DETECTION OF THE YORP EFFECT ON ASTEROID (1620) GEOGRAPHOS.

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Introduction: The rotational dynamics of small bodies in the Solar System is affected by the anisotropic reflection and thermal emission of sunlight. This so-called YORP (Yarkovsky–O'Keefe–Radzievskii–Paddack) effect was detected for the first time on asteroids (1862) Apollo [1] and (54509) YORP [2,3]. Here we report the direct detection of acceleration of the rotation rate of asteroid (1620) Geographos that agrees well with the value for YORP predicted by theory.

Observations: We obtained new photometric lightcurves of Geographos in 2008. Observations were carried out at Hunters Hill Observatory, Australia (35-cm telescope); Simeiz Observatory, Ukraine (1-m telescope); and at the Kharkiv Astronomical Observatory, Ukraine (70-cm telescope). We also used older unpublished data obtained in 2001 at Kharkiv Observatory. In total, we used a set of 89 lightcurves, most of them were taken from the Uppsala Asteroid Photometric Catalogue [4]. The lightcurves cover almost 40 years of observation.

Method: We used the lightcurve inversion method [5] to derive the rotation state and shape model of Geographos. We used the same approach as in [1]. The analysis of all available photometric data shows that lightcurves cannot be fitted with a model assuming a constant rotation period. However, if we include a linear change $d\omega/dt$ of the rotation rate ω as another free parameter into the modelling process, we obtain a perfect agreement between our model and observations for a nonzero value of $d\omega/dt$.

Results: Lightcurve data cannot be fitted with a constant-period model. The best-fit model assuming that the rotation rate changes linearly with time yields the acceleration of the rotation rate $d\omega/dt = (1.1 \pm 0.3) \times 10^{-8}$ rad/d^2. This value is consistent with the theoretical value 1.5×10^{-8} rad/d^2 that was determined from a theoretical model [6,7] using the convex shape model of Geographos derived from lightcurves and assuming the effective diameter 2.56 km [8] and uniform density 2.5 g/cm^3.

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