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When washed in sunlight, asteroids hit the spin cycle, Cornell researchers find

ITHACA, N.Y. —The sun is a cosmic spinmeister.

Using the highly sensitive radar telescope at the Cornell University-managed Arecibo Observatory in Puerto Rico and Goldstone antenna in California, Cornell astronomers have confirmed a theory that sunlight and the asteroid's shape determine how an asteroid's rotation evolves. Their research is reported today in *Science Express*, the online edition of the journal *Science*.

The Yarkovsky-O'Keefe-Radzievskii-Paddack Effect, named after a nineteenth century Russian civil engineer Ivan Yarkovsky, a late American planetary scientist John A. O'Keefe, a late Russian astronomer V.V. Radzievskii and NASA aerospace engineer Stephen J. Paddack, affectionately known as YORP, says that solar radiation will increase or decrease the rate of an asteroid's spin. This effect could help explain the formation of binary asteroids: The created centrifugal forces are so strong, that rubble-pile asteroids could break and form into two parts.

"For this particular asteroid, we confirmed that the expected strength of the YORP effect roughly matched the observed effect," says Jean-Luc Margot, Cornell assistant professor of astronomy.

Margot and Patrick A. Taylor, Cornell doctoral student in astronomy, are the lead authors of the research, "Spin Rate of Asteroid (54509) 2000 PH5 Increasing due to the YORP Effect." A companion paper, "Direct Detection of the Asteroidal YORP Effect," with research led by Stephen C. Lowry from Queen's University Belfast, United Kingdom, will be published concurrently in Science Express.

The astronomers examined asteroid 2000 PH5, which was discovered by MIT's Lincoln Laboratory's near-Earth asteroid search program (LINEAR) in August 2000.

The Arecibo Observatory takes high-resolution radar images, enabling the astronomers to construct digital shape models. With these models, the astronomers compared the predicted effect of YORP with the change in spin rate observed by Lowry's team. The theoretical calculations and the observed change in the spin rate agreed with each other, resulting in the first direct detection of YORP. And Arecibo's radar produces a more-detailed shape than data from an optical telescope, says Taylor.

The other authors are: David Vokrouhlicky of Charles University of the Czech Republic; Daniel J. Scheeres of the University of Michigan; Petr Pravec of the Academy of Sciences of the Czech Republic; Lowry and Alan Fitzsimmons of Queen's University, Belfast; Michael C. Nolan of Arecibo Observatory; Steven J. Ostro, Lance A. M. Benner and Jon D. Giorgini of the Jet Propulsion Laboratory, California Institute of Technology; and Christopher Magri of the University of Maine at Farmington.

The National Science Foundation's Arecibo Observatory is managed by Cornell's National Astronomy and Ionosphere Center. NASA operates the Goldstone antenna.

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