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Phenomenon of the wave ordering and the diagram "mean density – global period" in the Solar planetary system

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Abstract. It is shown that spatial ordering of the Solar planetary system can be described by simple wave algorithms. It is detected that the dependence "mean density – global period" reflects the ordering of this system and has signs of an evolutionary diagram.

Keywords. solar system: general.

One can show that for the Solar system exist a clear dependence of $a = f(n)$ (a is the semi-major axis of the planet orbit and n is the sequence number of the planet), which is approximated by two straight lines with a bifurcation point near the asteroid belt. This predicts some differences in the spatial organization of the inner and outer groups of planets. This fact is correlated with the principles of ordering of these planet groups in the scale $L_0 = cP_0 = 19.24$ AU (here c is the speed of light and the period $P_0 = 160$ min) that were published in (Kotov *et al.* 1985). These principles are defined as follows: $2\pi a = L_0/n$ for orbits of inner planets and $2a = nL_0$ for orbits of outer planets (here n is a natural number). Since L_0 – scale has the dimension of a wave, both these principles were transformed into a wave form (Skulskyy 2015). Then, the spatial ordering for outer planets can be represented in a form: $a = n\lambda/2$. Calculated distances from the Sun to outer planets and well-known dwarf planets in the wavelengths were as follows: Jupiter – $\lambda/4$, Saturn – $\lambda/2$, Uranus – $2\lambda/2$, Neptune – $3\lambda/2$, Pluto – $4\lambda/2$, Eris – $7\lambda/2$. This corresponds to the definition of standing waves that are formed as a result of the interference of counter-directed coherent waves in the medium whose linear dimensions are multiple to $\lambda/4$ or $\lambda/2$. The principle of the orbit ordering for inner planets was transformed into a form $2\pi a = m\lambda'$ with the step $\lambda' = (1/12)\lambda/2$ and $m = 3, 6, 8, 12$. In standing waves the orbital architecture of inner planets from Mercury to Mars can be presented as $\lambda/8 : \lambda/4 : \lambda/3 : \lambda/2$. The length of the Mars orbit is directly equal to the length of the standing wave $\lambda_{SW} = \lambda/2$ as to the fundamental harmonic. The logically expected a planet with an orbit length equal to λ was not formed on the position of the asteroid belt (at the bifurcation point of the above dependence $a = f(n)$). The spatial ordering of two groups of planets, which is described by two interrelated wave algorithms, does not look random (Skulskyy 2015).

In an attempt to find out some aspects of the nature of this wave phenomenon, an attention was drawn to the proximity of the observed 160-minute oscillations of the Sun with its eigen global 167-minute oscillations of the Sun. Considering this fact the own global oscillations of all planets were calculated in (Skulskyy 2015), and a resonance relation for the three groups of planets and the Sun was discovered. Here, the results of such calculations for major bodies of the Solar system (including objects which may

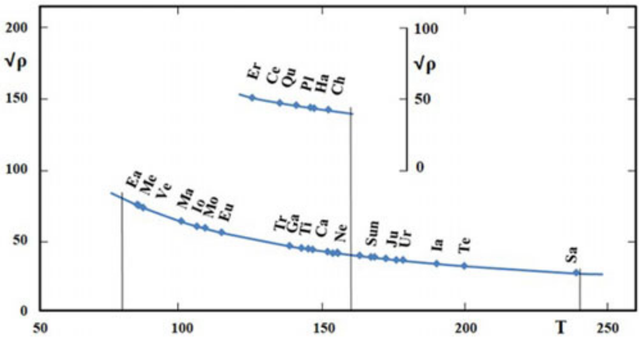

Figure 1. Dependence between periods of global oscillations and mean densities for the main objects of the Solar system (indicated by the first two letters). Planets and their satellites (Moon, Io, Europa, Ganimede, Callisto, Tethys, Dione, Rhea, Titan, Iapetus, Ariel, Umbriel, Titania, Oberon, Triton, Charon – some of them due to the density in the center of the curve are not marked) are given on the lower curve. Transneptunian objects Quaoar, Haumea, Pluto, Charon, Eris and also Ceres are given in the upper fragment. Vertical lines correspond to positions with $T = 80$, 160, 240 min.

still be in a hydrostatic equilibrium with a diameter of up to 500 km and a mass of their bodies up to 10^{21} kg) are presented. Oscillations of celestial objects with symmetric mass distribution and homogeneous gravitational field can be considered as eigen modes of central vibrators. The formula which is used to estimate such periods of celestial objects with mass M and radius R is well known: $T = 2\pi(R^3/GM)^{1/2}$ (here G is the gravitational constant). It was transformed to the form of $T = (3\pi/G\rho)^{1/2}$, where ρ is the mean density of the celestial body. As the result, the functional dependence of $T = f(\rho^{1/2})$ in a wide range of the parameter (which here is in kg/m^3) was formed for all main objects of the Solar system. As is shown in the Figure 1, this dependence has been formed of a smooth curve which is limited by the values of T-periods in the range from 80 to 240 min. Celestial objects and their groups on the curve $T = f(\rho^{1/2})$ take certain places. There is quite compact group of transneptunian dwarf planets, with Pluto and Charon among them. A somewhat isolated group of satellites of the planets with high density includes Io, Moon and Europe. These objects with a rocky surface are very close satellites to their planets and have a warmed up and dense core. Significant tidal forces provide the heating of their subsoils with subsequent sealing. In addition, the highest average density of the Earth can be explained with the tidal forces caused by the relatively close distance to the Moon. These forces can be responsible for the location and movement of celestial objects along the curve "mean density – global period" as a certain evolutionary diagram. The resulting diagram does not depend on the observed period of $P_0 = 160$ min. One can now talk about the coherence of the eigen oscillations of planets with existing eigen 167-minute oscillation of the Sun. Without the interpretation of obtained results one can conclude that wave and gravity factors are represented in obvious interconnections and create an indivisible phenomenon.

References

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