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Cassini's motions and resonant librations of some satellites of Saturn

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In the given work the motions of some synchronous satellites of Saturn under Cassini's laws are studied and estimations of the periods of resonant librations of these satellites are given. As the basic models of satellites the models of homogeneous ellipsoids are accepted, and also the modern data on gravitational fields of the Titan and Rhea are applied. The author in 1981 undertook the first attempts of determination of the resonant periods of librations in vicinity of synchronous motions for some satellites of the Jupiter and Saturn (Barkin, 1981). In the work four parameters of the resonant motions of each from considered satellites of Saturn are determined: the value of the average angle of inclination of rotation axis of the satellite relatively to normal to the orbital precessing plane, the period of resonant librations in a longitude, the period of the pole wobble and the period of spatial precession. For estimations of the specified parameters the known (and advanced) analytical formulas of the theory of resonant librations of synchronous satellites have been involved (Barkin, 1978, 1979).

The determined values of the specified parameters (in brackets after the name of the appropriate satellite, in the specified sequence) are resulted below. Values of Cassini's angles are given in arc seconds, and the values of periods, accordingly, in day or years. **Mimas (e) (116”9, 2.163 d, 10.72 d, 7.478 d) Enceladus (e) (0”8050, 4.208 d, 27.53 d, 19.38 d) Tephia (e) (23”69, 9.243 d, 104.5 d, 71.26 d) Diona (0”3825, 19.84 d, 323.4 d, 227.1 d) Rhea (C) (85”47, 51.86 d, 3.593 yr, 2.601 yr) Titan (260”7, 2.079 yr, 220.8 yr, 154.5 yr) Titan (C) (296”4, 2.094 yr, 306.6 yr, 175.6 yr) Phebe (e) (279”4, 4.112 yr, 12.35 yr, 11.68 yr) Janus (e) (8”501, 3.076 d, 1.954 d, 2.520 yr) Epimetheus (e) (14”97, 0.8486 d, 8.112 d, 2.185 d)**

Some from considered satellites of Saturn were modeled by homogeneous ellipsoids. These models are marked by index (e) and based on known data about forms and sizes of these satellites (www.nasa.gov). Models of Titan (C) and Rhea (C) were constructed on the base of the modern data about their gravitational fields obtained in result of Cassini mission. For others from considered models have been used ellipsoidal models of hydrostatic equilibrium state of synchronous satellite on the Goldreich, Peale results (1968). Values of the resonant periods of model the Titan (C) will well be coordinated to similar characteristics from the work of Noyelles et al. (2007): **2.098 yr**, **306.4 yr**, **167.5 yr**. The values of periods of librations in longitude and in the pole wobble of the Titan have been determined in the author work: **2.21 yr** and **252 yr** (Barkin, 2004).

For values of Cassini's angle of inclination in the mentioned works the certain divergences are observed. It needs more detailed research and in particular the analysis of orbital motion of the Titan. Periods of resonant librations for Rhea model (C) practically coincide with similar determinations of Noyelles (2007): **51.84 d**, **3.59 yr**, **2.60 yr**. The fulfilled studies on rotation of synchronous satellites have been supported by the Russian-Japanese grant N 07-02-91212.

References.

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.

Goldreich P., Peale S. (1968) The dynamics of planetary rotations. Ann. Rev. Astron. And Astroph., 6, Palo Alto, Calif., USA.

Noyelles B. (2007) About Titan's rotation. A forced "free" resonant wobble. Celestial Mechanics and Dynamical Astronomy manuscript.

Barkin, Yu.V. (2004) Comparative rotational dynamics of the Moon, Mercury and Titan. Astr.& Astroph. Transact.,v. 23, Issue 5, pp. 481-492.