Microquasar study reveals the structure of faraway radio galaxies

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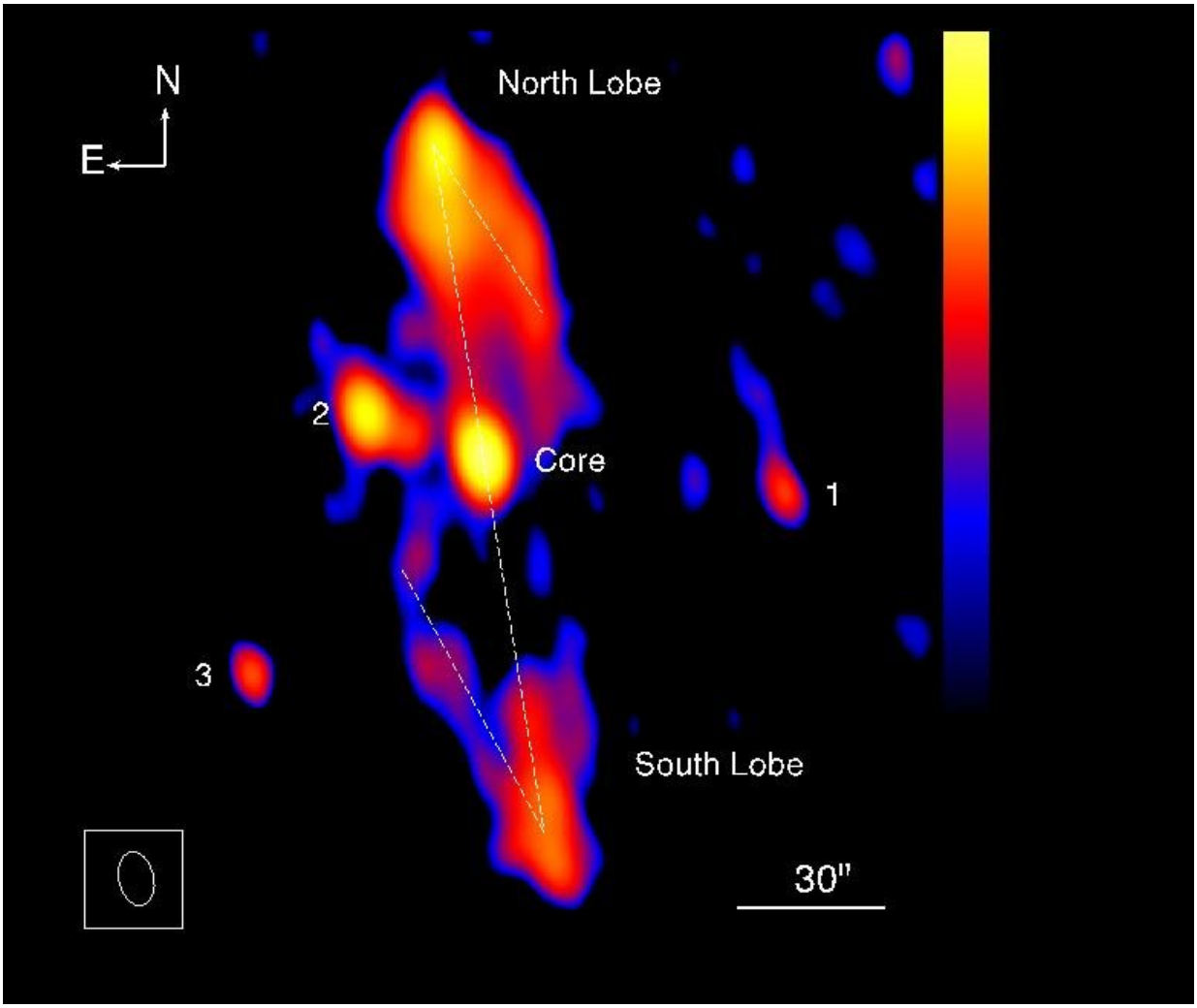

Picture of the GRS 1758-258 microquasar, obtained with the Jansky Very Large Array radiotelescope at 5 GHz frequency radio waves. The white line shows the Z-shape path formed by the relativistic plasma produced in the core region, where the black hole is located. Credit: Universidad de Barcelona

Researchers from the Institute of Cosmos Sciences of the University of Barcelona (ICCUB) and the University of Jaén have described, for the first time, the structure of a Z-shaped galactic microquasar. This astronomical object is considered to be a small-scale version of a winged radio galaxy, so far considered among the distant potential emitters of gravitational waves. The main conclusion of the study, published in *Nature Communications*, is that not all winged radio galaxies are sources of gravitational waves.

Microquasars are an astronomical objects fed by stellar black holes, which are smaller than the ones at the center of radio galaxies. They produce radio jets in opposite directions. "We determined that the Z-shaped morphology of the studied microquasar, the GRS 1758-258, can be explained with hydrodynamic interactions with the surrounding medium," says Josep M. Paredes from ICCUB.

Extrapolated results suggest that this scenario could work in winged radio galaxies, since these objects follow the same physical laws. So far, it was thought that those radio galaxies were X or Z shaped due the merger of two black holes, a process in which gravitational waves are generated. When these waves are produced at such a long distance, it is not possible to distinguish them individually, and gravitational wave background noise is created.

"Our results show that not all winged radio galaxies would be the origin of gravitational waves, which was commonly believed so far," says Valentí Bosch Ramon, researcher from the ICCUB. "Some of them owe their structure to hydrodynamic processes that would not create these kind of waves. Considering these results, the background of gravitational waves would be weaker than thought so far," concludes the researcher.

In order to determine the Z-shape of the GRS 1758-258 microquasar, several observations were made with the Jansky Very Large Array in New Mexico. The results were added to all the observations of the same microquasar that were carried out in previous decades. Gathering all this data made it possible to reach the required sensitivity to describe the Z-shape of GRS 1758-258 and deduce the processes that form it.

More information: Josep Martí et al. A galactic microquasar mimicking winged radio galaxies, *Nature Communications* (2017). DOI: 10.1038/s41467-017-01976-5

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