cluster SPT-CL J2032?5627

11 August 2020, by Tomasz Nowakowski



Radio data for SPT-CL J2032?5627. The background image is the robust +0.25 fullband ASKAP data, and the contours are as follows: ASKAP low resolution, compact-source-subtracted; white, ATCA low resolution and compact-source-subtracted; magenta. The beam shapes are shown as ellipses in the top left corner, with grey corresponding to the background map. Credit: Duchesne et al., 2020.

Using the Australian Square Kilometer Array Pathfinder (ASKAP), astronomers have performed observations of a cluster of galaxies known as SPT-CL J2032?5627. They identified two radio relics that could improve our knowledge about this cluster. The finding is reported in a paper published August 3 on arXiv.org.

Radio relics are diffuse, elongated radio sources of synchrotron origin. They occur in the form of spectacular single or double symmetric arcs at the peripheries of galaxy clusters. Astronomers are especially interested in the search for double relics

as such features could provide crucial information about cluster mergers and the resultant emission.

SPT-CL J2032?5627 is a galaxy cluster discovered in 2012 by the South Pole Telescope (SPT) at a redshift of approximately 0.284. According to previous studies, the mass of this cluster is estimated to be around 500 trillion solar masses.

Now, a team of astronomers led by Stefan W. Duchesne International Center for Radio Astronomy Research (ICRAR) has reported the detection of a double relic in SPT-CL J2032?5627 by analyzing observations conducted with ASKAP. Their study was complemented by data from the Australia Telescope Compact Array (ATCA), the Molonglo Observatory Synthesis Telescope (MOST), the Murchison Wide-field Array (MWA), and from ESA's XMM-Newton spacecraft.

"We present a radio and X-ray analysis of the galaxy cluster SPT-CL J2032?5627. Investigation of public data from the Australian Square Kilometer Array Pathfinder (ASKAP) at 943 MHz shows two previously undetected radio relics at either side of the cluster," the astronomers wrote in the paper.

According to the study, the two relics are clearly detected in the ASKAP dataset as well as in the 5.5-GHz ATCA data. The two relics were identified at around 2.77 and 2.61 million light years from the cluster center in the southeast and northwest directions, respectively.

The projected linear sizes of the southeast and northwest relics were measured to be 2.38 and 2.8 million light years. It was noted that both sources have steep integrated radio spectra. The spectral index of the southeast relic was found to be -1.33, while for the northwest one it is estimated to be at a level of -1.16.

Astronomers assume that radio relics may be generated from shocks in the intra-cluster medium

(ICM). However, in the case of SPT-CL J2032?5627 no shocks were detected, and a temperature map reveals only potential cold fronts preceding the two relic sources. The astronomers explained that the lack of detectable shock may be due multiple shocks along the line of sight or due to limitations of XMM-Newton.

The researchers also compared the double relic of SPT-CL J2032?5627 with other such features in various galaxy clusters.

"The relic properties are largely consistent with the established relic population, though they lie slightly below the P–M [power-mass] scaling relation for double relic systems," the scientists concluded.

Duchesne's team hopes that surveys like the Evolutionary Map of the Universe (EMU), which utilizes ASKAP, will be able to uncover a real wealth of new radio relics and other ICM-based diffuse radio sources.

More information: Duchesne et al., SPT-CL J2032-5627: a new Southern double relic cluster observed with ASKAP, arXiv:2008.00660 [astro-ph.GA] arxiv.org/abs/2008.00660

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