Modulated Wave Frequencies in the Solar System and Universe

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Abstract As all cosmic bodies in Universe move in several orbits with very different orbiting frequencies they are affected by modulated waves. Very low orbiting frequencies of Galaxy and assemblies of galaxies in Universe modulate orbiting frequencies of smaller cosmic bodies with production of short, fine and finest radio and gamma rays. They appear as predicted by radio wave physics. The modulation is division and multiplication of the higher frequency by the lower one. As a result along with main frequencies appear two side frequencies with corresponding those tectonic granules. Examples are on surfaces of Saturn, Pluto, the Moon, Titan, Ceres, Phobos, Churyumov-Gerasimenko comet core. Lost mass and dark energy possibly are related to the shortest not yet measured oscillations.

Keywords Cosmic Bodies, Universe, Modulated Waves, Radio Wave Physics, Modulation

(resolution of devices for fine waves and a body size for large waves). The wave born tectonic granules normally are evenly sized, shoulder-to-shoulder disposed in lines, crossing lines, grids and lattices.

Examples of main and modulated structures on surfaces of some cosmic bodies are below.

2. Materials and Methods

Numerous cosmic images of the Solar system bodies were used for structural measurements and comparisons, in particular, materials of the NASA-ESA Cassini project, Voyager' images, Dawn project data, classical lunar crater size – frequency chart, Rosetta images, Hubble Space Telescope (HST) photos and the New Horizons sensational materials on Pluto. Classical radio physics modulation method applied to simultaneous wave fluctuations of differing frequencies was successfully used in relation to cosmic bodies sharing at one time different orbits. Pluto images present in the paper are due to credit of NASA/JHUAPL/SwRI.

1. Introduction

All cosmic bodies of the Universe rotate and move in orbits with various orbiting frequencies [1,2 and others]. Normally any participates in several orbital movements with differing frequencies. As moving with periodically changing accelerations bodies inevitably are warped by inertia-gravity waves this means that “orbits make structures”. Any orbital frequency creates own wave structure imprinted in body shape. Several frequencies distort the same body by superimposed wave structures.

The firmest prove of the wave nature of structuring is presence of tectonic blocks (granules) size of which corresponds to modulated according to the wave science waves. When two frequencies are present the smaller one is divided and multiplied by the larger one to give two additional side frequencies. Thus, four frequencies (two main and two side ones) are present and corresponding them tectonic blocks are discovered if technically possible

3. Results and Discussion

At the beginning of applying wave modulation procedure for explaining numerous ring structures on surfaces of cosmic bodies was used very simple (not perfect) Titan image made by the Hubble space telescope (HST) (Fig. 1, 2; [3]). Images of Titan (Nature, 1995, v. 374, #6519) along with dichotomy show blurred even granularity. Its size is about 700 km and this can be predicted by the wave planetology [1,2,3]. Granulation sizes are proportional to orbital periods. Titan as a satellite has two orbital periods: around Sun and Saturn. Orbiting the first makes granula size $7.5\pi R$ (the scale is Earth with one year solar period and $\pi R/4$ granule size), orbiting the second makes $\pi R/91$ (~ 90 km). Both granules were not seen at that time: the first is too large (it only distorts the whole body, as well as Saturn itself), the second is out of

achieved for the time resolution. But the modulation of the high frequency by the low one gives granule size ~ 670 km $[(7.5 \times 1/91)\pi R = \pi R/12]$. One observes them (Fig.1-3).

Figure. 1, 2. IR image of Titan (Nature, 1995, v.374, #6519). On the right: interpretation of Titan's granulation of Fig.1.

The Cassini project studied Titan in much more details. Modulated features appeared clearly. Two modulated frequencies (division and multiplication of the higher circumsaturnian frequency by the lower circumsolar frequency (1/16 days and 1/30 years) and corresponding them tectonic granules are detected. The modulation gives $\pi R/12 = (1/91 \times 7.5)\pi R$ and $\pi R/667 = (1/91 : 7.5)\pi R$ granules (670 km and 12 km size). Both sizes are discernable on Titan's radar images PIA06154 and PIA08454. The first is as roundish white and dark areas (earlier distinguished in the HST distant image). 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 near equatorial parts of the satellite [4].

Figure 3. Titan (PIA06154); the image was taken Dec. 10, 2004 at a distance of 1746000 km by the narrow-angle camera with a special near-infrared filter at 938 nanometers (Credit: NASA/JPL/Space Sci. Inst.).

PIA06154 taken from distance of 1746000 km with a special near-infrared filter at 938 nanometers shows a broad bright area Xanadu, regular cross-cutting tight lineations (waves) covering the whole surface of Titan and producing chains and grids of hollows ("craters") with diameters about 70-100 km (Fig. 3). This granule size (88 km) corresponds to the circumsaturnian orbital frequency of Titan (1/16 days) and are superimposed on much larger blobs-"craters" (500-700 km across) hardly distinguished at the center and sometimes with multiple concentric rings. This is the larger modulated granule seen also in the HST image (Fig. 1, 2). The smaller modulated size (12 km) is presented in Fig. 4.

Figure 4. Titan, radar image, grid (ridge-to-ridge) spacing ~ 12 km (a portion of PIA08454).

In the center is a broad bright area Xanadu. Of particular interest are the regular cross-cutting tight lineations (waves) covering the whole surface of Titan and producing chains and grids of hollows (“craters”) with diameters about 70-100 km. This granule size (88 km) was calculated proceeding from the orbital frequency of Titan. These granules are superimposed on much larger blobs-“craters” (500-700 km across, hardly distinguished at the center) sometimes with multiple concentric rings. This size for wave granules, proceeding from two modulating orbits of the satellite, was predicted before the Cassini mission as one of the sizes corresponding to the modulated side wave frequencies (Fig. 1, 2).

The modulation procedure was equally applied to Saturn itself (“leopard skin”) and Proteus – a satellite of Neptune.

Very effective “leopard skin” structure of the saturnian atmosphere with regularly spaced storms about 400 km across (Fig. 5, 6; [5]) can be calculated by the modulation of rapidly rotating atmosphere (1/0.45 days, 60000 km radius) by slowly orbiting Saturn around Sun (1/30 years). To modulated side frequencies correspond smaller granules $(1/3244 : 7.5)3.14 \times 60000 = 7.74$ km and larger granules $(1/3244 \times 7.5)3.14 \times 60000 = 435.6$ km. The smaller granules are not yet observed (maybe they show themselves in kilometric radio emissions), but the larger granules are ubiquitous on the Saturn’s surface as the “leopard skin” spots.

In the saturnian outer B-ring with $R=117580$ km and orbital frequency 1/0.471 days a smaller main granule is $\pi R/3100$ or 119 km. The smaller modulated side granule is $(1/3100 : 7.5)3.14 \times 117580 = 15.9$ km. In PIA08836 (Fig. 7) tiny granules have about 15 km across [6].

Figure 5, 6. Saturn. On the right, PIA08333, South pole, IR image, “leopard skin” spots (false color); on the left, north pole, “hexagon” feature and spots.

Figure 7. Saturn. Outer B-Ring, a portion of PIA08836, grainy texture of some bands.

Modulated granule size of Proteus is ~20 km (Fig. 8, 9). It is calculated from its diameter 416 km, circumsolar granule size $41\pi R$, circumneptunian granule size $\pi R/1300$ (too small to observe with present facilities). Modulated size is $(41 \times 1/13000)\pi R = \pi R/32 = \sim 20$ km [2].

Figure 8, 9. Two views of Proteus, with grainy surface, P-34681

Pluto's rotation and orbiting with frequency $1/6.39$ days around the barycenter of the Pluto-Charon system gives granule size 16.3 km ($\pi R/228$) according to the relation between orbiting frequencies and tectonic granules sizes [1,2,7]. These granules as polygons about 20 km across are visible especially on the brightest and highest sector of Sputnik Planum. Another widespread granule size is about 0.25 km (Fig. 10, 11). It is calculated by modulation of frequency $1/6.39$ days by orbital frequency $1/248$ years = $1/90465$ days to obtain side frequency $1/14157$ and corresponding to it granule size 0.263 km .

Ceres has $1/4435$ days orbital frequency and $1/9.07$ hours rotation frequency. To both parameters correspond tectonic granules too large and too small to be observed ($3.3\pi R$ and $\pi R/3863$). The wave modulation (division and multiplication of the higher frequency, by the lower one) gives two side frequencies: $1/85212$ and $1/965410$. To them correspond tectonic granules $\pi R/38.8$ and $\pi R/440.8$ ($R=475 \text{ km}$), thus about 38.4 km and 3.4 km . Now both sizes are discerned: larger granules from larger distance as

'blobs' at wave intersections (HST image, Fig. 12) and small circles in strings and grids covering the whole imaged surface, Fig. 13. [8].

Figure 10. Pluto. Smallest wave granulation (0.25 km) on icy surface of Sputnik Planum. detail_lorri_rider

Figure 11. Pluto, the highest resolution cross-cutting modulated side waves making granules $\sim 0.25 \text{ km}$ across (Sputnik Planum area; a portion of NEW.SPUTNIK.top_). 2-4. interaction of waves reflected from walls of camera a few cm size {Science News, v. 140. # 18, 1991, 273-288}; this wave "tapestry" resembles a wave structure predicted by the quantum theory. Significant similarity with the Pluto's wave structure of 1.

Figure 12. Color view of Ceres (HST image), PIA10235. In visible and ultraviolet light between Dec. 2003 and Jan. 2004. Diameter 950 km . Image credit: NASA/ESA/J. Parker, Thomas, L. McFadden, M. Mutchler & Z. Levay

Figure 13. Ceres {Dawn image} 27CA2A1500000578-3047265

The Churyumov-Gerasimenko comet 6.6 years – 2398 days, 57552 hours - orbiting period ($1/57552$ hours frequency.) gives $1.65 \pi R$ tectonic granule according to the frequency-granule size relation [1,2,7] – too large to observe directly. But modulations by this small frequency the much higher rotation frequency of the comet ($1/12.5$ hours) gives two side frequencies (division and multiplication of the higher frequency by the lower one): $1/4604$ and $1/719400$. To them correspond two granule sizes: $\pi R/4604$ and $\pi R/719400$ ($R \sim 2500-2000\text{m}$) or $1.70-1.36$ and $0.011-0.009$ m. Rosetta ‘images reveal penetrating comet’s body geometrically regular lattice with spacing about a few meters (fig. 14, 15). Its more accurate dimension can be measured at a block of ~ 5 meters across where stripes width is about 1-2 meters and a granule, consequently, is about 1- 2 meters across [9]. The smaller (finer) modulated centimeter fragment size is presented in numerous “deluvial” covers in local depressions (for an example, Fig. 14). The coarser meter size spherical (polyhedron) boulders also are ubiquitous (Fig. 14, 15). It is important that only calculated two fragment sizes prevail amidst derbies released from outcrops appeared as 3D “wafer cakes” (Fig. 14) [9].

Figure 14. Outcrop at the Churyumov-Gerasimenko comet. AP_rosetta_comet_mission_2_jtm_141111_16x9_992.jpg

Figure 15. Churyumov-Gerasimenko comet core. Portion of Ch-G rock. NAVCAM_top_10_at_10_km_5.jpg. Crossing stripes with ready to detach meter size spherical fragments. Dawn mission.

On Phobos a series of crossing troughs and crater chains is well presented. Smallest wave forms concordant with the highest orbital frequency of the satellite ($1/7.65$ hours) still are not visible. However, modulated side waves and corresponding them forms (“craters”) are visible. $1/7.65 : 1/16488$ (martian frequency) gives side frequency $1/2155$ and corresponding granule size 16.5 m. Smallest visible features in Fig. 16 is about 15 m.

Two modulated frequencies of Deimos are interesting in that the corresponding them granules are, for the smallest (0.038 m) too fine making smooth surface and, for the large (34.6 m) hardly visible as grids in soft damping cover of fine dust material.

Figure 16. Phobos, PIA10369. From 5800 km distance, Mars Reconnaissance Orbiter (MRO), HiRISE instrument. A series of crossing troughs and crater chains. Smallest visible feature is about 15 meters.

Lunar scientists should realize that one of bases of the Moon’s geology – crater size-frequency curve – is of a complex nature. Impacts surely contribute to this curve but a significant part of it is due to ring structures of non-impact origin. The wave planetology [1,2,7,10 and

others] states that ring structures can be produced by an interference of standing inertia-gravity waves of 4 directions warping any rotating celestial body moving in an elliptical orbit. Many ring structures observed on solid and gaseous planetary spheres are of such nature. They form regular grids of “shoulder to shoulder” even ring structures (the best example from the past – Triton’s cantaloup surface). Their sizes depend on orbiting frequencies. Satellites having two orbiting frequencies in the Solar system are particularly “peppered” with rings as a low frequency modulates a high one producing along with the main ring populations side populations. The Moon as a satellite studied in detail reveals such populations: frequency peaks (anomalous number of craters) at $80\text{--}140$ ($\pi R/60$) and more than 600 km in diameter ($\pi R/4$) (main rings), $10\text{--}30$ ($\pi R/240$) and $300\text{--}400$ ($\pi R/15$) km in diameter (modulated side rings). This pattern reveals presence of modulated populations. The lower frequency around Sun modulates the higher frequency around Earth producing granules $\pi R(1/4 \times 1/60) = \pi R/240$ and $\pi R(1/60 : 1/4) = \pi R/15$ [10].

Modulation by the smallest orbiting frequencies of giant cosmic objects (galaxies and larger) smaller faster orbiting objects leads to very fine oscillations saturating Universe.

The wave planetology [1 and others] successfully applied to explain a number of structural peculiarities of planetary surfaces, lithospheres and atmospheres as well as shapes of planetary bodies states that “orbits make structures”. It means that all planetary bodies including asteroids and Sun (aster) moving in non-round (elliptical, parabolic) keplerian orbits are subjected to a warping action of inertia-gravity waves induced in them periodically changing accelerations. These waves having a standing character in closed spheres and 4 directions in rotating bodies interfere to produce structures in planetary spheres. Sizes of these structures depend on warping wavelengths. Thus, the fundamental wave 1 long $2\pi R$ produces ubiquitous tectonic dichotomy – an opposition of uplifted (+) and subsided (–) hemispheres (segments); the first overtone wave 2 long πR gives superimposed on the dichotomy tectonic sectoring; on these basic features are superimposed tectonic granules size of which is inversely proportional to the orbital frequencies. There is a row of planets starting from the solar photosphere arranged by increasing sizes of tectonic granules (a granule size = a half of warping wavelength): the Sun’s 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 $62\pi R$. A difference between the inner and outer planets is in what that the first are warped by wavelengths shorter than their dimensions and the second by waves longer than their dimensions. Asteroids are amidst with the warping wave equal to the great circle. These heavenly bodies have only one orbit each in the Solar system. But numerous satellites have two orbits: one around their planets and another around Sun. This means

that satellites of the inner planets have two populations of tectonic granules (“craters”) on their surfaces. But satellites of the outer planets also are lavishly peppered by granules (impact craters make a part of them). Where they are from? Along with the main orbital frequencies around their planets and circumsolar frequencies (too low to make visible granules) waves and forming at their intersections granules appear due to wave modulations. In full accordance with the wave theory the lower frequency modulates the higher one with production of side frequencies at both sides of the latter. Corresponding to them tectonic granules also are formed. This modulation process was repeatedly described and applied to the Moon, satellites of Saturn, the saturnian atmosphere. But the solar system is not entirely isolated. It belongs to Galaxy and moves in it with a certain frequency, say, about $1/200\,000\,000$ years. Orbiting frequencies of all celestial bodies in the Solar system – from $1/8$ hours of Phobos to $1/248$ years of Pluto – are high comparative to the Solar system orbiting in Galaxy. Dividing all possible orbiting frequencies of the Solar system bodies by the Galactic frequency one comes to a range of side frequencies from microwaves to kilometer waves. This conclusion is a very significant one because it is well known that all bodies of the Solar system are a source of often enigmatic radiowaves. Some calculations are below. A granule size is a half of a wavelength. A scale is the Earth’s orbiting frequency $1/1$ year and corresponding granule size $\pi R/4$.

Jupiter: $(12 \text{ y.} : 200\,000\,000 \text{ y.}) \pi R = (12 : 200\,000\,000) 3.14\,71400 \text{ km} = 13.4 \text{ m}$ tectonic granule or 26.8 m wavelength. Varying orbital frequencies and bodies’ radii one comes to the following wavelengths. Jupiter 26.8 m , Saturn 56.4 m , Uranus 67 m , Neptune 124 m , Pluto 10.9 m , Sun 1.46 m , Triton 11.4 m (for the circumsolar frequency), 1.84 mm (circumneptunian fr.), Amalthea 4.88 cm (circumsolar fr.), 0.0028 mm (circumjovian fr.), the Moon 5.46 cm (circumsolar fr.), 0.46 cm (circumterrestrial fr.) [11,12,13]. It is interesting that an enigmatic extra heat emission of Amalthea and its pronounced red color could relate to these calculated microwave and infrared emissions. Radio emission of the Moon at 2.5 cm wavelength was described in [14].

At the Vernadsky-Brown microsymposium a new scientific paradigm – the wave planetology was circulating since 1992. Besides, it was presented at many Russian forums (such as “Tectonic meetings”, i.g.), at EGS Assemblies, COSPAR Assemblies, LPS Conferences and some other meetings. Now one can firmly state that “orbits make structures” that means that shapes and tectonic patterns of celestial bodies are largely influenced by characteristics of their orbits (ellipticity and orbiting frequency) through inertia-gravity forces. Anybody has its own distinct orbit. There are no two equal orbits, all orbits are different and this means that there are no two equal structures of celestial bodies. It also means that Earth is unique as nobody has equal to it orbit. All orbits are

different because all bodies move complexly in several orbits in their own star systems, in galaxies, in clusters of galaxies, in clusters of galactic clusters in Metagalaxy. Such a complex moving in non-round orbits means oscillations with various frequencies.

High-frequency oscillations are modulated by low-frequency ones with production of side frequencies. The lower side frequencies in bodies terminate by the fundamental wave (wave 1) responsible for ubiquitous tectonic dichotomy (Theorem 1, [1] and others). The higher side frequencies correspond to radiowaves for bodies in galaxies (remember radiogalaxies) and have to be else higher frequent due to orbiting in clusters of galaxies and in clusters of galactic clusters. Orbiting velocities gradually increase from smaller systems to larger ones: the Solar (star) system ($n \times 10$ km/s) – galaxy ($n \times 100$ km/s) – cluster of galaxies ($n \times 1000$ km/s) – cluster of galactic clusters ($n \times 10000$ km/s, about $c/10$, c = the light velocity), where n is about 1 to 5 (on average about 3). Each step means enormous increase of the systems angular momenta as their not only velocities but also masses and radii increase enormously. Such ever increased energies and lower and lower orbiting frequencies provoke (modulate) in bodies higher and higher side frequencies. Thus, if a galactic movement gives radiowaves, orbiting a cluster of galaxies gives gamma-rays, orbiting a cluster of galactic clusters gives the hypothetic medium or isotropic mess of not yet measured very high frequency oscillations (nicknamed “vacuum”). This medium is a real substance where propagate the electromagnetic waves.

It is interesting that well known radio wave and gamma-ray background observations now are added by soft X-rays emitting from various celestial bodies – from cold comets to the hot Sun and measured by the Chandra X-ray Observatory [15]. Reality of Galactic influence at Earth is seen in changing geological periods and a strict 100 mln.y. periodicity of magmatism [16]. Directed changes in the Earth geologic history should be attributed to its Galaxy movement in a cluster of galaxies.

The following discrete scheme may be considered. Modulating frequencies diminish (and cosmic velocities increase) from smaller objects to larger ones:

the Solar (star) system (velocities $n \times 10$ km/s) - leads to tectonic granules, sound
galaxy ($n \times 100$ km/s) - radio waves
cluster of galaxies ($n \times 1000$ km/s) – gamma-rays
cluster of galactic clusters ($n \times 10000$ km/s, about $c/10$, c = the light velocity) – “vacuum”,
where n is about 1 to 5 (on average about 3).

Energy (angular momentum) of existent discrete rotating cosmic systems dramatically increase as their velocities, masses, radii increase drastically. Enormous hidden energy (and mass) in “vacuum” may be treated as “dark energy” and predicted “lost mass”.

It should be mentioned that discussed modulation

approach for the most widespread cosmic processes finds support in some recent publications concerning the orbit-spin coupling in case of the martian global dust storms [17].

4. Conclusions

All cosmic bodies move in several orbits with differing orbital frequencies simultaneously: around planets, stars, in galaxies, in groups of galaxies and so on. Each orbit has own imprint in body structure and many structural features appear as a reflection of modulated side frequencies. The modulation process is the same as in radio wave physics: the lower of two frequencies modulates the higher one by it division and multiplication. Thus appear two side frequencies and corresponding them tectonic features. Examples of them are presented for Saturn, Pluto, Titan, the Moon, Ceres, Phobos, Deimos, Churyumov-Gerasimenko comet core. Considering very slow orbiting frequencies of Galaxy and assemblies of galaxies in Universe, their modulation affect is in production of short radio waves, very short gamma rays and probably not yet measured the finest waves making “vacuum”. These waves occupy Universe.

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