Now you see it, now you don’t: The quasar that just disappeared

The image shows an artist's conception of the “changing-look quasar” as it appeared in early 2015. The glowing blue region shows the last of the gas being swallowed by central black hole as it shuts off. The spectrum is the previous one obtained by the SDSS in 2003.

Image: Dana Berry / SkyWorks Digital, Inc.

Astronomers can’t find any sign of the supermassive black hole at the center of the quasar named SDSS J1011+5442, and they couldn't be happier. "This is the first time we've seen a quasar shut off this dramatically, this quickly," said Penn State Postdoctoral Scholar Jessie Runnoe, who led the international team of astronomers from the Sloan Digital Sky Survey (SDSS) that is reporting this discovery today.

The black hole is still there, but the super-bright quasar it powered by swallowing the gas in its vicinity has disappeared over the past ten years, as it appears to have swallowed all the gas nearby. Runnoe's team reports today that it was unable to detect the light-spectrum signature of the quasar, which now looks like an otherwise normal galaxy -- one without a bright quasar in its core. Other Penn State scientists involved in this study are Professors of Astronomy and Astrophysics Michael Eracleous and Donald Schneider.

This animation shows an artist's conception of the changing-look quasar as it evolved from 2003 to 2015. The beginning of the animation shows gas falling into the central black hole, along with the first SDSS spectrum.
Astronomers have three proposed explanations for the dramatic variability. One possibility is that a thick layer of dust is passing through the host galaxy, obscuring our view of the central black hole, but there is no known way that a dust cloud could have moved sufficiently rapidly to cause a 50-fold drop in brightness in just a few years. Another possibility is that the observed quasar in 2003 was but a brief temporary flare caused by the black hole ripping apart a nearby star. While this possibility has been invoked in prior cases of quasar variability, it cannot to explain the fact that the changing-look quasar had been shining for many years before shutting down.

The changing look quasar is the first major discovery of the Time-Domain Spectroscopic Survey (TDSS), one of the components of the Sloan Digital Sky Survey's fourth phase. TDSS will continue for the next several years, promising many more surprising discoveries in the future.

"We are used to thinking of the sky as unchanging," says Scott Anderson of the University of Washington and the Principal Investigator of TDSS. "The SDSS gives us a great opportunity to see that change as it happens. In fact, we found this quasar because we went back to study thousands of quasars seen before. This discovery was only possible because the SDSS is so deep and has continued so long."

**DATA**
Real SDSS data for the changing look quasar is available from the SDSS's SkyServer website.

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