The outbursts of Fornax

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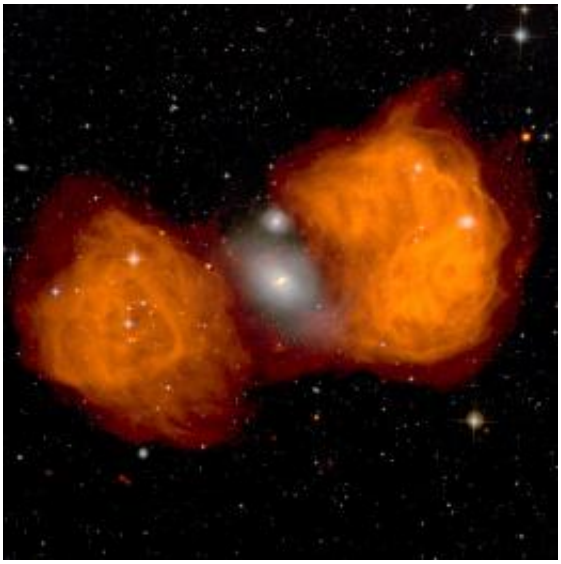

A false color image of the radio-wavelength emitting lobes in the galaxy Fornax A. This hot gas spans a distance of over one million light years. A new paper by CfA astronomers suggests that they are caused by the collision of another galaxy with Fornax in which dust and gas from the neighbor ends up triggering jets from the black hole at the galaxy's nucleus. Credit: Ed Fomalont (NRAO) et al., VLA, NRAO, AUI, NSF

(PhysOrg.com) -- The galaxy Fornax A, at a distance of about 74 million light-years, is one of the nearest and brightest galaxies with giant radio lobes. These huge radio lobes -- they span a million light-years -- are immense reservoirs of hot gas glowing brightly at radio wavelengths. They are thought to have been generated by oppositely-pointed jets of particles streaming out from the galaxy's supermassive black hole.

A collision between Fornax and a smaller galaxy may have swept material towards the black hole, creating the jets that in turn so brightly illuminate the ambient material. Exactly how this process occurs, however, is not known, in part because the black hole is obscured deep inside the galaxy's nuclear region. We still do not know, for example, whether the outbursts are one-time events, as perhaps is suggested by the collision scenario, or whether they recur, and on what timescales.

CfA graduate student Lauranne Lanz, together with CfA astronomers Christine Jones, Bill Forman, Matt Ashby, Ralph Kraft, and Ryan Hickox, combined the radio images of Fornax A with infrared images from the Spitzer Space Telescope and X-ray images from the Chandra X-ray Observatory and the XMM-Newton X-ray satellite to help answer some of the puzzles around these dramatic lobes.

By carefully modeling and then subtracting the starlight seen in the Spitzer images, the scientists were able to reveal excess dust emission around the nuclear region, and moreover show that the dust lies in two irregular arcs sweeping across about ten thousand light-years. The existence of that infrared dust emission is puzzling: Fornax A is a type of galaxy thought to be relatively dust-free.

When combined with X-ray and radio information for the same locations, however, the dust enabled the astronomers to construct a more complete picture of what is going on. Most likely the galaxy collided about 400 million years ago with a gas-rich neighbor -- one having 2-3 times the gas in Fornax A itself -- but with many fewer stars (perhaps only 10%). The dust comes from the neighboring galaxy; the collision also helped to funnel gas from the neighbor and trigger the outburst from the black hole.

The geometry of the nuclear region, and the presence of two X-ray cavities, further suggest that unless there are some nuclear regions still

undetected in the radio, which is a possibility, there were likely to have been not one but two outbursts during the past 400 million years that contributed to the structures observed. The new paper helps to unravel the mysterious origins of these dramatic radio lobes, and also highlights the importance of multiwavelength observations.

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