Study investigates dual nuclei in the galaxy merger remnant Mrk 212

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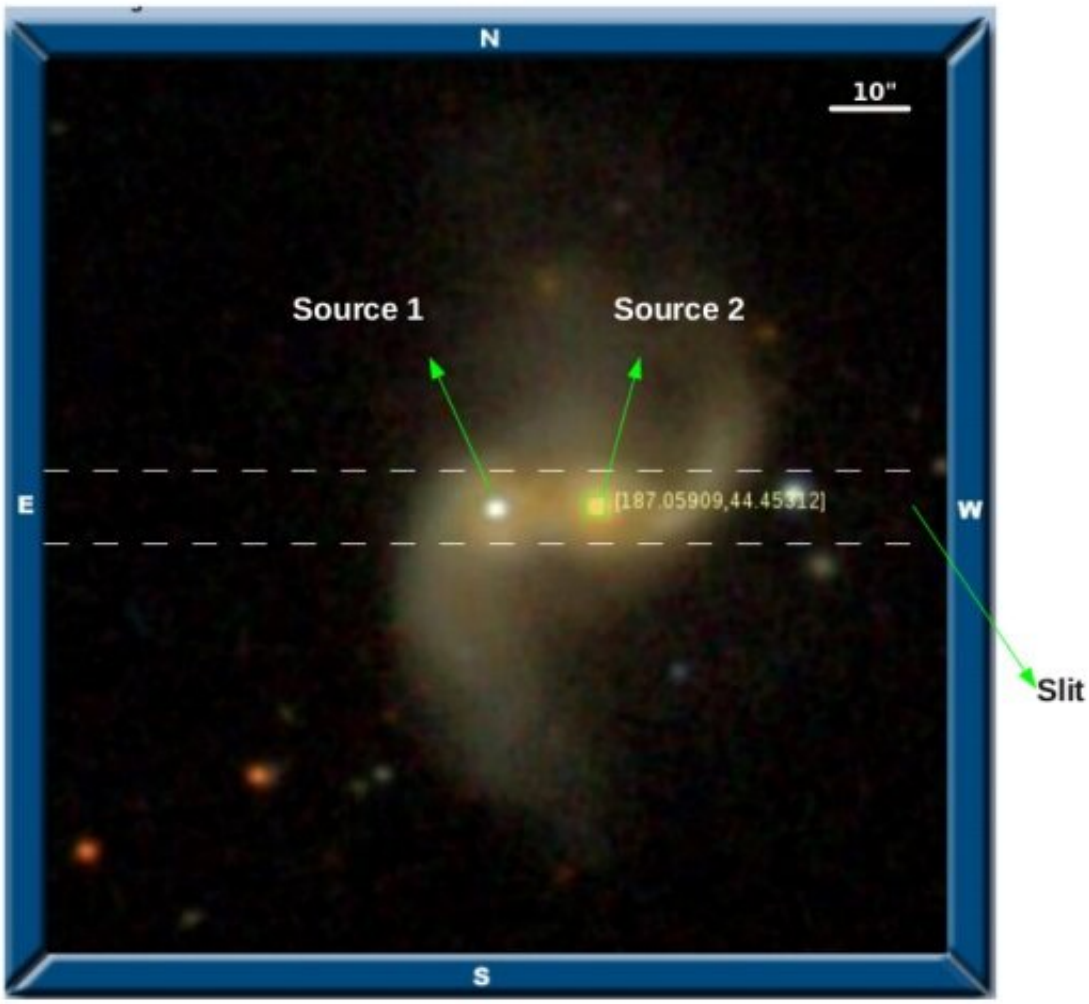

The SDSS color composite image of Mrk 212. The slit position of the HCT observations is indicated by the dashed line. Mrk 212 is referred to as Source 1 (S1) and the companion as Source 2 (S2). Credit: Rubinur et al., 2020.

Using the Karl G. Jansky Very Large Array (VLA) and the upgraded Giant Meter Radio Telescope (uGMRT), astronomers have conducted multi-wavelength observations of a galaxy merger remnant known as Mrk 212. Results of this observational campaign, presented in a paper published October 28 on arXiv.org, shed more light on the properties and nature of this remnant.

Galaxy mergers play an essential role in the evolution of galaxies. Major mergers even have the ability to change the shape of the parent galaxies and form an object with a completely new morphology.

Observations show that gas inflow during galaxy mergers can trigger mass accretion onto the supermassive black holes (SMBHs), turning them into active galactic nuclei (AGN). When both SMBHs are ignited at the same time, it may form AGN pairs. If the separation between the two AGN is less than 326 light years, they are known as binary AGN. In the case that the separation is bigger, astronomers call them dual AGN.

At a luminosity distance of about 322 million light years, Mrk 212 is a galaxy merger remnant with two known radio sources associated with two optical nuclei, designated S1 and S2. The projected separation between the two nuclei is estimated to be around 18,250 light years, making it a dual AGN candidate.

A team of astronomers led by Khatun Rubinur of the Indian Institute of Astrophysics in Bangalore, India, made deep radio, optical and ultraviolet observations of Mrk 212 using VLA and uGMRT. The main goal of this monitoring campaign was to confirm the object's dual AGN nature and to provide more insights into the properties of this source.

"We have carried out a multi-wavelength study of the merging galaxy

Mrk 212 that possesses two optical nuclei S1 and S2 at a projected separation of ~ 11.8" or ~ 6 kpc," the astronomers wrote in the paper.

VLA observations revealed a double radio source associated with S1 and a compact radio structure associated with S2. The VLA images also show an extended radio structure at 8.5 GHz that, located one arcsecond away from the S2 optical nuclei, which has a relatively flat spectral index and is assumed to be a compact core.

The researchers found that the total extent of S1 is about 2,445 light years and its average 1.4–8.5 GHz spectral index is at a level of approximately –0.81. These properties mean that S1 resembles a compact symmetric object (CSO).

According to the study, the presence of the compact radio core and the presence of AGN emission lines in the optical spectrum of S2 suggest the presence of another AGN in S2. Moreover, the optical observations show that S1 and S2 both fall in the AGN+SF (star formation) region in the BPT (Baldwin, Philips and Terlevich) diagram. All in all, the astronomers concluded that the obtained results strongly support the dual AGN nature of Mrk 212.

More information: Rubinur et al., A Multi-wavelength Study of the Dual Nuclei in Mrk 212, arXiv:2010.14914 [astro-ph.GA] arxiv.org/abs/2010.14914