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Granulation in planetary atmospheres and its relation to orbital frequencies of celestial bodies

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

Earlier we have shown that there is nearly direct relation between atmospheric masses of Venus, Earth, Mars and Titan and their orbital frequencies [1, 2, 3]. It was explained by an action of wiping out volatiles from planetary depths: more frequent orbital cycling (shaking) means more complete cleaning mantle depths of volatiles (gases). Comparisons between Venus, Earth and Mars were made with a conclusion that Venus is thoroughly outgassed, Mars is weakly outgassed (it was lately confirmed by significant masses of ice and constitutional water in salts and silicates on the martian surface), and Earth is between them. Titan -the only satellite with an important atmosphere – was also included in this comparative row as an example of a high orbital frequency body with a very dense atmosphere. Now with many brilliant images of celestial bodies we may state that structurization of these atmospheric masses (known long before and sometimes puzzling) also depends on the orbital frequencies. For a purpose of more complete comparison we include in our row also atmospheres of Jupiter (“Galileo” images,[4]), Saturn (“Cassini” data) and Sun (photosphere). For terrestrial planets and Titan there is an opportunity to compare their lithospheric structurization (granulation) with atmospheric one. They are in concordance: granules of a solid surface and covering gaseous envelope have the same size depending on orbital frequencies [1]. There is the inverse proportion between orbital frequencies and granulations (Theorem 3[4 & others]): higher frequency – smaller granules, and vice versa, lower frequency – larger granules. A comparative range of atmospheric granules starts with Sun. Its famous (and mysterious!) photospheric supergranulation has size πR/60 (30-40 thousand km across) corresponding to the photosphere orbiting the center of the Solar system with the 1month period. Venus has πR/6, Earth πR/4, Mars πR/2. For the outer planets Jupiter and Saturn we take their speedy rotations (or orbiting their atmospheres around the centers of respective planetary systems). For Titan

–its orbiting around Saturn. Thus we have for Jupiter πR/3539[4], Saturn πR/3448 (not yet observed?), Titan πR/91[5]. Titan as a satellite has two orbital frequencies : 1/30 years and 1/16 days, them correspond granules 7.5πR and πR/91, the first is too large to be directly observed but it makes a wave modulations[5 & others] with producing side granules πR/16 and πR/667 (662 km and 12 km). The larger ones were observed on a HST image before the Cassini era [5] , the smaller ones are detected on surface radar images of Cassini (PIA08454 & others). It is interesting to note that the same modulation procedure applied to Saturn itself can explain the size of the "leopard skin" spots detected in the south pole storm (PIA08333). Two orbiting frequencies of the saturnian atmosphere (1/30 y. and 1/10 hours) produce too large and too small granules to be observed directly (hopefully, the smaller ones will be detected later). Modulation predicts granules 410 km and 7 km. The first size (300 to 600 km) is the size of the "leopard skin" spots observed on IR image. The 7 km size is not yet visible in the saturnian clouds but ring B recently shown very fine grainy texture (PIA08836) that could be an analogy of a fine granulation in clouds. **References: [1]** Kochemasov G.G. (2002) Mars, Earth, Venus: concerted properties of lithospheres and atmospheres connected with regular tectonic granulation of the planets // Vernadsky-Brown microsymposium 36: "Topics in Comparative Planetology", Oct. 14-16, 2002, Moscow, Russia, Abstracts, CD-ROM; **[2]** Kochemasov G.G. (2006) Venus, Earth, Mars, Titan: intensity of wiping out volatiles from celestial bodies and building atmospheres //36^{th} COSPAR Scientific Assembly, Beijing, China, 16-23 July 2006, Abstr. COSPAR2006-A-00789, CD-ROM; **[3]** Kochemasov G.G. (2006) Atmospheres of Mars, Earth, Venus and Titan Increase Their Relative Masses with Increasing Orbital Frequencies of Respective Bodies // AOGS2006 meeting, 10-14 July 2006, Singapore, Abstr., CD-ROM; **[4]** Kochemasov G.G. (1997) Wave tectonic granulation of the Galilean satellites in comparison with some other cosmic bodies: crucial role of orbital periods // 26^{th} Vernadsky-Brown microsymposium on comparative planetology, Moscow, Vernadsky Inst., Abstr., 58-59; **[5]** Kochemasov G.G. (2000) Titan: frequency modulation of warping waves // Geophys. Res. Abstr., v. 2, (CD-ROM).