A DIAMOND IN THE SKY: IS THE ASTEROID STEINS' PHENOMENON AN EXCLUSION OR PRESENTS A REAL FUNDAMENTAL PROPERTY OF SMALL BODIES? G.G. Kochemasov, IGEM of the Russian Academy of Sciences, 35 Staromonetny, 119017 Moscow, Russia, (kochem.36@mail.ru).

The September 2008 encounter of the Rosetta spacecraft with the (2867) Steins asteroid of the Main asteroid belt brought some surprises to planetary scientists. Brilliant images of this small body – 4.6 km across – made scientists to exclaim: "A diamond in the sky"! (Fig. 1, 2)[1]. Moreover, the leading scientist, mission manager of the project Dr. Schwehm predicts images of another "diamond" in 2010 when the spacecraft will meet the bigger asteroid Lutetia [1]. One may suppose that his confidence in this is based on serious reasons.

The first hint on " diamond" shape in cosmos was presented by images of Amalthea (Fig. 11) –a small Jupiter satellite - acquired by Galileo mission. This hint was not adequately appreciated and did not evoke any discussion. Later on some features of polyhedron shapes were observed in some other asteroids (Mathilde, Ida, Eros, Dactyl) but were noticed and commented only by a few observers [2]. Now, wealth of small icy bodies is imaged by Cassini cameras and their sometimes almost artificial appearance (like the Plato's polyhedrons and "flying saucers") is commented [3-6]. Such a massive evidence of polyhedron shapes in cosmos claims for an explanation different from seldom impacts usually presumed.

The wave planetology [7-12 & others] main assertion is: "Orbits make structures". As all celestial bodies move in non-round (elliptical, parabolic) orbits with periodically changing accelerations they all are subjected to an action of inertia-gravity forces. These forces arouse in them warping waves that in rotating bodies (but they all rotate!) acquire a stationary character and 4 directions of propagation (ortho- and diagonal). Interferences of these waves produce three kinds of tectonic blocks: uplifting (+), subsiding (-) and neutral (0). Their size depends on warping wavelengths. The longest fundamental wave 1 produces ubiquitous tectonic dichotomy – an opposition of two segments: uplifted and subsided, expanded and contracted ($2\pi R$-structure). The first overtone wave 2 superposes on this segmentation smaller features - sectors (πR-structure). Next overtones give smaller features.

An essence of tectonic dichotomy is in tendency of 4 interfering waves 1 to make from a body a tetrahedron – the simplest Plato' figure [3, 4]. A dichotomous nature of this figure is revealed in opposition of a vertex and a face (cutting any of its 4 axes one always gets from one side a vertex, from another a face). In one direction three faces narrow towards a vertex (contraction), in opposite direction they expand towards a fourth face (expansion). Most often in small bodies (not only in satellites but also in asteroids and comets) one observes an oblong convexo-concave shape [12 & others] but sometimes at certain points of view a flatten concave side and a sharpened convex side are presented by such a way that a tetrahedron develops (Fig. 1, 3-7). Interfering waves 2 produce an octahedron. At the first time it was observed in a shape of Amalthea (see Kolva's drawing of this satellite after Galileo mission), and name "diamond" was pronounced but no explanation followed. Now some octahedron faces one can observe at a number of small bodies, just to mention Phobos, Phoeba, Yanus (Fig. 8-13). Interfering waves 4 produce a cube (Fig. 14-15). Shorter wavelengths – more vertices in a polyhedron: tetrahedron 4, octahedron 6, cube 8 and so on. Various polyhedrons are present in a body simultaneously because the wave warping occurs in various wavelengths at the same time but particular viewpoints present better view of one of them (for examples, Yanus, Amalthea, Hyperion, Helene).

So, produced by warping waves polyhedron shapes, often detected in small bodies due to their weak gravity, present a real fundamental property of these cosmic bodies. In larger bodies this forms are smoothed by gravity making bodies globular, but still some vertices and edges can be distinguished with help of analyses of geology, geomorphology and geophysics. For an example, "famous" hexagon feature in the northern hemisphere of Saturn presents a face of structural tetrahedron, whereas the southern hemisphere "hurricane" is its opposite vertex. Thus looks the structural dichotomy of this giant gas planet.


Fig. 1

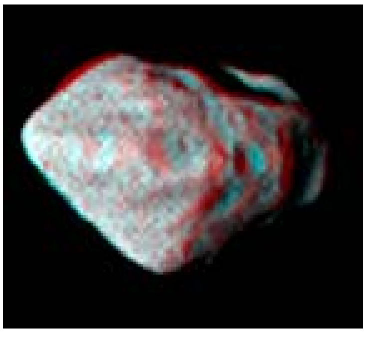
Fig. 2


Fig. 3

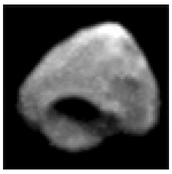
Fig. 4

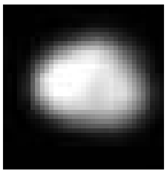
Fig. 5


Fig. 6

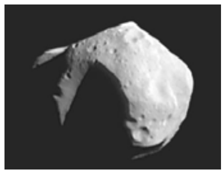
Fig. 7.


Fig. 8


Fig. 9

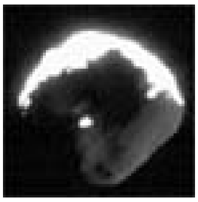
Fig. 10

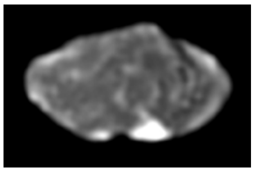
Fig. 11


Fig. 12

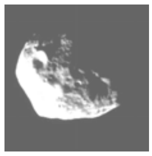
Fig. 13


Fig. 14

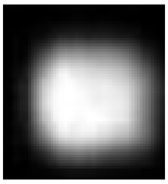
Fig. 15

Fig. 1. Asteroid (2867) Steins appears like a tetrahedron [1].
Fig. 2. Asteoid (2867) Steins appears like an octahedron under slightly different view-point [1]

A tetrahedron appearance of small bodies:
Fig. 3. Yanus, PIA10427, Mountain of ice, far-off view.
Fig.4. Thebe, PIA02531
Fig. 5. Telesto, PIA07546.
Fig. 6. Hyperion, PIA08904.
Fig. 7. Mathilde, PIA02477

An octahedron appearance:
Fig. 8. Yanus, PIA06613.
Fig. 9. Phoebe, PIA06066.
Fig. 10. Helene, PIA08269.
Fig. 11. Amalthea, PIA01074.
Fig.12. Prometheus, PIA07549.
Fig. 13. Yanus, PIA10417, a view toward the southern hemisphere.

A cubic (octahedron?) appearance:
Fig. 14. Epimetheus, PIA07531.
Fig. 15. Helene, PIA07547

References:

[1] ESA News. Steins: a diamond in the sky, 6 September, 2008 (http://www.esa.int/rosetta); **[2]** Kochemasov G.G. (1999) "Diamond" and "dumb-bells"-like shapes of celestial bodies induced by inertia-gravity waves // 30th Vernadsky-Brown microsymposium on comparative planetology, Abstracts, Moscow, Vernadsky Inst.,, 49-50; **[3]** Kochemasov G.G. (2006) The wave planetology illustrated – I: dichotomy, sectoring // 44th Vernadsky-Brown microsymposium "Topics in Comparative Planetology", Oct. 9-11, 2006, Moscow, Vernadsky Inst., Abstr. m44_39, CD-ROM; **[4]** Kochemasov G.G. (2008) Plato' polyhedra as shapes of small icy satellites // Geophys. Res. Abstracts, Vol. 10, EGU2008-A-01271, CD-ROM; **[5]** Porco C.C., Weiss J.W., Thomas P.C. et al (2006) LPSXXXVII, Abstract 2289.pdf; **[6]** NASA News releases-2007-142 Images of Saturn's small moons tell the story of their origin, December 6, 2007**; [7]** Kochemasov G.G. (1992) Concerted wave supergranulation of the solar system bodies // 16th Russian-American microsymposium on planetology, Abstracts, Moscow, Vernadsky Inst. (GEOKHI), 36-37; **[8]** Kochemasov G. G. (1994) 20th Russian-American microsymposium on planetology. Abstr., Moscow, Vernadsky Inst., 46-47; **[9]** Kochemasov G. G. (1998) Proceedings of international symposium on new concepts in global tectonics ('98 TSUKUBA), Tsukuba, Japan, Nov. 1998, 144-147; **[10]** Kochemasov G.G. (1999) Theorems of wave planetary tectonics // Geophys. Res. Abstr., , V.1, №3, p.700; **[11]** Kochemasov G.G. (2004) Mars and Earth: two dichotomies – one cause // In Workshop on "Hemispheres apart: the origin and modification of the martian crustal dichotomy", LPI Contribution # 1203, Lunar and Planetary Institute, Houston, p. 37; **[12]** Kochemasov G.G. (1999) On convexo-concave shape of small celestial bodies // Asteroids, Comets, Meteors. Cornell Univ., July 26-30, 1999, Abstr. # 24.22.

The images of cosmic bodies credit: NASA/JPL/Space Science Inst., University of Arizona (Fig. 3-15).