



Do tidal or swing waves roughen planetary surfaces?

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Surfaces of the terrestrial planets and their moons are far from being smooth. They are warped by several wavelengths and show a remarkable regularity: their roughness increases with the solar distance. Thus, if for Mercury the surface relief range does not exceed several km, for Mars it is already about 30 km. Earth's range is 20 km, Venus' one 14 km. Recently it was shown that this row of ranges reflects ratios of the tectonic granules radii of terrestrial planets [1, 2]. These radii related to unity of reduced planetary globes (in a geometrical model all planets are represented by even circles [2]) are as follows: Mercury R/16, Venus R/6, Earth R/4, Mars R/2. It means that in the great planetary circles (equators) there are 32, 12, 8, and 4 tectonic granules (now they all are mapped by remote methods) and their numbers are inversely proportional to the orbital frequencies of the planets: higher frequency - smaller granule, and, vice versa, lower frequency - larger granule. In this planetary law is a firm confirmation of the main conceptual point of the wave planetology: "Orbits make structures" [3]. But how this happens? A basic reason lies in the keplerian elliptical orbits implying periodical changes of planetary bodies accelerations. Periodical slowing down and speeding up produce inertia-gravity waves warping any celestial body. In rotating bodies this wave warping is divided in four directions: two orthogonal and two diagonal. An interference of these directions produces tectonic blocks of three kinds: uplifting, subsiding, and neutral. Sizes and amplitudes of the blocks (granules) depend on the warping wavelengths and increase with the solar distance. Thus, a relief-forming potential and the actual relief range observed on the planets increase in this direction [1, 2, 4]. But the tidal forces diminish in this direction. That is why they cannot be a reason for the relief-forming potential. Having in mind a swinging action of planetary orbits on heavenly bodies one might think of swing forces and swing waves (contrary to the tidal waves) producing the wave warping surfaces and the deeper planetary spheres [1]. Three observations in relation with this revelation might be mentioned. 1. An increasing surface roughness of the icy satellites of Saturn with increasing distances from the planet [5]. 2. Atmospheric masses of terrestrial planets increase with the diminishing solar distance as a sequence of more frequent wave oscillations – a sweeping out making atmospheres volatiles from planetary depths is facilitated by more frequent oscillations. 3. The inner rapidly orbiting satellites of Jupiter (Io), Saturn (Enceladus), and Neptun (Triton) are still emitting volatiles as a result of more thorough sweeping out their volatile stock. Mercury also has traces of some metals in its exosphere (MESSENGER data).

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