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Saturn's outer ring much bigger than thought

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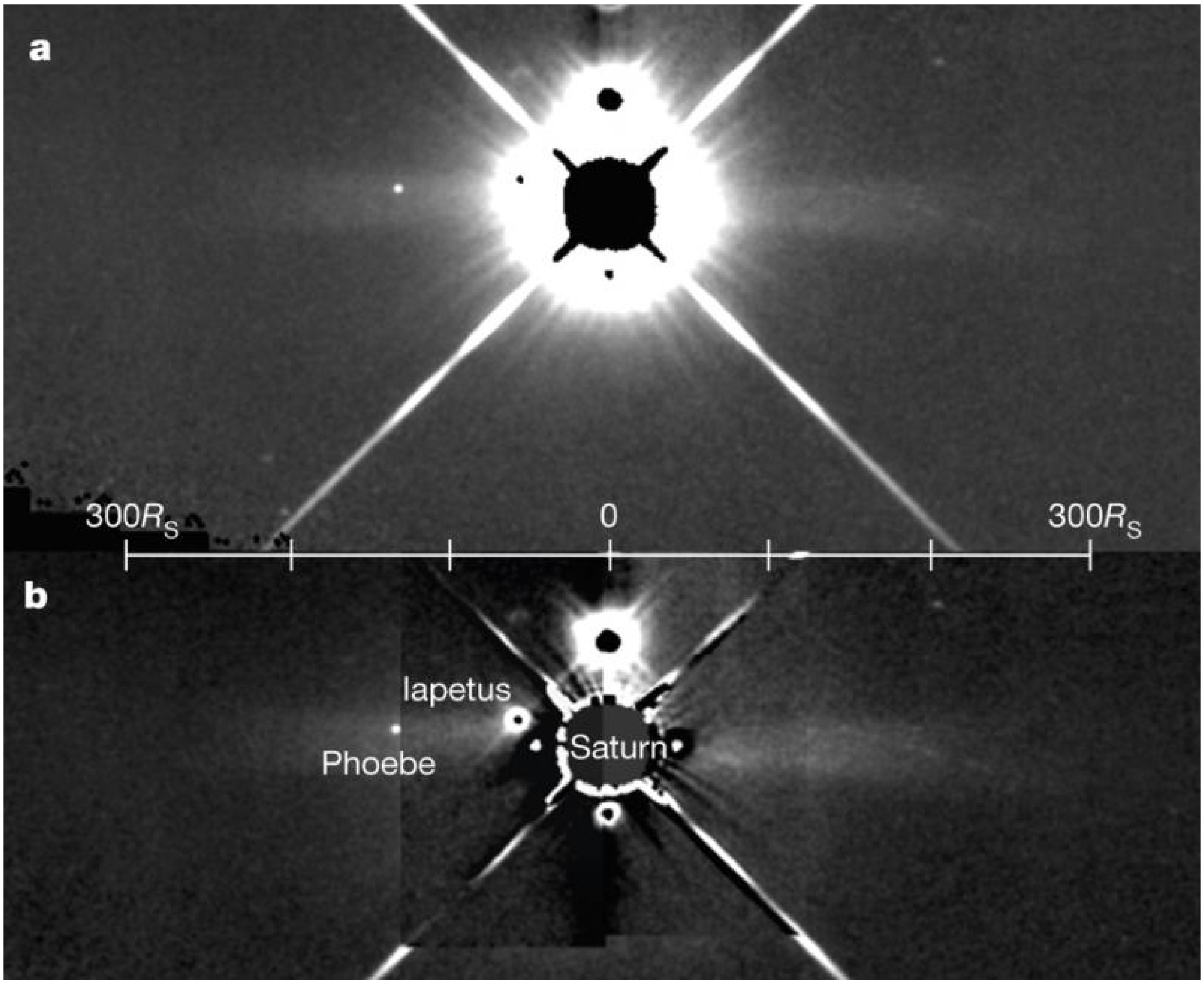

WISE Band 4 mosaic of the Phoebe ring. a, Individual WISE frames manually combined: scattered light from Saturn forms the large white overexposed blob with a black centre while four diagonal diffraction spikes radiate outward. Bright reflections of Saturn are visible as smaller white lumps with black centres at the six and twelve o'clock positions. Iapetus (black dot) and the more distant Phoebe (white dot) are visible at nine o'clock. The Phoebe ring is the white, horizontally oriented 550RS × 40RS rectangle. b, We subtract ±90° rotations of the top frame from itself, yielding clean and cluttered ring ansae (the apparent ends of edge-on rings); here we stitch the two clean ansae together to significantly reduce scattered light and reveal the ring's inner regions. Distance scale applies to a and b. Credit: (c) *Nature* 522, 185–187 (11 June 2015) doi:10.1038/nature14476

(Phys.org)—A small team of researchers with members affiliated with the University of Maryland, the University of Virginia and Caltech, has found that the outermost ring of Saturn is much bigger than had been previously thought. In their paper published in the journal *Nature*, the team describes how they studied the ring using an infrared telescope and what they believe caused its immense size to come about.

Back in 2009, a team of researchers working with NASA's infrared Spitzer Space Telescope discovered that there was an outer ring circling Saturn that had not been known to exist—made mostly of extremely tiny dark dust particles, the ring was difficult to see. They estimated at the time that the ring was likely over two hundred times the radius of its host planet. In this new effort, the researchers studied images taken from NASA's WISE probe, which has also been taking infrared pictures. Those pictures, the team reports, suggest the ring is actually over 270 times the radius of Saturn, which mean it stretches from almost four million miles from the planet to just over ten million miles, making it approximately ten times the size of the E ring, until this new discovery, Saturn's largest ring. Putting it into perspective, if Saturn were merely the size of a basketball, this new outer ring would extend nearly two thirds the length of a football field away from it.

The ring has only been revealed by infrared cameras because the dust particles in it absorb heat from the sun—such particles the researchers report are extremely small, just microns in size. They also report that there are some other much larger, though far less in number particles, some as large as soccer balls. Because of the huge distance between the ring and planet, the researchers theorize that the material in the ring is probably very old, perhaps in the billions of years. They also suspect the tiny particles are material ejected from the distant moon Phoebe.

Prior to the discovery of Saturn's largest ring, it was believed material ejected from moons at such a distance would coalesce into a new moon, rather than form a ring—now it appears such theories will have to be rethought. Also, because of similarities between Saturn's moons and Jupiter's moons, the researchers suspect Jupiter likely has a massive unseen ring around it as well.

More information: Small particles dominate Saturn's Phoebe ring to surprisingly large distances, *Nature* 522, 185–187 (11 June 2015) DOI: 10.1038/nature14476

Abstract
Saturn's faint outermost ring, discovered in 2009 (ref. 1), is probably formed by particles ejected from the distant moon Phoebe2, 3. The ring was detected1 between distances of 128 and 207 Saturn radii (RS = 60,330 kilometres) from the planet, with a full vertical extent of 40RS, making it well over ten times larger than Saturn's hitherto largest known ring, the E ring. The total radial extent of the Phoebe ring could not, however, be determined at that time, nor could particle sizes be significantly constrained. Here we report infrared imaging of the entire ring, which extends from 100RS out to a surprisingly distant 270RS. We model the orbital dynamics of ring particles launched from Phoebe, and construct theoretical power-law profiles of the particle size distribution. We find that very steep profiles fit the data best, and that elevated grain temperatures, arising because of the radiative inefficiency of the smallest grains, probably contribute to the steepness. By converting our constraint on particle sizes into a form that is independent of the

uncertain size distribution, we determine that particles with radii greater than ten centimetres, whose orbits do not decay appreciably inward over 4.5 billion years, contribute at most about ten per cent to the cross-sectional area of the ring's dusty component.