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Cassini's motions and resonant librations of Galilean and others satellites of Jupiter

Yu. Barkin

Sternberg Astronomical Institute, Universitetskii pr-t, 13, Moscow, Russia
barkin@sai.msu.ru/phone: 07-095-9395024

The first determinations of the resonant periods of librations in vicinity of synchronous motions for some satellites of the Jupiter and Saturn have been undertaken by the author in 1981 (Barkin, 1981). Thus satellites have been considered as rigid homogeneous ellipsoids with the certain semi-axes. Now for Galilean satellites the dynamic oblatenesses (coefficients of the second harmonics of gravitational potentials) rather confidently are determined. On the basis of the specified parameters of Galilean satellites in the given paper the parameters of their motions on Cassiniu's laws and values of periods of their resonant librations are more precisely determined. Values of the basic Cassini's parameter **p** (it is the average angle of inclination of the axis of rotation relatively to normal to the precessing orbit plane) and the periods of resonant librations in the longitude, in the pole wobble and period of space precession (and their errors) have been appreciated by us under known analytical formulas (Barkin,1978, 1979). So values of the angle of inclination **p** for Galilean satellites make: for satellite Io **7”607+/-0”019**, for Europe **201”3+/-7”5**, for Ganymede **109”8+/-5”2** and for Callisto **23’2+/-2’7**. The periods of librations in longitude by the executed estimations make: for satellite Io **13.323 +/-0.021** days, for Europe **52.66 +/-0.88** days, for Ganymede **186.4 +/-2.97** days and for Callisto **2.461 +/-0.051** years. For the periods of free pole wobble of the specified satellites the following values have been obtained: for Io **225.70 +/-0.64** days, for Europe **4.86 +/-0.13** years, for Ganymede **30.1 +/-1.17** ã and for Callisto **317 +/-11** years. Similarly for the periods of precession the following estimations have been obtained: for Io **159.32 +/-0.39** days, for Europe **3.604 +/-0.134** years, for Ganymede **23.6 +/-1.1** ã and for Callisto **625 +/-73** years. The ob-

tained estimations of inclinations and the periods of resonant (free) librations will well be coordinated to the similar estimations obtained in recent works (Motomoto et al., 2002; Henrard et al., 2005; Lemetre et al., 2006, Noyelles, 2007). The first estimations of the periods of resonant librations of the satellites: Io, Japetus, Phobos, Deimos etc. (modelled by homogeneous ellipsoids), have been obtained by the author in 1981. In particular the period of Io librations in longitude has been determined in **11.3** days, and the period of its pole wobble in **163** days (Barkin, 1981). In the work the estimations for Cassini's angle and for periods of resonant librations also have been obtained for Jupiter satellites Adrastea and Amalthea, but already on the basis of their models as homogeneous ýëëèïñîèäîâ with certain semi-axes (http://www.nasa.gov). For example, the value of the angle **p** for Adrastea has made **1" 68**, and for the fifth satellite of Jupiter Amalthea **3"54**. The period of librations in longitude for Amalthea by the executed estimations makes **0.312 days**, the period of the pole wobble makes **1.070** days, and the precession period is equal **0.259** days. The period of librations in longitude for Adrastea by the executed estimations makes **0.287** days, accordingly, the period of the pole wobble of this satellite makes **0.464** days, and the period of spatial precession is equal **0.258** days. These evaluations are formal character. The existence of resonant relations between specified resonant and orbital periods of kinds **1:1**, **1:3**, **1:4** etc. is possible. Opportunity of existence of similar resonances for some satellites has been marked earlier (Barkin, 1981). Periods of librations of Amalthea in longitude, in the pole wobble and in precession have been evaluated earlier as **0.44** days, **1.88** days and **0.315** days (Barkin, 1981). The given work has been fulfilled at partially financial support under Russian - Japanese grant N 07-02-91212.

Referenses.

Barkin, Yu.V. (1981) **On rotational motion of bodies of the solar system**. Prikl. nebesn. mekh. i upr. dvizheniem. Tr. 5 Obedin. nauchn. chtenij po kosmonavt., posvyashch. pamyati vydayushch. sov. uchenykh. - pionerov osvoeniya kosm. Prostranstva (Moskva, February 2-6, 1981). Moskva, IIET AN SSSR, pp. 115-130 (in Russian).