Object located around a black hole five billion light-years from Earth has been measured

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A team of Spanish researchers, with the participation of the University of Granada (UGR), has accurately detected a structure in the innermost region of a quasar (small, very far objects that emit huge amounts of energy, comparable to that emitted by a whole galaxy) at a distance of more than five billion light-years from Earth.

It's the most accurate measurement achieved to date of such a small and distant object, which was achieved via the so-called gravitational microlensing effect caused by the gravitational distortion of light by stars in a galaxy between Earth and the quasar, and which magnify tiny regions within the quasar.

The researchers measured the accretion disc orbiting quasar Q2237+0305 (known as the Einstein Cross) through the study of the changes in the brightness of four different images. Those images were obtained via two ongoing experiments, OGLE (Optical Gravitational Lensing Experiment) and GLITP (Gravitational Lensing International Time Project), which monitored the quasar for 12 years and for 9 months, respectively.

In the frontier of a black hole

A quasar emits energy through a disc of hot matter orbiting a supermassive black hole at high speed, and whose mass is the equivalent

of a billion stars. The disc's size is comparable to that of our solar system but, due to its distance, it's not possible to measure its structure by usual means. In this case, it has been measured via the gravitational microlensing effect, which has allowed the researchers to detect a structure in the disk's inner edge, in the very border of the black hole.

As Jorge Jiménez Vicente, researcher at the UGR Department of Theoretical Physics and Cosmology and one of the authors of this paper, explains: "The breakthrough of this work has been that we've been able to detect a structure in the inner edge of such a small disk at such a great distance, thanks to the gravitational microlensing effect. It would be the equivalent to detecting an Euro coin at a distance of more than 100,000 kilometers."

Only one in 500 quasars is affected by the gravitational microlensing effect. The information obtained will be very useful for understanding quasars, which in turn is essential to understanding how galaxies were born and evolve.

Jiménez Vicente notes that in the future, when great monitoring programs are available, "the possibility of detecting high magnification events caused by the gravitational microlensing effect could be applied to thousands of quasars." An example of said monitoring programs is the planned Large Synoptic Survey Telescope, a telescope with a primary mirror of 8.4 meters in diameter, capable of analyzing the whole visible sky. It will be constructed in the north of Chile and will begin operation in 2022.

More information: Resolving the Innermost Region of the Accretion Disk of the Lensed Quasar Q 2237+0305 through Gravitational Microlensing. E. Mediavilla, J. Jimenez-Vicente, J.A. Munoz, T. Mediavilla 2015, ApJL, 814, L26 www.iac.es/pdf/resultados/157_Perfil%20Disco.pdf

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