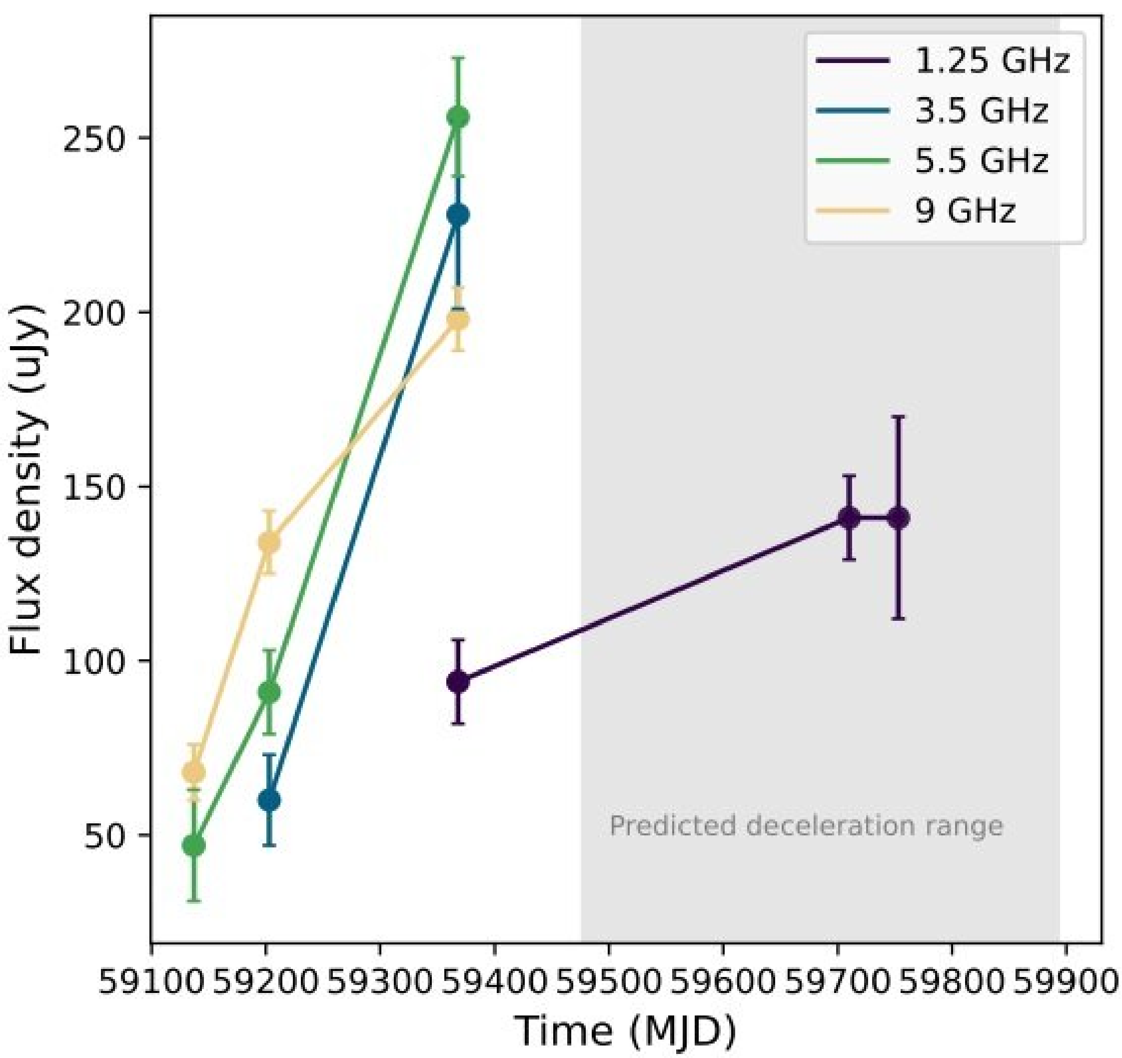
Tidal disruption event AT2020opy investigated with radio telescopes

September 6 2022, by Tomasz Nowakowski



Radio light curve of AT2020opy at 1.25, 3.5, 5.5, and 9 GHz. Credit: Goodwin et al., 2022.

An international team of astronomers has inspected a tidal disruption event (TDE) known as AT2020opy using various radio telescopes. Results of the study, published August 30 on the arXiv pre-print server, could shed more light on the origin and nature of the TDE phenomenon.

TDEs are astronomical phenomena that occur when a star passes close enough to a supermassive black hole and is pulled apart by the black hole's tidal forces, causing the process of disruption. Such tidally disrupted stellar debris starts raining down on the black hole and radiation emerges from the innermost region of accreting debris, which is an indicator of the presence of a TDE.

For astronomers and astrophysicists, TDEs are potentially important probes of strong gravity and accretion physics, providing answers about the formation and evolution of supermassive black holes.

Recently, a group of astronomers led by Adelle J. Goodwin of Curtin University in Perth, Australia, has performed radio observations of AT2020opy—a TDE first detected on July 8, 2020 by the Zwicky Transient Facility (ZTF) at a redshift of 0.159. The scientists investigated the radio evolution of this TDE with Karl G. Jansky Very Large Array (VLA), MeerKAT radio telescope, and upgraded Giant Metrewave Radio Telescope (uGMRT).

"In this work we present the radio detection of AT2020opy, including three epochs of radio spectral observations of the event over eight months," the researchers wrote in the paper.

The observations found that radio properties of AT2020opy indicate that a non-relativistic outflow was launched at the time of or just after the initial optical flare was observed from the source. It was calculated that the outflow has an approximately constant velocity at a level of approximately 30,000 km/s and energy of about one quindecillion erg for radii of 0.01 light years.

Therefore, the astronomers concluded that the radio emission from AT2020opy is likely due to this non-relativistic outflow, which could take the form of a spherical wind, collision induced outflow or a mildly collimated jet. Based on the synchrotron spectral modeling of the radio emission, the researchers concluded that the circumnuclear medium of the host galaxy of AT2020opy is denser than inferred for other TDE hosts. This causes brighter, quickly rising radio emission from the outflow.

According to the study, in the case of an outflow like the one observed in AT2020opy, the radio emission can continue to increase for up to years after the initial event, depending on the energy available in the outflow and the density of the circumnuclear medium.

Summing up the results, the researchers noted that their findings make AT2020opy the most distant thermal TDE with radio emission reported to date. They propose follow-up observations of this event in order to continue to observe the long-term decay of the radio emission.

More information: Adelle J. Goodwin et al, Radio observations of the tidal disruption event AT2020opy: a luminous non-relativistic outflow encountering a dense circumnuclear medium. arXiv:2208.13967v1 [astro-ph.HE], arxiv.org/abs/2208.13967

© 2022 Science X Network

Citation: Tidal disruption event AT2020opy investigated with radio telescopes (2022, September 6) retrieved 25 April 2024 from https://phys.org/news/2022-09-tidal-disruption-event-at2020opy-radio.html

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.