

WHY DOES THE MOON'S EQUATION COINCIDE WITH THE PLANE OF ECLIPTIC ?

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The investigation of the tidal constitutes a field of celestial mechanics of the bodies, which have geometrical sizes. The sequence of investigation of the tidal forces is similar to the sequence of investigation of the orbital movement, which is accepted in celestial mechanics. As the first approximation is given the description of tidal force in the case of unperturbed (Keplerian) movement of the investigated and the external body (the problem of two bodies). Then is given the description of the tidal force in the case of the perturbed, corresponding to the actual materials of observation, orbital movement of the investigated body (the problem of n-bodies).

I. Newton gave in geometrical figures the full description of the tidal force, i.e. the parts, corresponding to keplerian movement, plus perturbations [1]. P.S. Laplace gave in analytical form the description of tidal force only in the case of unperturbed (keplerian) movement of the investigated and the external body (the problem of two bodies).

In modern science is used the formula of Laplas, which characterizes the tidal force in pairs: the Earth–the Moon, the Earth–the Sun, the Earth–the Venus or the Moon–the Earth, the Moon–the Sun, the Moon–the Jupiter and so on.

The summary of tidal forces, corresponding to pair interactions, gives an uncomplete description of power influence. It is impermissible especially in the case of tidal processes on the Moon, where the unperturbed part of the influence of the Moon and the Sun is estimated as $1,2 \cdot 10^{-3} \text{ cm/s}^2$ and $0,7 \cdot 10^{-5} \text{ cm/s}^2$ and the perturbed part has greater module, which is equal to $1,5 \cdot 10^{-3} \text{ cm/s}^2$. That's why the comparison of the Moon's seismic activity with the variations of tidal influence with the Earth and the Sun on the Moon, which were calculated using the formula of Laplace, didn't illuminate their interconnection. After the addition (according to I. Newton) of the perturbations, produced by the Sun, to the description of tidal force the cause–effect connection of tidal influence with the manifestation of the activity of deep (800–1000 km) and nearsurface (25–300 km) centers is estimated convincingly enough.

Periodically changing tidal force on a geological scale of time (hundred of millions of years) may be considered as «vibration». That's why the figure of celestial body, which is formed by axial rotation, bears an imprint the direction of an acting «vibration». The dominating harmonics of tidal force are linked to the plane of ecliptic, where the value of perturbation, produced by the Sun, is maximal. Consequently, the tendency of formation of the Moon's figure had the preferable direction.

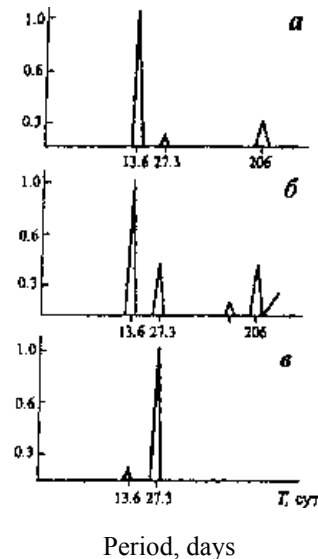


Fig. 1 [2-4]. The comparison of spectra at the main tidal waves, calculated using the formula of Laplas (b), or using formula of Newton (a) with the spectrum of repeats of moonquakes, registered during the experiment «Apollo» (21.04.72-21.05.74) (c)

In favor of originally fast axial rotation of the Moon and tidal warming of the Moon's internal regions at the first stages of formation of the system the Earth–the Moon advocates a substantial magnetic field with the age of 4.0–3.7 milliads of years. Mechanical warming (i.e. thermal losses, corresponding to cyclic deformations) favored the beginning of inhibition of the Moon's axial rotation and the transition of the Moon to the nearly synchronic state of rotation at the approximately 3 mlrd. of years, as can be judged by the fall of magnetic value from 0.3 to 0.05 oersted. During the period from 4.0 to 3.0 mlrd. of years the Moon has significantly lost the angular speed of rotation and at the course of cooling, which has begun (volcanic activity finished at 3.3 mlrd of years ago), the modern figure of Moon has formed. As the Moon's equator lies in the plane of ecliptic, the figure has formed under the condition: the Sun's influence is greater than the Earth's. The shift of 3 km of the Moon's center of mass relative to its geometrical center towards the Earth, as well as basaltic effluxes only on the Moon's surface, which is visible from the Earth, indirectly favor the shift of molten masses under the influence of perturbed parts of tidal influence of the Sun on the Moon.

The lack of folded mountains on the Moon points to, most probably, the fact that the powerful influence of the Sun at the period 4.0 to 3.0 mlrd. of years has

completely formed and oriented the figure of the Moon in the plane of ecliptic, and the influence of the Earth made no subsequent correction.

All these reconstructions, surely, are opened to discussion. But it is clear that the early stages of the evolution could take part at a substantial withdrawal of the Moon from the Earth, exceeding the modern size of the orbit. That's why during the original stages the tidal influence dominated on internal regions, and the change of their aggregate condition caused the loss of axial rotation and the gradual declination of the power of mechanical warming. The Moons example clearly demonstrates that traditional, settled recommendations how to calculate the tidal force must be carefully analyzed within the frame-

work of dynamics, and that one should not use static analogies, which seem to be clear.

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