Dynamical considerations regarding asteroid (3200) Phaethon

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Asteroid (3200) Phaethon is an Apollo asteroid having very small (0.14 au) perihelion distance, and rather small (2.7 au) aphelion distance. Its origin is not quite clear [1]. We analyze influence of various perturbation factors on the asteroid motion. The set of estimated accelerations contains gravitational perturbations from all major planets, Pluto, the Moon, Ceres, Pallas and Vesta. As to nongravitational perturbations we consider the Earth and the Sun oblateness, the solar pressure and relativistic effects from the Sun.

The perturbation estimation was done by five different methods [2], allowing to evaluate the perturbation influence both on the nominal orbit and on the probability domain. The mentioned methods are based on residuals (O–C) and on the study of the orbital evolution. The purpose is to classify the perturbation accelerations as powerful, medium or weak ones, and the criteria for classification are built on the value of the mean accuracy of positional observations from the Earth.

All five methods show good consistency. We found that the solar pressure exerts a weak influence on the Phaethon motion, and relativistic effects from the Sun could be classified as medium perturbations. Graviational perturbations include all varieties of possibilities.

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References: [1] Ryabova et al. (2014) ACM 2014 Abstracts. (This volume). [2] Skripnichenko P.V. , Galushina T.Yu. (2013) Izvestiya Vuzov. Fizika. 56. № 6/3. 229–231 (in Russian).