Modern problems of the physical libration of the Moon

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The certain detection of the Lunar free libration parameters with significant dissipation by LLR analyses, geophysical data about lunar interior after Apollo (dissipation factors Q), Clementine (tomography of lunar internal structure) and Lunar Prospector (pole ice lakes and "mascons") impose heavy demands on analytical description of the Lunar interior models. Most of fine effects of the physical libration of the solid Moon were concidered by Eckhardt (1981), Moons (1982, 1984) and by Chapront & Chapront-Touze (1997, 1998). Effects of the free libration were investigated by Calame (1977), Yoder (1981), Eckardt (1993); Newhall & Williams (1997). An action of the lunar core on the PhLL is analised by Yoder (1981), Dickey et al. (1994), the core-mantle differential rotation is considered by Williams et al. (1998, 1999), by Petrova & Gusev (1998) the free core nutation of the Moon is calculated by Petrova & Gusev (1999), of the Mars – by Souchay & Bouquillon (1998), Dehant et al. (2000). It is proposed, that, the further development of the analytical theory of physical libration of the visco-elastic multy-layer Moon will be carried out in the following directions:

- a development the model of two-layer convective dissipation Moon in the frame of Hamiltonian approach with the generalized forces;
- investigation of the core-mantle differential rotation as the source of internal heating and of maintaining of free libration;
- a creation of the modern high-precision analytical tables of physical libration of the Moon and of the "Lunar annual".