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The wave modulation approach to explain sizes of some features on Saturn and Titan

G. Kochemasov
IGEM of the Russian Academy o Sciences, Moscow, Russia (kochem@igem.ru)

The excellent Cassini' images of the saturnian world shown numerous features on surfaces of Saturn, its rings and satellites that are created by omnipresent wave processes. Even before arriving Cassini SC at Saturn we were sure that wealth of data will be obtained by this SC to prove a leading role of waves in shaping and structurizing objects of this remote cold world [1]. Sometimes before the Cassini era using the Hubble ST picture showing not very clear but still existing granulation of Titan we calculated size of the granules applying procedure of a wave modulation to two orbital frequencies of the satellite and having as a scale Earth (orbital frequency 1/1year = πR/4 granule size) [2]. Recently, after Cassini SC took pictures of almost all saturnian satellites, the wave modulation procedure was applied to show that populations of granules (craters) are suitable for this kind of calculations [3]. So, to any orbital frequency corresponds a characteristic wavelength and granule size (a half of the wavelength). To two orbital frequencies of satellites correspond two wavelengths and granule sizes. These are the main granule sizes. But a wave modulation creates at least two side frequencies, corresponding them wavelengths and granule sizes. These are the side granule sizes. Now it is clear why satellite surfaces are so densely peppered with "craters", hints on craters (chains and grids of shoulder-to-shoulder evenly sized hollows and mounds, creating them evenly spaced crossing ridge-groove systems). Only a part of them is of an impact origin [3]. The modulation consists of dividing and multiplying of the higher frequency by the lower one thus getting two side frequencies. Titan rather extensively studied by imaging systems and radar presents now a good example of the wave modulations. It has two orbiting frequencies: around Sun –1/30 years, around Saturn –1/16 days. The corresponding main granule sizes are 7.5πR and πR/91, or 60641 and 88 km, the former size is too large to be directly observed (its wave probably influences only the whole shape of the satellite) and the latter is visible in the

near IR image PIA06154 as chains and grids of hollows (about 70 to 100 km across) at intersections of cross-cutting tight lineations covering the whole Titan's surface. This mode of granulation is also clearly presented in PIA03567. The modulated side frequencies give granules 662 and 12 km across (πR/12 and πR/667). Both sizes are discernable on Titan's radar image PIA08454. The first as roundish white and dark areas (these granules were discerned and calculated earlier on the Hubble image of Titan in pre-Cassini era [2]). The second size is produced by an intersection of regular wavings-ripples (erroneously interpreted as dunes) with spacing about 10-20 km covering mainly smooth dark parts of the satellite. Thus, three granule sizes (662, 88, 12 km) are detected on Titan's surface by imaging from various distances and using different wave diapasons. At Saturn south pole recently was observed a huge storm about 8000 km across (PIA08333) with many regularly spaced smaller storms about 300 to 600 km across. We can calculate size of these regular wave roundish features with the above procedure. What kind of waves could create this pattern? The saturnian atmosphere has two orbiting frequencies –around Sun and around the center of the Saturnian system: 1/30 years and 1/10.2 hours. Two main waves are not suitable: one is too long (grain 7.5πR), another too short (grain πR/3448, not visible in present images). Remain two modulated side waves with grains πR/25860 (7 km) and πR/460 (419 km). Grains 7 km across are not visible at present, grains 410 km across correspond to spots of the south pole "leopard skin" with approximate average diameters 450km. **References: [1]** Kochemasov G.G. (2004) Cassini experiment: what gains from new knowledge of the Saturnian system the wave planetology? // 35^{th} COSPAR Scientific Assembly, Paris, France, 18-25 July 2004, Abstr. COSPAR-A-00909; **[2]** Kochemasov G.G. (2000) Titan: frequency modulation of warping waves // Geophys. Res. Abstr., v. 2, (CD-ROM); **[3]** Kochemasov G.G. (2005) Cassini' lessons: 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 microsymposium-42 "Topics in Comparative Planetology", Oct. 10-12, 2005, Vernadsky Inst., Moscow, Russia, Abstr. m42_31, CD-ROM.