CALCULATING SIZE OF THE SATURN'S "LEOPARD SKIN" SPOTS. G.G. Kochemasov, IGEM of the Russian Academy of Sciences, 35 Staromonetny, 119017 Moscow, Russia, kochem@igem.ru

The different wavelengths images of the saturnian south pole region with a huge hurricane (~8000 km across) and the central eye (~1500 km across, Fig. 1, PIA08333) display numerous regularly placed roundish spots about 300 to 600 km across. They are considered as local storms, and their characteristic sizes were not discussed. Knowing about widespread wave features in saturnian clouds, rings, satellites one could try to calculate size of these spots considering them as wave forms. "Orbits make structures" – this principal statement of the wave planetology [1, 2 & others] connects orbital periods (frequencies) of celestial bodies with their shapes and internal structures through warping action of inertia-gravity waves induced in them by their motion in non-round keplerian orbits. These inertia-gravity waves propagating in rotating bodies in 4 orthogonal and diagonal directions and having a stationary character interfere producing waveforms of various sizes according to warping wavelengths. The longest fundamental wave 1 gives always present tectonic dichotomy (in celestial bodies of various sizes, densities, chemical compositions, physical states) – theorem 1 of the planetary wave tectonic [2, 3 & others]. The first overtone wave 2 produces tectonic sectoring – theorem 2. On these already rather complicated waveforms is superimposed tectonic granulation size of which depends on orbital periods or frequencies: higher frequency – smaller granulation and, vice versa, lower frequency – larger granulation (Theorem 3).

In sequence of planets with diminishing orbital frequencies, starting with the solar photosphere as the closest to the center of the solar system and having fastest orbit, one has the following row of granule sizes (a half of wavelength) inversely proportional to orbital frequencies: solar photosphere $\pi R/60$, Mercury $\pi R/16$, Venus $\pi R/6$, Earth $\pi R/4$, Mars $\pi R/2$, asteroids $\pi R/1$, Jupiter $3\pi R$, Saturn $7.5\ \pi R$, Uranus $21\pi R$, Neptune $41\pi R$, Pluto $62\pi R$ [4]. It has to be noted that asteroids are in a position where the fundamental wave 1 forming dichotomy and their individual wave making granules , also wave 1, are in the strongest destroying 1 to 1 resonance. That is why in this belt there is a large deficiency of material, thrown out of the zone, and any "would-be" planet would be destroyed before being assembled into rather decent massive body (Ceres is maximum possible?). More lucky is Mars in its orbit where in the strongest 1: 1 resonance are the weaker first overtone wave 2 and its individual granule making also wave 2. As a consequence, Mars is strongly cracked, elliptical in shape but still "alive". Earth and Venus both keep rather globular shape being warped by shorter waves (not like Mars) and have tectonic granules about 5000 and 3000 km across respectively. Mercury's warping waves are again shorter and produce grains about 500 km across. To solar photosphere monthly rotations (= orbiting around the center of the solar system) correspond well known supergranules about 30 000 km across.

Now to the outer planets. Their individual waves are much longer than planets measure themselves and do not influence much their shapes and structures (Saturn's large flattening maybe is due to this wave), but their importance is evident in ubiquitous process of wave modulations in domain of satellites and rings. At first this physical law was applied long before the Cassini spacecraft era to explain size (about 700 km across) of vague granules seen by the HST on Titan [5] and small (about 20 km across) granules on Proteus (Voyager images). Then, when excellent Cassini images of numerous saturnian satellites were obtained their main and calculated side frequencies were applied to explain sizes of numerous aligned, shoulder-to-shoulder, evenly sized, often square in shape craters [6]. The modulation procedure is in dividing and multiplying the higher frequency by the lower one and getting by this way two additional side frequencies. In case of Saturn the lower frequency is 1/30 y. and the higher ones vary between 1/ 0.63 d. and 1/ 550 d.

The cloudy surface of Saturn shows many peculiar features, but recently published in Internet pictures of the saturnian south pole hurricane peppered in IR waves with distinct circular spots ("leopard skin") is especially interesting . Dark spots evidence that this areas block some thermal radiation from interior of the planet because they are denser (contracted) or have somewhat different chemical composition or both. The lighter areas between the spots, contrary, are less contracted (comparatively expanded) or chemically different or both. But this alternation is exactly what one would expect from a wave action. What kind of waves could create this pattern? Two main waves are not suitable: one is too long (produces grain $7.5\ \pi R$), another to short (produces $\pi R/3448$ grain which is not visible in present images; though in the Jupiter's atmosphere rotating nearly as the saturnian one, we detected such small grains [7]). So, remain two modulated side waves producing grains as follows: $[1/3448 : 7.5]\pi R = \pi R/25860 = 7$ km and $[1/3448 \times 7.5]\pi R = \pi R/460 = 410$ km. Grains 7 km across are not visible now* but the larger grains 410 km across correspond to spots of the south pole "leopard skin" with approximate diameters 300 to 600 km, with an average 450 km (Fig. 1).

Two more saturnian features probably also related to waves might be mentioned. Firstly, "String of pearls" (Fig. 2, PIA01941) at the northern hemisphere narrow belt (40 degrees latitude) with more than two dozens regularly spaced roundish objects over more than 60000 km distance (diameter~1200 to 1400 km each). They are spaced by 3.5 degrees of latitude or by ~2800 km that is a wavelength (Internet, November 2006). This "up-down" sequence is probably formed by another mode of modulated waves about 2 to 3 times longer than previously considered at the southern hemisphere. Secondly, puzzling change of the whole Saturn's hues from gold at south to azure at north. This dichotomic behavior most probably is a manifestation of a wave tectonic dichotomy expressing hemispheric difference in altitudes, chemistry and temperature of clouds. This kind of the north-south dichotomy is not unique in the solar system. For examples, the famous martian dichotomy and less known but rather vivid solar one (Fig. 4).

Another examples of the wave modulation mechanism applied to explain granulations on surfaces of celestial bodies include Titan, the smaller saturnian satellites [6], the Moon, Phobos.

* Fig. 3 (a part of PIA08836) is a close-up of the inner edge of the Cassini Division with a fine grainy texture in B ring. These very fine wave grains possibly can correspond to one of modulated waves in rings.

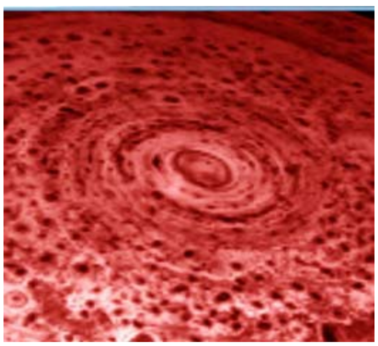
Fig. 1

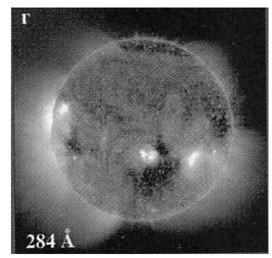

Fig. 4

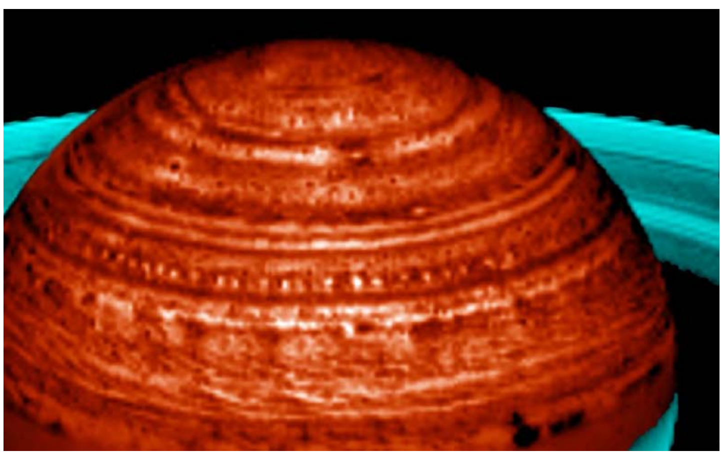
Fig. 2

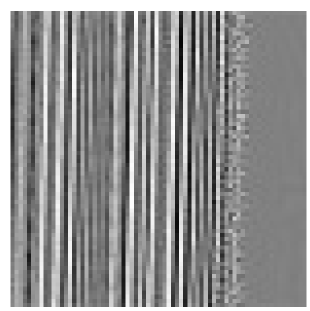
Fig.3

Fig. 1. A portion of PIA08333. The stormy saturnian south; the 5000 nm thermal image, false color; the eye is ~1500 km across. **Fig. 2**. PIA01941. "String of pearls"- regular wave features in the saturn's northern hemisphere; false color. **Fig. 3**. A portion of PIA8836. Fine grainy texture in the outer B ring material. **Fig.4.** Sun's dichotomy at the moment of imaging is of the martian type – north-south segmentation (SOHO).

References: **[1]** Kochemasov G. G. (1994) 20th Russian-American microsymposium on planetology. Abstr., Moscow, Vernadsky Inst., 46-47; **[2]** Kochemasov G. G. (1998) Proceedings of international symposium on new concepts in global tectonics ('98 TSUKUBA), Tsukuba, Japan, Nov. 1998, 144-147; **[3]** Kochemasov G.G. (1999) Geophys. Res. Abstr. V.1, №3, p.700; **[4]** Kochemasov G.G. (1992) 16th Russian-American microsymposium on planetology, Abstr., Moscow, Vernadsky Inst., 36-37; **[5]** Kochemasov G.G. (2000) Geophys. Res. Abstr., v. 2, (CD-ROM); **[6]** Kochemasov G.G. (2005) Vernadsky-Brown Microsymp.-42, Moscow, Vernadsky Inst., Oct. 2005, Abstr. M42_31, CD-ROM; **[7]** Kochemasov G.G. (1997) 26th microsymposium on comparative planetology (Vernadsky-Brown microsymp.26), Abstr., Mascow, Vernadsky Inst., 58-59;