



## On Titan's orbit, surface structure, composition and atmosphere

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“Orbits make structures” – this is the main point of the wave planetology. The higher orbital frequency – the narrower spacing in “ridge-groove” cross-cutting systems and smaller wave induced circular (polygonal) granular features (craters). Satellites have 2 orbital frequencies in the Solar system. So, 2 main frequencies and 2 modulated side frequencies give 4 frequencies and corresponding to them granula sizes. Observed in pre-Cassini era Titan's granulation (size  $\sim 700$  km) was confirmed by this kind of considerations and calculations [1]. The scale was Earth with its orbital frequency 1/year and corresponding granula size  $\pi R/4$ . Now we have on the high resolution Titan's images (PIA03567, 03568) ridge-groove cross-cutting spacing about 1-2 km, the smallest calculated granula size is 12 km [2]. How to explain this discrepancy? As was shown for Venus-Earth-Mars atmospheres their masses are increasing with orbital frequencies. Titan's orbital fr. is much higher than those of inner planets, also it is volatile rich (low density), so its wiping out volatiles is more effective. Now it has a very important atmosphere, but probably only a part of what was wiped out of it during eons. So, if Titan has lost much of its original mass it probably increased its past orbital radius trying to keep momentum. That is why now one observes tight warping spacing (1-2 km) instead of calculated 12 km corresponding to its present orbit. Otherwise 1-2 km spacing corresponds to one of the wave resonating overtones. Some more remarks. Mercury, also thoroughly degassed, has lost its atmosphere due to proximity to Sun. Mostly metallic and rocky it didn't diminish its mass significantly and keeps its orbit. Titan's situation is different. It lost significant part of its mass and increased orbital radius. Lost volatiles (mainly water vapor, tiny icy crystals, and other substances) aggregate, increase particle mass and fall onto Saturn's rings. Enceladus vapor jets probably also add to rings by the same mechanism. Energy source to heat interiors is a friction of phases of short standing waves under changing signs (+ or -),

as was postulated for Io –also a short orbital period satellite.

References: [1] Kochemasov G.G. (2000) Titan: frequency modulation of warping waves // Geophys. Res. Abstr., v.2, (CD-ROM); [2] Kochemasov G.G. (2005) Cassini's lesson: square craters, shoulder-to-shoulder even-size aligned and in grids craters having wave interference nature must be taken out of an impact craters statistics to make it real. Vernadsky-Brown Microsymp.-42, Moscow, Oct. 2005, Abstr. M42\_31, CD-ROM.