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Atmospheres of terrestrial planets in a row of the Solar system atmospheres around Sun, planets, Titan.

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Up to now there are 7 rather well studied atmospheres in the solar system: Sun's photosphere and atmospheres of 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 (Kochemsov, 1992-2007): higher orbital frequency smaller atmospheric granules and, vice versa, lower orbital frequency larger granules. "Orbits make structures" – this three words 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/48(60); or Earth: 1/1 year – πR/4 (R – a body radius).

The **jovian** atmosphere rotates (or orbits the center of the jovian system) with a 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. The **saturnian** atmosphere rotating or orbiting the center of the saturnian system with a 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; the theoretical size is 55 - 61 km (πR/3448- πR/3082). The **venusian** atmosphere rotates or orbits the center of Venus with a frequency 1/4d.what makes granule size 65 km (πR/295).

Measured granule size (PIA 00072) is about 50 to 80 km (or dark nodules like "beads on a string" $\sim$ 100 km across). **Titan** orbits Saturn (and rotates) in 16 days. Corresponding granule size is 88 km (πR/91) what suits nearly perfectly to observations (IMG001101-br500). The **solar** photosphere rotates (or orbits the center of the solar system) with a frequency 1/ 1 month. Corresponding granule size is about 30 to 40 thousand km (πR/60(48)) what matches well with sizes of long ago known solar supergranules. The **Earth**'s atmosphere and lithosphere orbiting frequency around Sun is 1/365days. This gives granule size πR/4 or about 5000 km across 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 ($\sim$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 great circle what is observed in the solid body and atmosphere. Dust devils could mark smaller atmospheric grains due to martian rotation (πR/1340, $\sim$8 km across, compare to tornado cyclones)[1]. Granules of other sizes simultaneously exist in atmospheres along with the described grain sequence. They represent waves due to other orbits as atmospheres of planets and Titan 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 [1 & earlier publications]. For examples, there are such granules at Saturn (πR/460, "leopard skin", PIA08333; "cloud phantoms", PIA09001), Venus (πR/49, PIA00073), Titan (πR/12, the Hubble ST image of the pre-Cassini era [2]), Earth (πR/365 = 55 km, actually typical marine stratocumulus cells are 15-45 km, PIA03704). The modulation strictly witnesses for wave processes involved in structurization of the Solar system bodies and their atmospheres. **References: [1]** Kochemasov G.G. (2007) Atmospheric wave granulation in the solar system: the star – planets – satellite // 46^{th} Vernadsky-Brown microsymposium on comparative planetology, 2-3 Oct. 2007, Moscow, Russia, Abstr. m46_37, CD-ROM. **[2]** Kochemasov, G.G. (2000) Titan: frequency modulation of warping waves // Geophys. Res. Abstracts, v. 2, (CD-ROM).