Possible parent bodies for the Geminid meteor shower

Ireneusz Włodarczyk[1,2]

1. Polish Astronomical Society, Bartycka 18, 00–716 Warszawa, Poland
2. Polish Society of Amateur Astronomers, Rozdrażew, Powstańców Wlkp. 34, 63–708 Rozdrażew, Poland

We proposed graphical method of searching of the parent body for the Geminid meteor shower. Firstly, we selected 36 Apollos which orbits are close to the orbit of the Phaethon – one of the several parent body of the Geminid stream proposed so far. Among them, we found several asteroids with orbital parameters similar to that of Phaethon.

1 Introduction

Asteroid (3200) Phaethon can be a parent body for Geminid meteor shower (Jopek & Williams, 2013). In this paper, we searched for another parent bodies for Geminid stream. First, we selected all 8853 orbital elements of Apollos from JPL (Jet Propulsion Laboratory) Small Body Database[1].

Then we used simplified D-criterion suitable for comparing the orbit of asteroid with the orbit of meteor stream proposed by Steel et al. (1991). We compared orbit of Phaethon with all selected Apollos orbits. We found 36 orbits of Apollos which have similar orbits to that of Phaethon.

2 Orbital computations

To compute the orbit of the asteroids we used the freely available OrbFit software v.5.0[2]. In all our computations, we follow the same method of the weighting and selection of observations that is being used by the NEODyS[3] site (Milani et al., 2005a,b; Milani & Gronchi, 2010).

We used the JPL DE431 and additionally 25 perturbing massive asteroids (Chesley et al., 2014). Then we used OrbFit software v.5.0 to compute time evolution of orbital elements for all selected 36 Apollos. We computed time evolution of both orbital nodes of these asteroids in the years between −12000 and 17000 and next, presented graphically in Fig. 1.

Asteroid 2005UD, now named (155140), has similar orbit to that of Phaethon as was mentioned by Ohtsuka et al. (2008).

3 Results

It is visible in Fig. 1 that there are some asteroids with time evolution of the orbital nodes similar to that of Phaethon, and hence to the Geminid meteor shower.

[1] https://ssd.jpl.nasa.gov/sbdb_query.cgi
[2] http://adams.dm.unipi.it/∼orbmaint/orbfit/
[3] http://newton.dm.unipi.it/neodys/index.php?pc=0

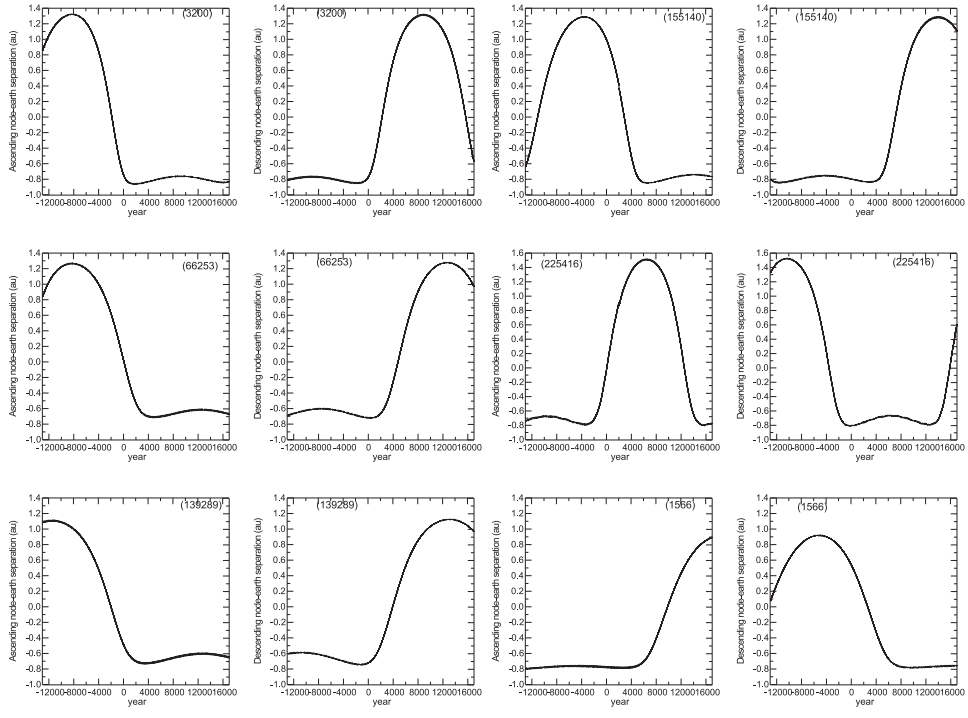

Fig. 1: Left panel: Apollos with similar evolution of nodes to Phaethon. Right panel: Apollos with similar (upper panel) and with different evolution of nodes (two bottom panels).

So, parent body for Geminid shower can be one of the following objects: (3200) Phaethon, asteroids (66253) 1999 GT3, (139289) 2001 KR1 or (155140) 2005UD.

Acknowledgements. We would like to thank the Space Research Center of the Polish Academy of Sciences in Warsaw for the possibility to work on their computer cluster.

References

Chesley, S. R., et al., *Icarus* **235**, 5 (2014)

Jopek, T. J., Williams, I. P., *MNRAS* **430**, 2377 (2013)

Milani, A., Gronchi, G. F., Theory of Orbital Determination, Cambridge University Press (2010)

Milani, A., et al., *Icarus* **173**, 362 (2005a)

Milani, A., et al., *Icarus* **179**, 350 (2005b)

Ohtsuka, K., et al., *Meteoritics and Planetary Science Supplement* **43**, 5055 (2008)

Steel, D. I., Asher, D. J., Clube, S. V. M., *MNRAS* **251**, 632 (1991)