Astronomers glimpse birth of a quasar

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ASTRONOMERS GLIMPSE BIRTH OF A QUASAR

While peering through the heavens with a network of 17 radio telescopes scattered in Europe and the United States, a team of astronomers has detected something unusual in the center of a nearby merging galaxy: a quasar in the process of being formed.

Though its estimated age is about a million years, the quasar detected as a compact radio source in the galaxy Markarian 231 or Mrk 231--is a mere babe in the cosmos.

"This is the youngest quasar we know about," said Harding E. Smith, a professor of physics in the Center for Astrophysics and Space Sciences at the University of California, San Diego. "We believe that the turning on of the radio source coincides with the birth of the quasar, still shrouded by a layer of gas and dust too thick to peer through at visible wavelengths.

"If our inferences are correct, then over the next million years or so Markarian 231 will shed its dusty shroud to reveal a full-fledged quasar."

Other members of the astronomer team include Colin Lonsdale of the Massachusetts Institute of Technology's Haystack Observatory, Carol Lonsdale of Caltech's Infrared Processing and Analysis Center, and Philip Diamond of the National Radio Astronomy Observatory. A sort of family project, Carol Lonsdale is Smith's wife and Colin Lonsdale's sister.

Though still in its formative years, the quasar is no less monstrous than many of its elders, shining with the power of 5 trillions suns, with a glow a few thousand times brighter than our own Milky Way galaxy. Quasars are considered the ultimate fireworks show in the universe.

Since Markarian 231 is a mere 500 million light years away, the newly born quasar would also be one of the closest to earth yet detected.

The discovery, reported today at the American Astronomical Society meeting in San Diego, offers astronomers new insights into the evolution of quasars and their relationship to "ultraluminous infrared galaxies." First detected during NASA's Infrared Astronomical Satellite mission, energy generated by ultraluminous infrared galaxies rivals the output of quasars, except these galaxies emit all their light in the invisible, infrared part of the spectrum.

For about a decade, astronomers have speculated that ultraluminous infrared galaxies created by colliding galaxies--might be related to quasars.

According to this theory, colliding galaxies might awaken a massive black hole lurking the galactic core. Once activated, huge quantities of gas and dust stirred up by the collision would start falling into the center, feeding the black hole and allowing it to grow and shine with the power of billions of suns. Thus, a quasar is born.

A competing theory, dubbed the "starburst" model, suggests that these ultra-radiant galaxies are illuminated by young, hot stars and powerful supernovae that are born from shockwaves moving through large masses of gas in colliding galaxies.

The discovery of the emerging quasar in Mrk 231 offers another possibility, that there might be an evolutionary link between the two theories.

"The discovery (of the new quasar) looks like a transition phase between the period of star formation and the subsequent quasar lifetime," said Smith. "This idea was suggested about 10 years ago, but this is the strongest evidence yet in its support. Our research suggests that the starburst phase has a lifetime comparable to the quasar phase, but the transition phase is relatively short."

To cut through the dense clouds surrounding the galaxy, the research team turned to radio waves capable of passing through the dust without obstruction. By using radio telescopes that span the globe and a technique known as Very Long Baseline Interferometry (VLBI), the astronomers were allowed to peer into the heart of the galaxy and pinpoint the quasar's radio emission, a region about a hundred light-years across.

"We can't see the black hole directly," the astronomers note. "It is much too small to see with even the finest, most sensitive instruments, but we see its effect on the surrounding region."

The images not only revealed a strong source of radio light from the volume immediately surrounding the black hole, but a second region of strong radio emissions. This second region represents the endpoint of a "jet" or stream of high velocity particles spewing out of the central region, and crashing into clouds of gas about 75 light years from the center.

It is this second region that provided the astronomers with clues to the age of the source. From a careful mapping of the radio structure of this region, the team deduced the characteristics of the jet and the cloud it was plowing into.

"We have estimated that the radio-interaction region is moving outward from the central source with a speed that is at least 0.04 percent of the speed of light," Smith said. "This allows us to trace the jet back to its origin, which must have been less than a million years ago, very recent by astronomical standards."

The team has plans for continued observations at radio and infrared wavelengths.

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