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Letter

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Saturn's largest ring

Anne J. Verbiscer[1], Michael F. Skrutskie[1] & Douglas P. Hamilton[2]

1. Department of Astronomy, University of Virginia, Charlottesville, Virginia, 22904-4325, USA
2. Department of Astronomy, University of Maryland, College Park, Maryland 20742-2421, USA

Correspondence to: Anne J. Verbiscer[1] Correspondence and requests for materials should be addressed to A.J.V. (Email: verbiscer@virginia.edu).

Most planetary rings in the Solar System lie within a few radii of their host body, because at these distances gravitational accelerations inhibit satellite formation. The best known exceptions are Jupiter's gossamer rings[1] and Saturn's E ring, broad sheets of dust that extend outward until they fade from view at five to ten planetary radii. Source satellites continuously supply the dust, which is subsequently lost in collisions or by radial transport. Here we report that Saturn has an enormous ring associated with its outer moon Phoebe, extending from at least 128R_S to 207R_S (Saturn's radius R_S is 60,330 km). The ring's vertical thickness of 40R_S matches the range of vertical motion of Phoebe along its orbit. Dynamical considerations argue that these ring particles span the Saturnian system from the main rings to the edges of interplanetary space. The ring's normal optical depth of ~2×10^{-8} is comparable to that of Jupiter's faintest gossamer ring, although its particle number density is several hundred times smaller. Repeated impacts on Phoebe, from both interplanetary and circumplanetary particle populations, probably keep the ring populated with material. Ring particles smaller than centimetres in size slowly migrate inward[2, 3] and many of them ultimately strike the dark leading face of Iapetus.

1. Department of Astronomy, University of Virginia, Charlottesville, Virginia, 22904-4325, USA
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