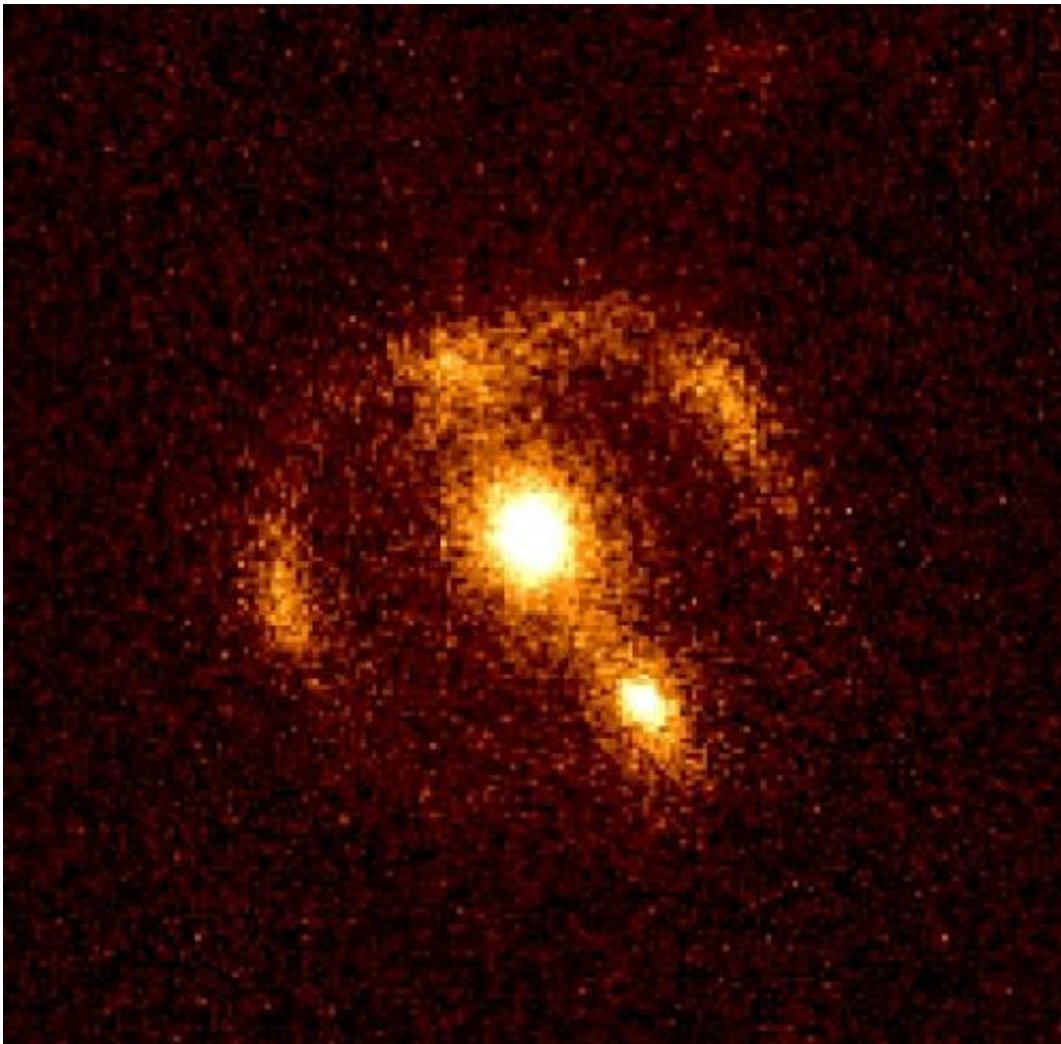


Herschel is key to discovery of spectacular gravitational lens

June 13 2014



An irregular ring of radiation can be seen around the distant galaxy in the center of this 2.2-micron CCD photograph, made with the 10-meter Keck telescope on Hawaii. The lensing galaxy is associated with radio source 3C 220.3. The radiation of the ring originates from an extremely distant galaxy-in-formation and is a result of the gravitational-lens effect. Just below the lensing galaxy a

neighboring galaxy can be seen, which also contributes to the lensing effects.
Credit: ESA and the W. M. Keck Observatory.

An international team of astronomers including Dutch astronomers Peter Barthel and Léon Koopmans (University of Groningen) reports the discovery of a unique case of a cosmic gravitational lens. Using several telescopes on the ground and in space, the scientists show that a distant radio galaxy, acting as a cosmic lens, distorts and magnifies the radiation of an even more distant mysterious dark object, thereby making that object visible.

Owing to the lens magnification, the faint background object becomes visible as a ring-like structure around the lensing foreground radio galaxy, seen well on an image made with one of the two 10-meter Keck telescopes on Hawaii.

Led by Martin Haas of Bochum University, Germany, the research started as rather simple observations with the Herschel Space Telescope of a sample of distant radio galaxies. It rapidly grew into a project where crucial supplementary observations demonstrated the unique character of this cosmic lens.

While formally the Herschel Space Observatory did not discover this gravitational lens, it was the breakthrough Herschel performance that allowed the astronomers to measure the far-infrared emission of 3C 220.3, which in turn made them suspicious about its origin. The original target, the very massive radio galaxy, emitted simply too much far-infrared radiation. Additional observations, with optical and radio telescopes, subsequently demonstrated unambiguously the cosmic lens effect of the radio galaxy making the dark background object visible in the far-infrared.

Astronomers have known of the cosmic [gravitational lens](#) phenomenon since 1979, although the light bending of distant stars by the Sun was already observed in 1919. Calculations by Einstein in 1912 already predicted the existence of such cosmic lenses.

Gravitational lenses allow astronomers to investigate the properties of both the very distant [lens](#) and the even more distant object, a galaxy in the process of formation. Modeling of the geometry of the lensing situation for instance demonstrated that the lensing galaxy which hosts the radio source contains an unexpectedly low fraction of mysterious dark matter compared with that predicted for large radio galaxies.

More information: "3C 220.3: A Radiogalaxy Lensing a Submillimeter Galaxy" by an international group of 20* astronomers led by Martin Haas (Ruhr University, Bochum, Germany) is accepted for publication in *The Astrophysical Journal*. Preprint: arxiv.org/abs/1406.2872

Provided by Netherlands Research School for Astronomy

Citation: Herschel is key to discovery of spectacular gravitational lens (2014, June 13) retrieved 28 April 2024 from

<https://phys.org/news/2014-06-herschel-key-discovery-spectacular-gravitational.html>

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