

# Observations of the 3200 Phaethon and Geminid meteor shower during the epoch of close approach with the Earth

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## Abstract

Results of the coordinated observations of the asteroid 3200 Phaethon and Geminids meteor shower during the epoch of close approach with the Earth (16 December 2017) are presented.

## 1. Introduction

In December 2017, the asteroid (3200) Phaethon approached to the Earth at a distance of 0.069 AU, the smallest in the interval 1983 (discovery) – 2093 (approaching 0.02 AU). Since its discovery in 1983 and until 2009, the asteroid has shown no activity, although its search was conducted. In 2009, observations from the NASA STEREO space observatory made it possible to record a short-term (about two days) activity in perihelion [1]. This phenomenon was also observed in 2012 and 2016 [2, 3].

Asteroid Phaethon is the parent body of a main annual meteor shower of Geminids, which is observed on Earth in the middle of December. Mathematical simulation [4] showed that the structure of Geminids is consistent with the comet scheme of its formation. However its origin is still under discussion. E.g. a dynamical pathway was found from the Pallas family [5, 6], but how the Geminids could be generated on this pathway is not clear. We need more data allowing to ascertain physical properties of the asteroid, so we need more observations.

Results of mathematical modeling [7] has shown that activity of the Geminid meteor shower should rise with time, and that was confirmed by analysis of visual observations 1985–2017 [8]. We need more data of the shower observations, especially its flux density and meteoroid mass distribution profiles.

## 2. Observations and results

The observations of the asteroid (3200) Phaethon and the Geminid meteor shower were carried out in epoch of close approach of the asteroid with the Earth.

We observed asteroid (3200) Phaethon at the prime focus of the 2-m telescope Terskol branch of INASAN (Russia) and 1.3-m telescope Skalnaté pleso (Slovakia). We conducted a long series of photometric observations aimed to infer the light curve of Phaethon. These data allow us to investigate the physical characteristic of the object.

The observations of the Geminid meteor shower were performed from the territory of Cuba (the reserve “Sierra del Rosario” (~70 km from Havana)). The wild-field of view camera Watec LCL-902H3 and the lenses Computar F=2.9–8.2 mm were used for observations. The results of observations of meteors during the period 12–14 December 2017 (in period of Geminid meteor shower maximum activity) are presented.

Using these data we estimated of the variation of activity of the Geminids (ZHR and IMA) in 2017 and compare with the different visual and television data. According to the various data and mathematical simulation [7, 8] the activity of Geminids in 2017 was increased.

### 3. Summary

The coordinated observations of the asteroid 3200 Phaethon and Geminids meteor shower in 2017 to allow us to estimate the physical characteristic of the asteroid (color, radius and period rotation) and characteristics of the Geminid meteor particles.

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