Long-term radio observations track the evolution of a tidal disruption event

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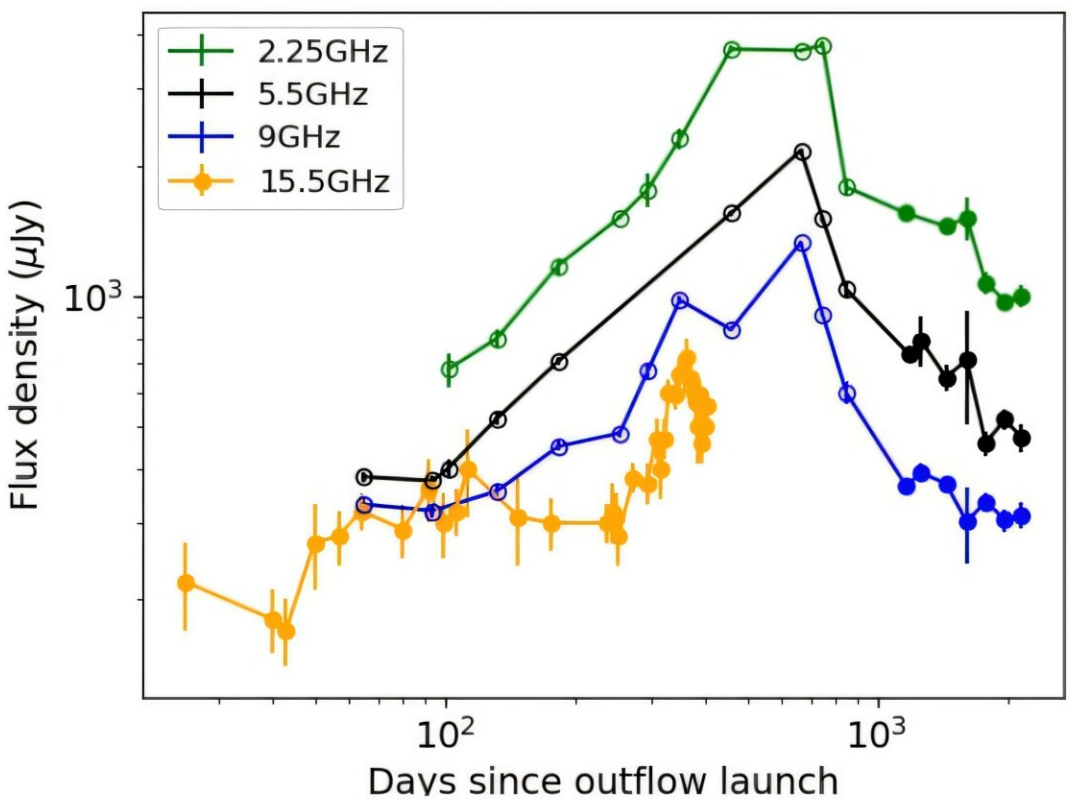

2.25, 5.5, 9, and 15.5 GHz light curve of AT2019azh. Credit: *arXiv* (2025). DOI: 10.48550/arxiv.2509.17525

Astronomers from Curtin University in Australia and elsewhere have performed radio observations of a tidal disruption event known as AT2019azh. Results of the new study, published September 22 on the *arXiv* preprint server, provide crucial information regarding the evolution of this event.

Tidal disruption events (TDEs) are phenomena that occur when a star passes close enough to a supermassive black hole (SMBH) and is destroyed by the black hole's tidal forces. As a result, around half of the stellar debris is unbound from the system, while the rest of the material remains bound, producing a luminous flare as it accretes onto the SMBH.

AT2019azh is a TDE at a redshift of 0.022, detected in 2019 in the galaxy KUG 0180+227. It showcases persistent blue colors, has a high blackbody temperature, and previous observations have reported a lack of spectroscopic features associated with a supernova or an active galactic nucleus (AGN), which confirmed its TDE nature.

A team of astronomers led by Curtin University's Matthew Burn has conducted long-term radio monitoring of AT2019azh with the Very Large Array (VLA). The observations, carried out between April 2022 and July 2024, were performed with the aim of better understanding the evolution of this TDE a few years after the disruption.

"We observed the radio evolution of AT2019azh from ~1,000-2,000 days post disruption. (...) Analysis of radio emission from tidal disruption events allows for detailed constraints on the properties of ejected outflows and the host environment surrounding the black hole," the researchers explained.

The observations found that the radio emission from AT2019azh has continued to decay at all frequencies after its peak reported by previous studies (about 650 days after the disruption). It does not show late time re-brightening up to six years post-disruption, which has been seen in a number of other known TDEs.

In particular, the collected data show that at all frequencies, the radio emission from AT2019azh initially decayed steeply post-peak, before flattening at times over 1,000 days post disruption, which is most pronounced at 9.0 GHz. Moreover, both the 5.5 GHz and 2.25 GHz light curves appear to be flattening in the last three epochs (more than 1,700 days after the disruption).

By modeling the light curve evolution of AT2019azh, the astronomers found a very flat circumnuclear medium (CNM) density profile, which is flatter when compared to other CNM densities in the sample of known TDEs.

According to the authors of the paper, the obtained results generally support the scenario in which the outflow from AT2019azh was produced by a single ejection of material close to the time of stellar disruption. Furthermore, the current rate of the evolution of AT2019azh indicates that radio afterglow from this TDE should be detectable for decades.

More information: Matthew Burn et al, The 6 year radio lightcurve of the tidal disruption event AT2019azh, *arXiv* (2025). DOI: 10.48550/arxiv.2509.17525