

## HYPOTHETICAL PLANETS AS PARENT BODIES OF SOME ASTEROIDS AND METEORITES

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**Introduction:** In early 1970s, J. Anfinogenov [1,2,3] hypothesized that Tunguska meteorite might be a new-type meteorite coming to the Earth as a remnant of the hypothetical planet called Phaeton [4] once revolving between the orbits of Mars and Jupiter. Nature of Phaeton and mechanisms of its explosive disintegration remain controversial. Various mechanisms have been proposed to answer the challenges of the exploded planet hypothesis [5]. Considering interorbital structural characteristics of the Solar system, two or even three planets could be spaced between the orbits of Mars and Jupiter. Providing certain geometry of their orbits and influence of the giant planet Jupiter, these neighbor planets might approach each other up to a catastrophic collision.

**Aim:** The aim of our study was to elaborate a scenario and conditions of the exploded planet hypothesis.

**Results:** Based on mathematical modeling with iterative refining, here we propose a scenario involving two hypothetical planets Phaeton I and Phaeton II with the following characteristics: (i) masses comparable with the mass of Mars; (ii) average distances of 2.4 A.U. between the Sun and Phaeton I and 3.95 A.U. between the Sun and Phaeton II; (iii) elliptic orbits like those of Pluto and Mercury with the major axes in the ecliptic plane; (iv) orbital plane inclinations of 15° relative to the ecliptic plane, and the angle of 30° between the orbital planes of these planets; (v) similar Phaeton II's perihelion and Phaeton I's aphelion distances ( $2.9 \pm 0.1$  A.U. from these planets to the Sun, respectively) and the distance between these planets of  $\leq 0.1$  A.U. at their closest approach to each other.

The catastrophic collision was possible in case of spatial and temporal co-occurrence of Phaeton II's perihelion and Phaeton I's aphelion if the courses of these planets were intersecting at 30° angle; if individual orbital velocities of Phaeton I and Phaeton II were ~16 and ~20 km/s, respectively; and if their closing velocity was ~9 km/s at the moment of the collision. If this was the case, different variants of a spacial arrangement of Phaeton I and Phaeton II physical bodies relative to each other were possible including a scenario where Phaeton I collided with a rear hemisphere of Phaeton II (billiard ball impact type). If closing velocity was ~9 km/s, the impulse of impact force and the kinetic energy were sufficient for disintegration of both planets and dispersion of their fragments with the velocities exceeding second cosmic speed for their masses. In such a case, a significant portion of the mass from Phaeton II and its fragments might acquire an additional orbital acceleration accounting for the stretching of their orbit up to the Jupiter orbit with a possible capture of some Phaeton II fragments by Jupiter so these fragments assumed orbital motion around Jupiter and even the entry into the Jovian atmosphere. A significant portion of the mass from Phaeton I might undergo deceleration which caused the exit of its fragments from orbit and the acceleration towards the Sun and the Earth-type planets with a possible fall on them. Middle part of the zone where two planets collided could form the asteroid belt.

**Discussion:** We believe that the layered structure of Mars' moon Phobos may suggest its origination from the planetary crust of Phaeton I. This notion agrees well with work of Simioni E. *et al.* [6] who proposes the explanation of the observed distribution of the grooves on Phobos as remnant features of an ancient parent body from which Phobos could have originated after a catastrophic impact event [6]. We hypothesize that Olympus Mons, the largest volcano in the Solar system, could form when the other large fragment of Phaeton I collided with Mars and produced gigantic impact hole in its planetary crust.

Proposed reconstruction of the initial planetary structure of the Solar system and its partial disruption are compatible with the structural and dynamic characteristics of the preserved parts of the Solar system. Identification of progenitors for the meteorites and the bodies from the asteroid belt as well as determination of cosmic age of their formation require to consider that some of them may belong to the rocks originating from planetary crusts of hypothetical planets Phaeton I and Phaeton II.

**Conclusions:** Hypothetical planets Phaeton I and Phaeton II that possibly existed in the past may represent parental bodies of putative new-type planetary meteorites including Martian-like meteorites and meteorites belonging to upper-crust rocks such as volcanic and highly-metamorphic igneous and sedimentary rocks.

**References:** [1] Anfinogenov J. (1973) Tomsk: *Molodoy Leninets Regional Newspaper* NN 47, 49, 52–54. [2] Anfinogenov J. F. and Budaeva L. I. (1998) Tomsk: *Tunguska etudes* 108 pp. [3] Anfinogenov J. *et al.* (2014) *Icarus* 243:139–147. [4] McSween H. Y. (1999) *Meteorites and Their Parent Planets*. Cambridge University Press. p. 35. [5] Van Flandern T. (2007) *International Journal of Astrobiology* 6:185–197. [6] Simioni E. *et al.* (2015) *Icarus* 256:90–100.