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The First Triple Quasar

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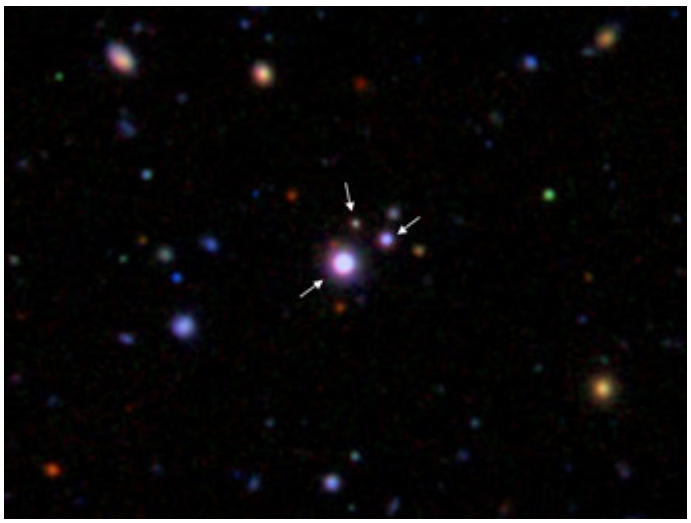
by Robert Naeye



This false-color composite of the triple quasar system was made using a combination of Keck Observatory's and the European Very Large Telescope's visible and infrared data.
S. G. Djorgovski and colleagues, Caltech, and EPFL

Of all the known objects known in the universe, quasars probably deserves the most superlatives. These blazing cosmic beacons pack the energy of an entire galaxy's worth of stars into a volume of space the size of our solar system. Until now, astronomers have found about 100,000 of these extraordinary objects, which are fueled by supermassive black holes devouring large clumps of matter. Most quasars are solitary objects residing in the cores of large galaxies. Since the late 1980s, astronomers have found about 100 double quasars. But in an announcement made on Monday at the American Astronomical Society conference in Seattle, astronomers have confirmed that quasars can come in threes.

Using one of the 10-meter Keck Telescopes in Hawaii and one of the four 8.2-meter reflectors of the Very Large Telescope (VLT) in Chile, an American-Swiss team led by George Djorgovski (Caltech) has identified a third quasar very close to a known binary quasar. The three quasars are separated in space by only a few tens of thousands of light-years, less than the distance from Earth to our nearest sizable galactic neighbors, the Large and Small Magellanic Clouds.

The binary quasar, previously known as LBQS 1429-008, was discovered by Paul Hewett (Cambridge University, England) and his colleagues in 1989. But in deep Keck images, Djorgovski's group found a much fainter third quasar (at 24th magnitude) within 5 arcseconds of the known pair, which translates to a physical separation of a few tens of thousands of light-years at the quasar's great distance (we see the quasar as it existed 10.4 billion years ago).

Subsequent observations at Keck and VLT have virtually ruled out that astronomers are being fooled by a cosmic mirage — an effect predicted by Einstein's general theory of relativity known as gravitational lensing.

"We see this system at exactly the right time," says Djorgovski. The three quasar host galaxies are in the process of merging. The result thus bolsters the prevailing view that quasars light up during galaxy mergers, during which powerful gravitational perturbations funnel huge quantities of gas into the monster black holes. The three black holes in this triple system probably range in mass from a few tens of million to a few billion times that of the Sun.

Computer simulations by Frederic Rasio (Northwestern University) and his colleagues show that the two of the supermassive black holes will sink to the center of the newly formed large galaxy and form a binary system. When the third black hole also ventures into the core, the system will undergo what Rasio describes as a "chaotic dance" that lasts at most a few million years years. Eventually one of the black holes will be ejected into the galaxy's halo or possibly even intergalactic space, and the two binary members will coalesce relatively quickly. But this process won't occur in this triple system for another few hundred million years.

In other quasar news announced at the conference, Induk Lee and Myunghshin Im (Seoul National University, South Korea) presented an efficient method for finding quasars in the plane of our Milky Way Galaxy. This region has been known as the "zone of avoidance" because the thick clouds of gas and dust obscure light from more distant objects. But by correlating strong radio sources with objects having particularly red colors, Lee and Im have found 40 new quasars. These quasars shine though the galactic plane, which Lee says gives astronomers an opportunity to use them a tool to study the gaseous component of the Milky Way.
