Radio astronomers detect 'baby quasar' near the edge of the visible Universe

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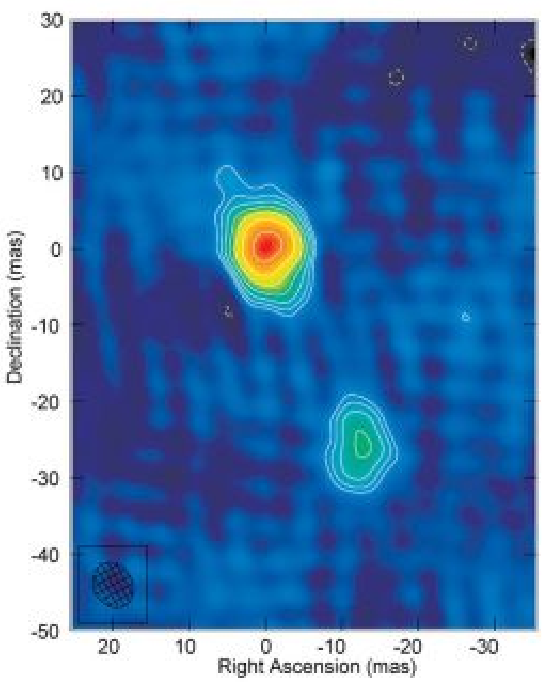

The naturally weighted 1.6-GHz VLBI image of J1427+3312 at the frequency of 1.6 GHz (18 cm wavelength). The positive contour levels increase by a factor of v2. The first contours are drawn at -50 and 50 µJy/beam (3 sigma RMS noise). The peak brightness is 460 µJy/beam. Image: JIVE.

An international group of radio astronomers has found an unexpected morphology in the most distant radio quasar ever. This was done using the world's most sensitive network of radio telescopes called the European VLBI Network (EVN). The results of their discovery are published in the *Astronomy and Astrophysics* journal on 5 June.

Quasars are the most powerful 'engines' in the Universe. Observed with a radio telescope they look like stars, but they are much farther away from Earth. Because they are so powerful, their light can be seen by modern telescopes from distances comparable with the size of the Universe. The observation of the newly found quasar was conducted with ten radio telescopes in Europe (including the Westerbork Synthesis Radio Telescope in the Netherlands), China and South Africa, at the frequency of 1.6 GHz (wavelength of 18 cm).

The quasar, called J1427+3312, can be seen in the image. It shows a double morphology and the components are about 480 light years apart. This kind of double morphology, combined with a steep radio spectrum, is typical for young radio sources. What makes the quasar in the picture so interesting is its extremely distant location. It is so far away from our Galaxy that it takes the light it emits more than 90% of the age of the Universe to reach us. In other words, what we see corresponds to the time when the Universe was less than 10% of its present age.

Being so distant, the quasar J1427+3312 is located relatively close to the inner edge of the so called Epoch of Reionisation (EoR) - the cosmological 'Dark Ages'. In a sense, the EoR is responsible for the appearance and composition of the Universe we live in - the variety of galaxies, stars and, ultimately, planets. The reionisation is one of the most tantalizing subjects for investigations with the next generation of radio telescopes, LOFAR and the Square Kilometre Array (SKA). Currently Dutch efforts in radio astronomy focus largely on the implementation of LOFAR and SKA.

The quasar J1427+3312, in the words of Leonid Gurvits, Senior Astronomer at the Joint Institute for VLBI in Europe (JIVE, Dwingeloo, the Netherlands), is "a powerful lighthouse that happens to be located at the place where we want to light up surroundings in search for something terribly important; one day, with new radio telescopes, we will 'use' this lighthouse as a handy tool in the search for EoR signatures."

The EVN observation that resulted in the image on the figure has become possible only owing to the impressive progress in radio astronomy technologies achieved over the last several years. "In this observation, owing to the extremely high data rate registered by all ten telescopes, we were able to achieve a sensitivity which was unthinkable just a few years ago," explains Zsolt Paragi, Senior Support Scientist at JIVE. "The combined data rate at the entry point of the EVN data processor at JIVE for this experiment was 10 Gigabit per second - an equivalent of about 1000 DVD movies played simultaneously."

Astronomers are used to intriguing sources which occupy our skies. But some sources are more wonderful than others. "In historical analogy," continues Gurvits, "finding the astronomical lighthouse J1427+3312 in such a young state at such an early cosmological epoch is like discovering one of the Seven Ancient Wonders, the Lighthouse of Alexandria, in perfect operational condition!"

The group of astronomers that discovered the quasar includes: Sándor Frey of the Satellite Geodetic Observatory, Hungary, and a former research fellow at JIVE; Gurvits; Paragi; and Krisztina Gabányi of the Institute of Space and Astronautical Sciences, Japan, and Research Group for Physical Geodesy and Geodynamics, Hungary.

Source: JIVE