INFLUENCE OF THE YORP-EFFECT ON THE ROTATION RATES OF SMALL MAIN-BELT ASTEROIDS. D.F. Lupishko, V.G. Chiorny and O.I. Mikhalchenko, Institute of Astronomy of Kharkiv V.N. Karazin National University (Sumska str. 35, Kharkiv 61022, Ukraine. lupishko@astron.kharkov.ua)

As is known, the distribution of rotation rates for near-Earth asteroids (NEAs) is characterized by the presence of excesses of asteroids with fast and slow rotation [1−3]. In [3] this feature of the NEA distribution has been explained by the influence of the YORP-effect [4], which appears because of reflection and IR re-emission of the solar radiation by the rotating irregular-shaped body. Now YORP-effect is well-known as an effective mechanism of evolution of the NEA rotation, efficiency of which depends on the size of the body, its shape, the intensity of solar radiation obtained (insolation) and other factors [3−5]. At the same time, an increment of angular momentum may be both positive and negative. And in this connection there is a natural question: does this effect have a noticeable influence on the axial rotation of small asteroids in the main belt, where the intensity of solar radiation is substantially less than in the region of the NEA orbits?

We will try to answer the question.

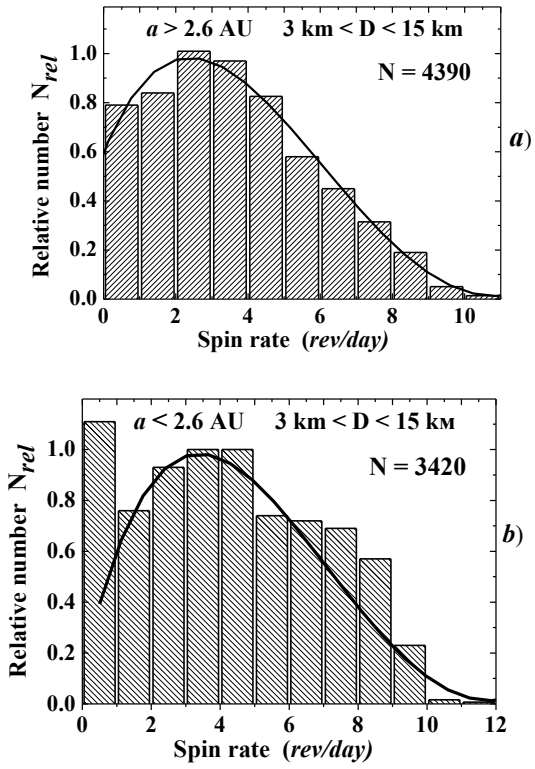

Fig. 1. Spin rate distributions of small asteroids in the outer part of main belt (*a*) and in the inner one (*b*).

In Fig. 1 the spin rate distributions of small main-belt asteroids are presented separately for external part of main belt (*a*) and for internal one (*b*). They were obtained using data available on website http://www.minorplanet.info/lightcurvedatabase.html collected by Warner et al. [6]. It was assumed that if the influence of the YORP-effect on the rotation of small main-belt asteroids would be noticeable, the excesses of fast and slow rotators would be more prominent in the distribution for asteroids of the inner part of the belt, where intensity of solar radiation is higher.

To compare the distributions obtained, the first of them (a>2.6 AU) was approximated by the fourth-degree polynomial and this approximation was transferred to the second distribution for a<2.6 AU. Such a procedure clearly shows the presence on the distribution for the asteroids of the inner part of the belt (see Fig. 1*b*) of relative excesses of slow (ω<1 rev/day) and fast (ω>7 rev/day) rotating asteroids. We emphasize that these are the excesses in the distribution for the asteroids of the inner part of the belt relative to the distribution for the outer one. These excesses are very similar to those that are present on the distribution of the rotational rates of the NEAs and which are explained by the influence of the YORP-effect [3].

Importantly, that depending on the sense of rotation of the asteroid (i.e., the angular velocity vector) the angular momentum increment can be both positive and negative [7, 8]. That is why as a result of the YORP-effect action, the excesses of asteroids are formed with both fast and slow rotations. And it is quite natural that they are more pronounced in the distribution of the rotation rates for the inner part of the main belt, where insolation is approximately 1.5 times higher than in the outer part.

Thus, on the basis of this analysis one can draw an important conclusion that according to available observational data, the YORP-effect exerts a noticeable influence on the rotation rates of small-sized asteroids (D=3−15 km) of the main belt, at least its inner part (a<2.6 AU), which is closer to the Sun. The obtained correlation of the rotation rates of these asteroids with their sizes confirm this conclusion. It can be assumed that the influence of the YORP-effect can also be noticeable for the asteroids of the outer part of the belt (a>2.6 AU), but much smaller in sizes.

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