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Atmospheric cell sizes in the solar system related to orbital and rotation frequencies of celestial bodies

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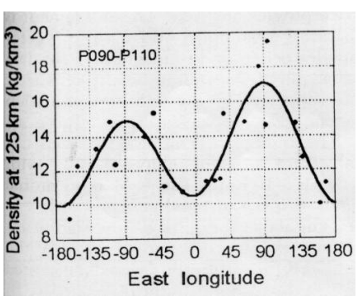
Up to now there are 7 rather well studied atmospheres in the solar system: Sun's photosphere, Venus, Earth, Mars, Jupiter, Saturn, Titan. They have differing radii, thickness, masses, densities, compositions, physical states, belong to celestial bodies of three types, but one property unites them. They are structurized by inertia-gravity waves (as well as their lithospheres) and obey one law of the wave planetology [2-8 & others]: higher orbital frequency smaller atmospheric granules and, vice versa, lower orbital frequency larger granules. "Orbits make structures" – this three-word sentence is an essence of the wave planetology – the only science uniting all so different heavenly bodies on a basis of their orbital properties. Always present orbital eccentricities and frequencies and body rotations are main reasons for their wave structurization. All mentioned atmospheres demonstrate this rather clear. Arranged in a row of diminishing orbital frequencies they show increasing relative atmospheric granule sizes. The relation frequency – size is scaled to the photosphere: 1/1month – πR/60 (48) or Earth: 1/1 year – πR/4 (R – a body radius). The **jovian** atmosphere rotates (or orbits the center of the jovian system) with the period of 9.9 hours (frequency 1/ 9.9 h). The theoretical granule size is πR/3539 or 63 km. These grains or spots can be detected in the high resolution Galileo P-47938 BW images -415 & 886 nm filters (Fig. 7) [3].. The **saturnian** atmosphere rotating or orbiting the center of the saturnian system with period of 10.2 (10.8) hours (frequency 1/10.2 – 1/10.8 h.) reveals in the IR radiation under clouds a vague scarcely resolvable fine granulation comparable with a grainy sandstone texture (PIA08934). A size of separate sand particles is about 50 to 100 km. This size is comparable with the theoretical one – 55 - 61 km (πR/3448-πR/3082) (Fig. 6). The **venusian** atmosphere rotates or orbits the center of Venus with the period of 4 days (frequency 1/4d.). Corresponding granule size is 65 km (πR/295). Measured granule size (PIA 00072) is about 50 to 80 km (or dark nodules like "beads on a string" ~ 100 km across according to PIA00072 – a Galileo image) (Fig. 8). **Titan** orbits Saturn (and rotates) in 16 days. Corresponding granule size is 88 km (πR/91) what suits nearly perfectly to observations (IMG001101-br500) (Fig. 5). The **solar photosphere** rotates (or orbits the center of the solar system) with a monthly period (frequency 1/ 1 month). Corresponding granule size is about 30 to 40 thousand km (πR/60) what matches well with sizes of long ago known solar supergranules (Fig. 4). The **Earth's** atmosphere and lithosphere orbiting frequency around Sun is 1/365days. This gives granule size πR/4 or about 5000 km across (Fig. 2) what is observed in lithosphere and sometimes in atmosphere where weather systems (anticyclone & cyclone) reach this dimension. Much higher atmospheric orbital frequency around the Earth's center (rotation) gives granule size πR/1460 (~14 km) –similar to tornado cyclone or mesocyclone. The **martian** theoretical granule size πR/2 (orbital frequency 1/687days) gives two bulges separated by two hollows in a big circle (Fig.1) what is observed in the solid body and atmosphere. Dust devils could mark smaller atmospheric grains due to martian rotation (πR/1340, ~8 km across, Fig. 12). Along with described grain sequence granules of other sizes simultaneously exist in atmospheres. They represent waves due to other orbits as satellite Titan and atmospheres of planets move not only around centers of their planetary systems but at the same time around Sun. These low around Sun orbiting frequencies modulate the higher around planets frequencies with production of side frequencies and corresponding waves and granules [6-8 & earlier publications]. For examples, there are such granules at **Saturn** (πR/460, "leopard skin", PIA08333, Fig. 9; "cloud phantoms", PIA09001, Fig. 10) [7], **Venus** (πR/49, PIA00073, Fig. 3 [8], **Titan** (πR/12, the Hubble ST image of the pre-Cassini era [6], **Earth** (πR/365 = 55 km, actually typical marine stratocumulus cells are 15-45 km, PIA03704, Fig. 11). The modulation strictly witness for wave processes involved in structurization of the Solar system bodies.



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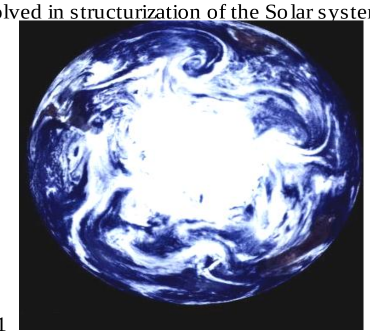
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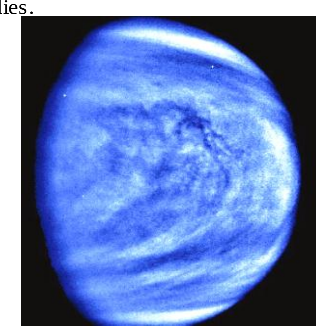
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Fig. 1. Mars. Thermospheric density, normalized to 125 km above surface, as a function of East longitude (solid circles) measured from polar orbits PO90 through P110 by the Mars Global Surveyor accelerometer. The solid curve represents a least-mean-square fit solving for wave 1 and wave 2 (πR/2 grains).[1]. **Fig. 2.** Earth, PIA00729, South polar projection, mosaic of Galileo images, regularly spaced weather systems (πR/4 grains) are visible. **Fig. 3.** Venus, PIA00073, near IR Galileo image, granulation πR/49. **Fig. 4.** Sun, supergranulation with πR/60 cells. **Fig. 5.** Titan, atmospheric granulation, IMG001101-br500, grain πR/91. **Fig. 6.** Saturn, a portion of PIA08934, grainy "sandstone" texture, πR/3082. **Fig. 7.** Jupiter, a high resolution Galileo image P-47938 BW, 886 nm filter, NE of Jupiter's Great Red Spot, πR/3539 grains. **Fig. 8** Venus, PIA00072, Galileo image, "beads on a string", πR/295 grains. **Fig. 9.** Saturn, PIA08333, South Pole, IR image, "leopard skin" spots, πR/460.


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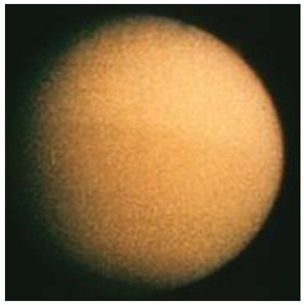
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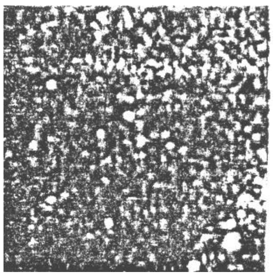
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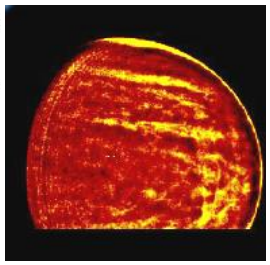
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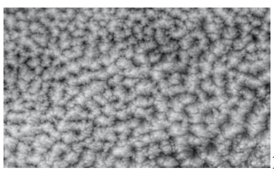
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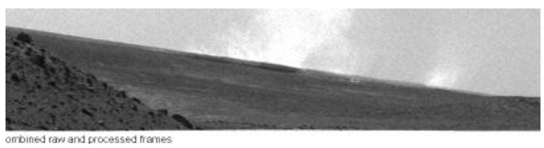

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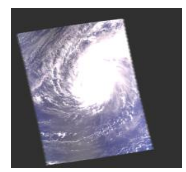
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Fig. 10. Saturn, a portion of PIA09001 IR image, "cloud phantoms" spots arranged along lineaments, πR/460. **Fig. 11.** Earth, PIA03704, Closed small cell clouds in the South Pacific (marine stratocumulus) with diameters 10-15 km instead of the 15-45 km typically noted in satellite observations, comparable with πR/365 size. **Fig. 12.** Mars, PIA12120, Hugh dust devil NW of the Rover Spirit location. Dust devils – swirling thermal plumes of warmer air near the heated by sun surface. Devils pick up the fine dust from the surface (Grant & Schultz, 1987). **Fig. 13.** Earth, PIA00367, Supertyphoon Pongsona. It struck the Island of Guam in Pacific.

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