Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10827, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10827
EGU General Assembly 2008
© Author(s) 2008

Some fundamental problems of dynamics and evolution of the Moon and their possible mechanical interpretation

Yu. Barkin

Sternberg Astronomical Institute, Universitetskii pr-t, 13, Moscow, Russia barkin@inbox.ru, yuri.barkin@ua.es/phone: 07-095-9395024

In the report some results of theoretical studies on evolution and internal dynamics of the Moon shells which are carried out within the framework of the Russian - Japanese project (RFBR and the Japanese society of promotion of a science) "Spin - orbital evolution of the Moon, dynamics of its multiphase core, gravitational and topographical anomalies of the far- side of the Moon in projects SELENE and ILOM " (2007-2009).

I offer possible dynamic interpretation and an explanation of rather difficult questions on evolution and the inner construction of the Moon. **1.** Why so the seen and far – sides of the Moon on its relief, tectonic formations, gravitational, geochemical, mineralogical both magnetic distributions and anomalies strongly differ? **2.** Whether there is a water ice in polar areas of the Moon? **3.** What nature and an origin of the biggest crater (more than 2500 km in diameter, the depth up to 12 km) in the Solar system, located at South Pole of the Moon? **4.** Why epicenters of deep lunar earthquakes fall to depths about 1000 km? **5.** Why the free librations of the Moon are confidently observed which should disappear in result of dissipation of energy? The specified questions obtain the certain interpretation and an explanation on the basis of the concept developed by the author (or planet-dynamic model) of the forced relative oscillations, displacements and turns of shells of the planet (or the satellite) under action of a gravitational attraction of external celestial bodies (Barkin, 2002). On this model the biggest tectonic features of the Moon are connected with eccentric positions of its inner shells relatively to the top shells (to the crust and the mantle). Eccentric relative positions are

occupied with the core, the mantle and the crust. On what specifies in particular the observably displacement of the centre of mass of the Moon approximately on 2 km to the Earth direction. This observable state is a result of dynamical evolution of the Moon-Earth system as consequence of formation of resonant synchronous motion of the Moon and of continuation of its specified evolution. Attributes of similar eccentricity of the planet shells are seen at Mars (well-known Mars bipolarity), at Mercury and at the majority of synchronous satellites of planets (Japetus, Titan, Io, Triton etc.). Therefore at the Moon and other synchronous satellites of planets the contrast of geodynamical conditions in a hemisphere inverted to a parent planet, and in an opposite hemisphere is widely observed. In a geological time scale, since the moment of formation of synchronous motion of the Moon, there were intensive relative oscillations of the core and the mantle layers along a direction to the Earth. Orientation of evolutionary displacements - in the direction of the Earth - also has resulted in fundamental observably contrast of morphological, geophysical and other contrast distinctions of the seen and far-side of the Moon (**Question 1**). The analytical solution of the problem about forced relative oscillations of the core and mantle of the Earth separated by a viscoelastic layer has shown (Barkin, 2001, Barkin, Vilke, 2004), that oscillations with annual, the decade periods and with the periods of planetary secular perturbations have mainly the polar character. With reference to the Moon it means, that its fluid masses during evolution under action of the specified mechanism could tend of asymmetric concentration in polar zones (**Question 2**). Moreover, the concentration of oceanic water masses is observed on the Southern pole of Enceladus, liquid masses (methane lakes, bogs) are concentrated at the polar areas of the Titan. Therefore it is quite real to expect residual concentrations of ice-water masses in subpolar areas of the Moon and Mercury. The huge crater in southern-polar area of the Moon also can be considered as dynamical consequences of relative polar displacements of the core and the mantle layers of the Moon on geological intervals of time (**Question 3**). The eccentricity of the Moon shells and layers results to their additional perturbations by external celestial bodies. In result we observably increased seismic activity on boundaries of the appropriate shells of the Moon (**Question 4**) and excitability of resonant librations of the Moon in a vicinity of Cassini's motion (**Question 5**). The fulfilled studies on the selenodesy and selenodynamics have been supported by Russian-Japanese grant N 07-02-91212.

References. Barkin, Yu.V. (2002) Tectonic activity of the planets and satellites: mechanism and nature of cyclicity, Proc. of the 36^{th} ESLAB Symp. «Earth-Like Planets and Moons» (Noordwijk, The Netherlands, 3-8 June 2002), ESA, SP-514, October 2002, pp. 201-207.