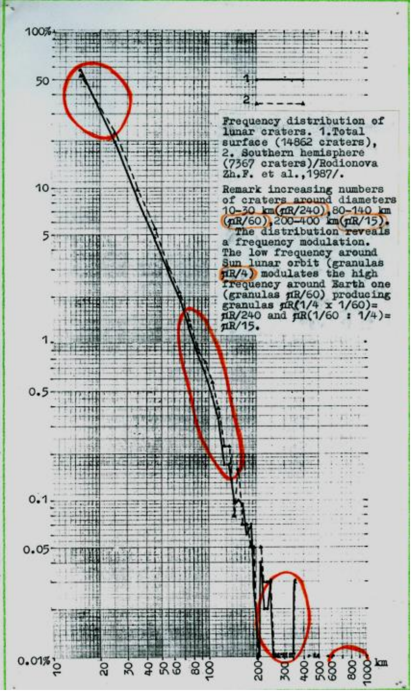
Centimeter size crossing ripples both on the near and far sides of the Moon (Chang'E 3 & 4): modulation of the Moon orbit by the Galactic rotation.

G. G. Kochemasov, IGEM of the RAS , Moscow, RF, 109017, Staromonetny 35, kochem.36@mail.ru 82nd MetSoc, Sapporo, 2019 , LPI Contrib. 2157 **E-poster № 6036**

Intersecting ripples of certain wavelengths and produced them tectonic granules are inversely proportional to the satellite main orbital frequencies (1/1 month – πR/4 and 1/1 year- πR/60 for the Moon) and calculated side frequencies (division and multiplication of the higher frequency by the lower one- πR/15 and πR/240) (Fig. 3) [4]. The granules can be observed on the lunar surface more or less pronounced. Often they are confused with impact cra№ters but their even sizes and regular shoulder-to-shoulder disposition in lines and grids normally solve the problem. Rare chances present the landings of the Chinese probes Chang'E 3 &4 on the Mare Imbrium and SPA areas. Landing surface possibly cleaned by thruster jets of landing device revealed clear crossing lineation of a few centimeters spacing and produced them granules. This very fine granulation fortunately can be calculated comparing it with a track of the Yutu' rover weel. (about 10 cm wide) (Fig.1, 2). An explanation of the granule size should be done with the above modulation procedure using two frequencies as was done for some celestial bodies earlier [4-7]. The Moon main frequencies are 1/1 year and 1/1 month, the modulating Galaxy frequency is about 1/200 000 000 years. A scale is the Earth's orbiting period 1 year with the corresponding tectonic granule size πR/4 [6-7]. Calculations for the Moon: (1y. : 200 000 000y)πR = (1 : 200 000 000) 3.14 x 1738 km = 5.46 cm wave length for the circumsolar orbiting (or 0.46 cm wavelength for the around Earth orbiting). By the same galactic frequency modulation one obtains enigmatic metric radio waves for the Sun and decametric waves for Jupiter [5-7]. Amalthea has 4.88cm (for the circumsolar fr.), 0.0028mm (circumjovian fr.), the Moon 5.46 cm (circumsolar fr.), 0.46cm (circumterrestrial fr.) [5-7]. 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 Berezhnoi et al., 2001 [1]. It is worth to note that well known radio wave and gamma-ray background observations 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 [2]. The Chinese Chang'E-1 orbiter was equipped with a passive microwave radiometer (MRM) to measure the natural microwave emission from the lunar surface. The microwave emission, characterized by ncy-dependent brightness temperature (TB), is related to the physical temperature and dielectric properties of the lunar surface. By measuring the brightness temperatures at different frequencies, detailed thermal behavior and properties of the lunar surface can be retrieved. The resulting maps show fine structures unseen in previous microwave maps that disregarded the local time effect. The new features revealed and their possible connections with the lunar geology were dicussed. Daytime brightness temperatures are found to correlate well with TiO_2 abundance by numerical analysis [8]. In an earlier publication Chan et al. [3] indicated that resulting maps from the high frequency microwave channel show lunar topographic signatures with close similarity to those seen in Clementine's lunar topographic maps, while the low frequency channels reveal intriguing lunar surface properties not previously observed. Two characteristics displayed by the filtered brightness temperature maps are discussed: in the high frequency maps the existence of an anti-correlation between daytime and nighttime brightness temperature deviations in certain regions (especially in the lunar maria), and in the low frequency maps the appearance of cold spots which correspond with the hot spots observed in the infrared during lunar eclipses. Thus, some relationship between lunar microwave emission and the geological background was discussed earlier [1, 3, 8]. In the present work we show existence of the fine crossing rippling of the lunar surface at the microwave lengths and its origin indicating at galactic structuring trace. Similar fine cm-size crossing rippling is clear in images of the Chang'E-4 (Fig. 2). Thus, this modulation process, involving orbital frequencies of the Moon and Galaxy, is observed at the northern and southern lunar hemispheres as well as in the near and far lunar sides. Now, one might speak about the whole Moon modulation event. It is worth to note that the same approach is applied to calculating frequencies of the martian global dust storms (joint consideration of the rotation and orbiting of Mars-spin-orbit coupling) [9,10].

[1] Berezhnoi A.A. et al (2001) // First Convention of Lunar Explorers, 8th to 10th March, 2001, Programme and Contributed Abstracts, Palais de la Découverte, Paris, France, p. 2. **[2]** Bhardwaj A. et al..(2002) // ESLAB 36: Earth-like planets and moons Abstract # 23. **[3]** Chan K.L.et al.(2010) // EPSL, v. 295, (1-2),287-291. **[4]** Kochemasov G.G. (2001)// Programme and Contributed Abstracts, Paris, p. 26. **[5]** Kochemasov G.G. (2003)// GRAbstracts, Vol. 5, 02159. **[6]** Kochemasov G.G. (2008) // GRA, Vol. 10, EGU2008-A-01272. **[7]** Kochemasov G.G. (2002)// GRA, Vol. 4, , European Gepphysical Society XXVII General Assembly. **[8]** Zheng Y.C. et al.(2012)// Icarus,,v. 219, issue 1,194-210. **[9]** Shirley J.H. (2017)// Plan. Space Sci., 141, 1-16. **[10]** Kochemasov G.G. (2018) // Univ Journal of Physics and Application 12(4): 68-75 Doi: 10.13189/ujpa.2018.120402



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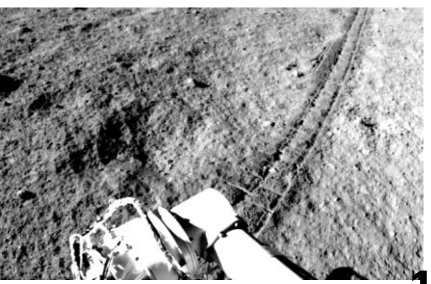

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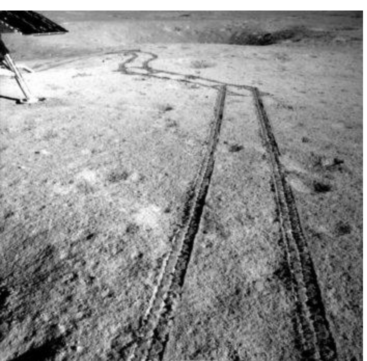

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Fig.1. Yutu's rover weel track on Mare Imbrium surface clearly showing fine intercrossing lineation (centimeters spacing). A portion of Chang'E 3 image 00. Fig. 2. Chang'E 4 image. DwEFLIgUwAEMYFq-1.jpg . Fig. 3. Frequency-lunar crater size curve. Main and side lunar frequencies and corresponding them crater sizes.