Measuring the Yarkovsky Effect via Radar Ranging to Golevka: Place Your Bets

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The Yarkovsky effect, a subtle nongravitational phenomenon involving accelerations of an object due to anisotropic thermal emission of absorbed sunlight, has been invoked to explain the transport of asteroids into the inner solar system, as a source mechanism for meteorites, as one of the processes that affect the evolution of asteroid spin states, and a factor that limits the long-term predictability of near-Earth asteroid trajectories. However, despite its profound theoretical importance in asteroid science, Yarkovsky accelerations have never been detected in the motion of natural objects in the solar system. Vokrouhlicky et al. [Icarus 148, 118-138 (2000)] have argued that precise radar refinement of the orbits of near-Earth asteroids offers the possibility of detecting the Yarkovsky effect during the next few decades.

We will describe prospects for detection of the Yarkovsky effect from fine-precision delay-Doppler radar observations of the half-kilometer asteroid 6489 Golevka in late May 2003. This "test" of the effect will make use of a previously published, radar-derived physical model of the asteroid as well as one of the most sophisticated Yarkovsky models implemented to date. The Yarkovsky acceleration depends strongly on the asteroid's bulk density and surface thermal conductivity. We will discuss the extent to which the radar astrometry should be able to constrain these physical properties. Predictions of the outcome of the experiment will be solicited from the audience.

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