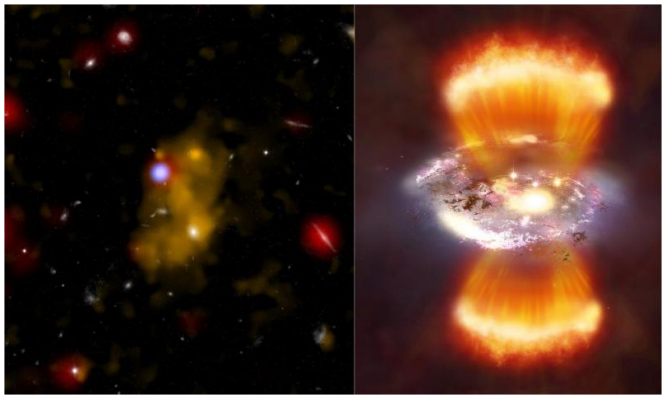
Expanding super bubble of gas detected around massive black holes in the early universe

30 March 2017



Left - Composite image of a large gas blob of glowing hydrogen gas, shown by a Lyman-alpha optical image (colored yellow) from the Subaru telescope (NAOJ). A galaxy located in the blob is visible in a broadband optical image (white) from the Hubble Space Telescope and an infrared image from the Spitzer Space Telescope (red). Finally, the Chandra X-ray Observatory image in blue shows evidence for a growing supermassive black hole in the center of the galaxy. Radiation and outflows from this active black hole are powerful enough to light up and heat the gas in the blob.

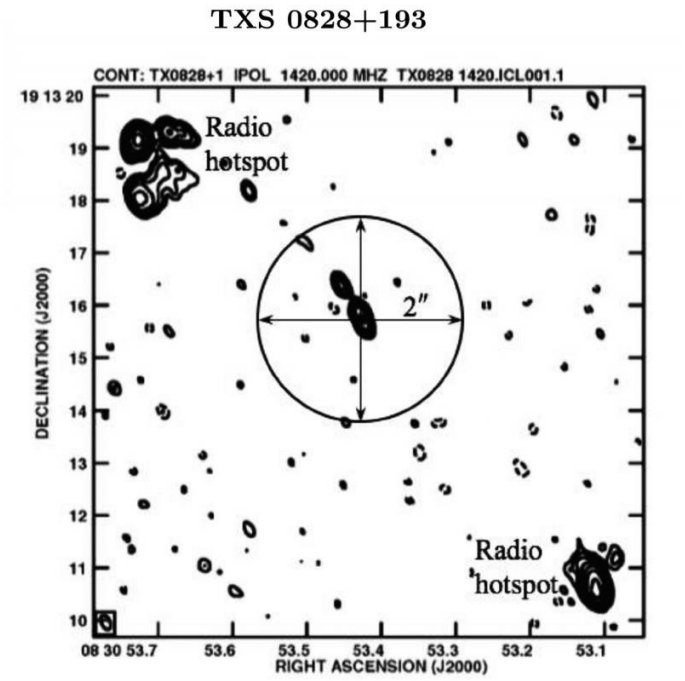
In a study led by Sandy Morais, a PhD student at Instituto de Astrofísica e Ciências do Espaço and Faculty of Sciences of the University of Porto (FCUP), researchers found massive super bubbles of gas and dust around two distant radio galaxies about 11.5 billion light years away.

Andrew Humphrey (IA & University of Porto), the leader of the project, commented: "By studying violent galaxies like these, we have gained a new insight into the way supermassive black holes affect the evolution of the galaxies in which they reside."

The researchers used two of the largest observatories available today, the Keck II (Hawaii) and the Gran Telescópio de Canárias (GTC), to observe TXS0211?122 and TXS 0828+193, two powerful radio galaxies, harboring the most energetic type of Active Galactic Nuclei (AGN) known. This type of galaxy houses the most massive black holes and have the most powerful continuous energy ejections known.

The team discovered expanding super bubbles of gas around each of TXS 0211-122 and TXS 0828+193, most likely caused by "feedback" activity whereby the AGN injects vast quantities of energy into its host galaxy, creating a powerful wind that sweeps up gas and dust into an expanding super bubble.

Study of the symbiosis between the supermassive black hole and the galaxy is a key to understanding the evolution of the most massive galaxies. Ultraviolet emission from the black hole's accretion disk can inhibit star formation temporarily, by ionizing the Interstellar medium, and the great outflows of gas towards the black hole can lead to permanent inhibition of star formation.



Schematic of the expanding gas Bubble, over a radio image of the full field of TXS 0828+193. Credit: Morais et al. 2017

More information: S. G. Morais et al. Ionization and feedback in Ly? haloes around two radio galaxies at? 2.5, *Monthly Notices of the Royal Astronomical Society* (2017). DOI: 10.1093/mnras/stw2926

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