

## New restrictions on nucleus mass density of some short-periodic comets

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Today one of the main problems in research of the comet nature is a determination of mass density of comet nucleus. On a way of definition of the given parameter there is a set of serious difficulties. An estimation of nucleus mass is rather difficult task owing to the small effects of gravitational interaction of comets and planets. Determination of the nucleus size is also not easy task. The huge distances from a nucleus and dense comet coma interfere to the decision of last problem. Till the present moment the attempts of spacecraft to land on a nucleus surface for gathering a comet substance have been not successfully achieved. Today there are some rough estimates of nucleus mass density, characterized by wide intervals of possible values [1], [2].

According to the previous talk the new algorithm of determination of mass density restrictions for comet nucleus is represented in the given work. For decision of the given problem we developed new multicomponent model of a spherical comet nucleus. New stronger restrictions on the interval of allowable values of nucleus mass density for comets 1P/Halley and 81P/Wild 2 are received with use of the new algorithm.

$$1P/Halley: 310 \leq \rho_N \leq 1151 \text{ (}\kappa z/M^3\text{)},$$

$$81P/Wild 2: 310 \leq \rho_N \leq 767 \text{ (}\kappa z/M^3\text{)} .$$

It is shown, that new restrictions depend from Bond albedo nucleus and are in good agreement with the estimations of mass density received by predecessors [1], [3]. It is important to note, that new intervals of allowable values of nucleus mass density are essentially less than ones received by previous authors. Undoubtedly, it is a new step in the decision of the specified problem. The received restrictions on mass density of comet nucleus 81P/Wild 2 are consistent with the data of space mission StarDust [4]. It also proves validity of the offered algorithm.

### References:

- [1] *Sagdeev R.Z., Elyasberg P.E., Moroz V.I.* Nature. 1988. V. 331. № 240. P. 61.
- [2] *Boss A.P.* Tidal Disruption of Periodic Comet Shoemaker-Levy 9 and a Constraint on Its Mean Density // *Icarus*. 1994. V. 107. P. 422-426.
- [3] *Davidson B., Gutierrez P.* Non-gravitational force modeling of Comet 81P/Wild 2 // *Icarus*. 2006. V. 180. P. 224-242.
- [4] StarDust – NASA's comet sample return mission // <http://stardust.jpl.nasa.gov/index.html>