INFLUENCE OF THE YORP-EFFECT ON AXIS ROTATION OF NEAR-EARTH ASTEROIDS. D. F. Lupishko and I. N. Tielieusova, Institute of Astronomy of Kharkiv V. N. Karazin National University, Sumska str. 35, Kharkiv 61022, Ukraine. lupishko@astron.kharkov.ua

Introduction: In contrast to MBAs the distribution of rotation rates for NEAs shows excesses of fast and slow rotators [1, 2]. One of the possible reasons of the difference can be so-called YORP-effect [3], which appears because of reflection and IR-reemission of the solar radiation by an irregular-shaped body. The YORP-effect acting depends on size, shape and body insolation [3, 4]. At the same time, an increment of angular momentum due to the effect may be both positive and negative. An action of the effect is very faint but the body accumulates it during the whole its lifetime (~10^7 yrs) that can be resulted in noticeable change of rotation rate and inclination of small NEAs.

NEA Rotation Rates Distribution: The obtained distribution (Fig. 1) clearly shows the excesses of slow (ω=0÷2 *rev/day*) and fast (ω=8÷11 *rev/day*) rotators.

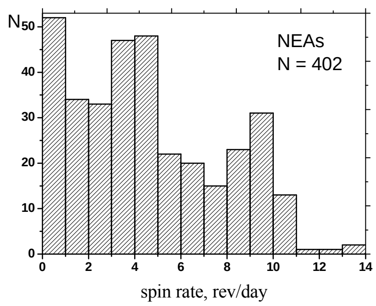

Fig. 1. Distribution of axis rotation rates of NEAs.

Analyzing this distribution and identical ones for MBAs, one can note that the smaller average size of asteroids of fixed population, the more clearly we can see excesses of fast and slow rotators. Such dependence of rotation rates on asteroid sizes is just typical for the YORP-effect influence. That is why the analysis of an average size of NEAs in both excesses and in the middle of the distribution is of immediate interest.

Axis Rotation Rates and Average Diameters: We used the Database "Physical Properties of Near-Earth Objects" by Gerhard J. Hahn. When diameter of asteroid is unknown it was calculated as 2 lg(D) = 6.247– 0.4 H – lg (p_v), where D is diameter in km, H is absolute magnitude, p_v is a geometrical albedo of an asteroid. The latter was taken as an average value for the given composition type of asteroid (see [5]).

The obtained dependence (Fig. 2) shows that average size of NEAs is decreasing from the middle of the distribution of their rotation rates to its edges, i.e. the excesses of slow and fast rotators are composed by NEAs which are in average 1.5 times smaller than those in the middle of the distribution. This result is in excellent agreement with the YORP-effect influence.

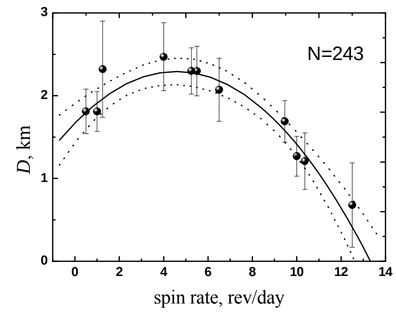

Fig. 2. Diameter-axis rotation rates diagram for NEAs.

Axis Rotation Rates and Relative Insolation: We calculated the relative amount of solar energy, received by each NEA during a single revolution around the Sun as $E_{rel} = 1/a^2\sqrt{1-e^2}$, where *a* and *e* are semi-major axis and eccentricity of asteroid orbit.

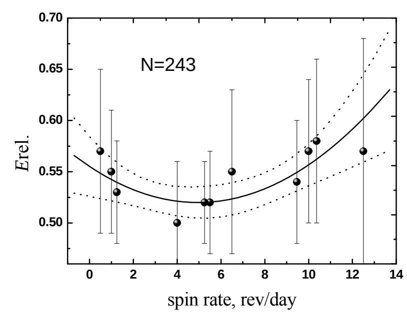

Fig. 3. Correlation of the relative insolation of NEAs and their axis rotation rates.

Fig. 3 shows that asteroids of both excesses are in the orbits where they receive about 8-10% of solar energy more than in orbits of NEAs which are in the middle of the distribution. Obtained correlation is less confident as one in Fig. 2, but it qualitatively agrees well with the character of possible influence of YORP-effect and can be considered as another independent argument in favour of it.

Resume: This work is the first attempt to estimate statistically the YORP-effect influence not on the rotation of some particular NEAs (as it has already been done) but on the distribution of NEA rotation rates, that is, on axis rotation of the whole NEA population.

References: [1] Harris A.W. and Pravec P. (2006) *Proc. IAU Symp. 229. Cambr. Univ. Press,* 439–447. [2] Lupishko D. F. et al. (2007) *Proc. IAU Symp. 236. Cambr. Univ. Press,* 251–260. [3] Rubincam D. P. (2000) *Icarus, 148*, 2-11. [4] Bottke W. F. Jr. et al. (2006) *Annu. Rev. Earth Planet. Sci., 34*, 157–191. [5] Lupishko D. F. and Di Martino M. (1998) *Planet. Space Sci., 46,* 47–74.