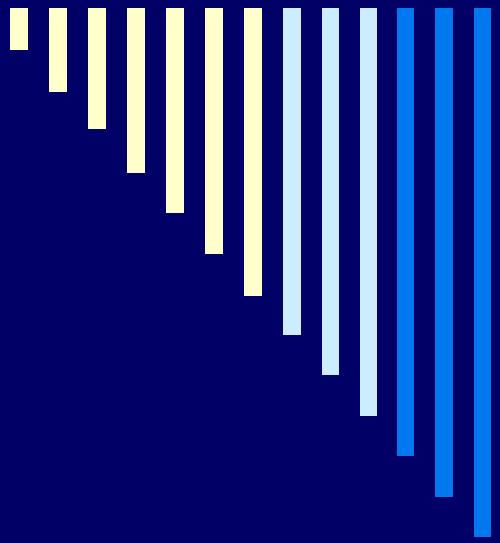

Is it possible to observe meteoroids ejected from asteroid (3200) Phaethon in 2009?

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Asteroid (3200) Phaethon

- Discovered as 1983TB
- NEA, a = 1.4 AU, e = 0.9 $\Rightarrow$ q = 0.14
- Geminid's parent body
- No activity was observed
- … till 2009

Dead comet?

Asteroid?

Jewitt D., Li J. AJ, 2010,140, 1519-1527.

Phaethon brightened by 2 mag or more at UT 2009 June 20.2 ± 0.2

Outburst lasted 2 days

- Interaction with the solar wind
- Sublimation of the deep ice
- Thermal decomposition and fracture

Model

- Ejection of 30 000 particles
- Ejection velocity < 100 m/s
- Integration forward till 2021

  (Everhardt, all planets)

Phaethon will approach the Earth in 2017

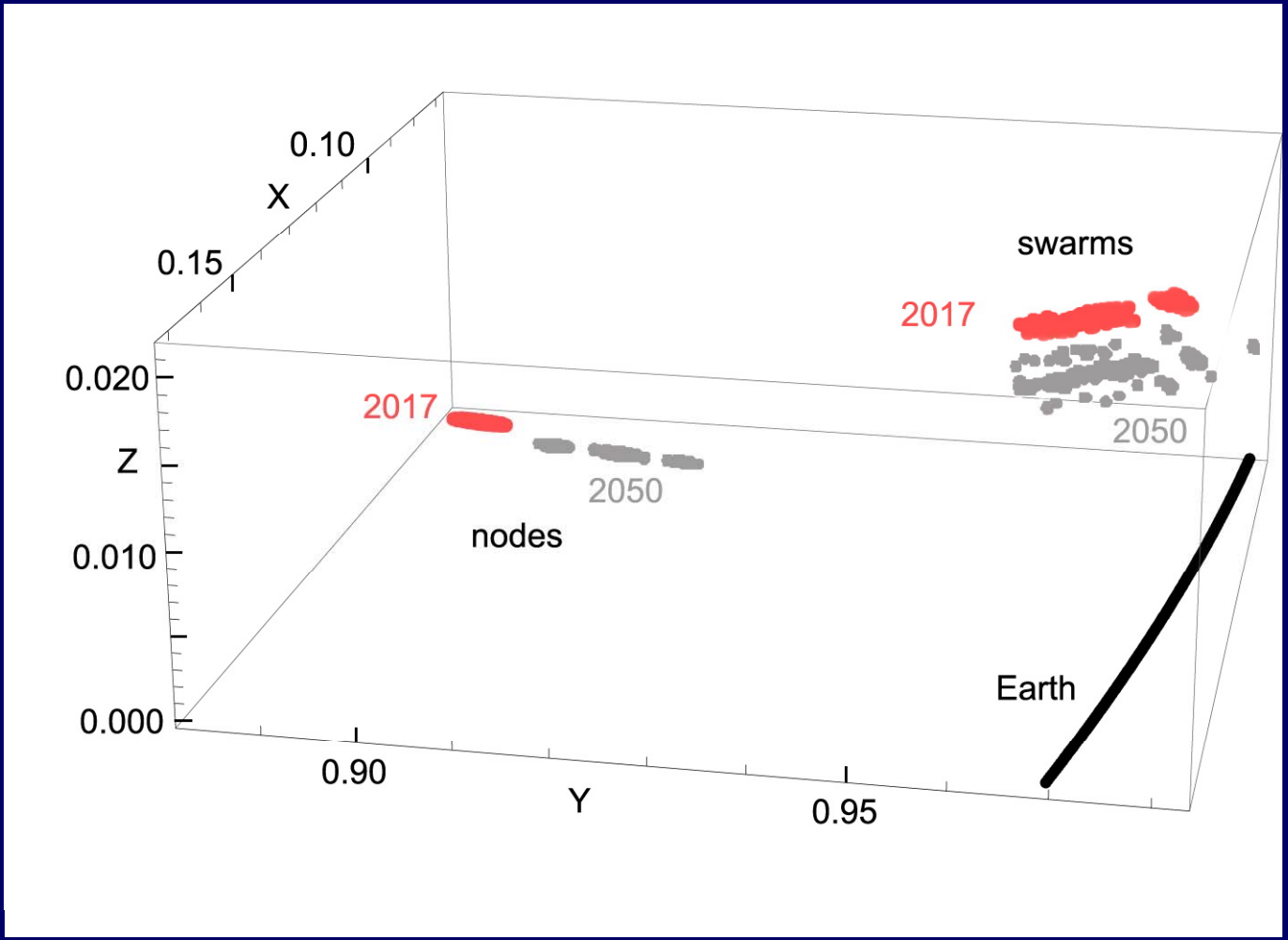
Δ = 0.0689 AU

We looked for the following answers:

- could the dust produced be observed on the Earth as meteors?
- could these meteors somehow be separated from the ‘regular’ Geminid meteors?

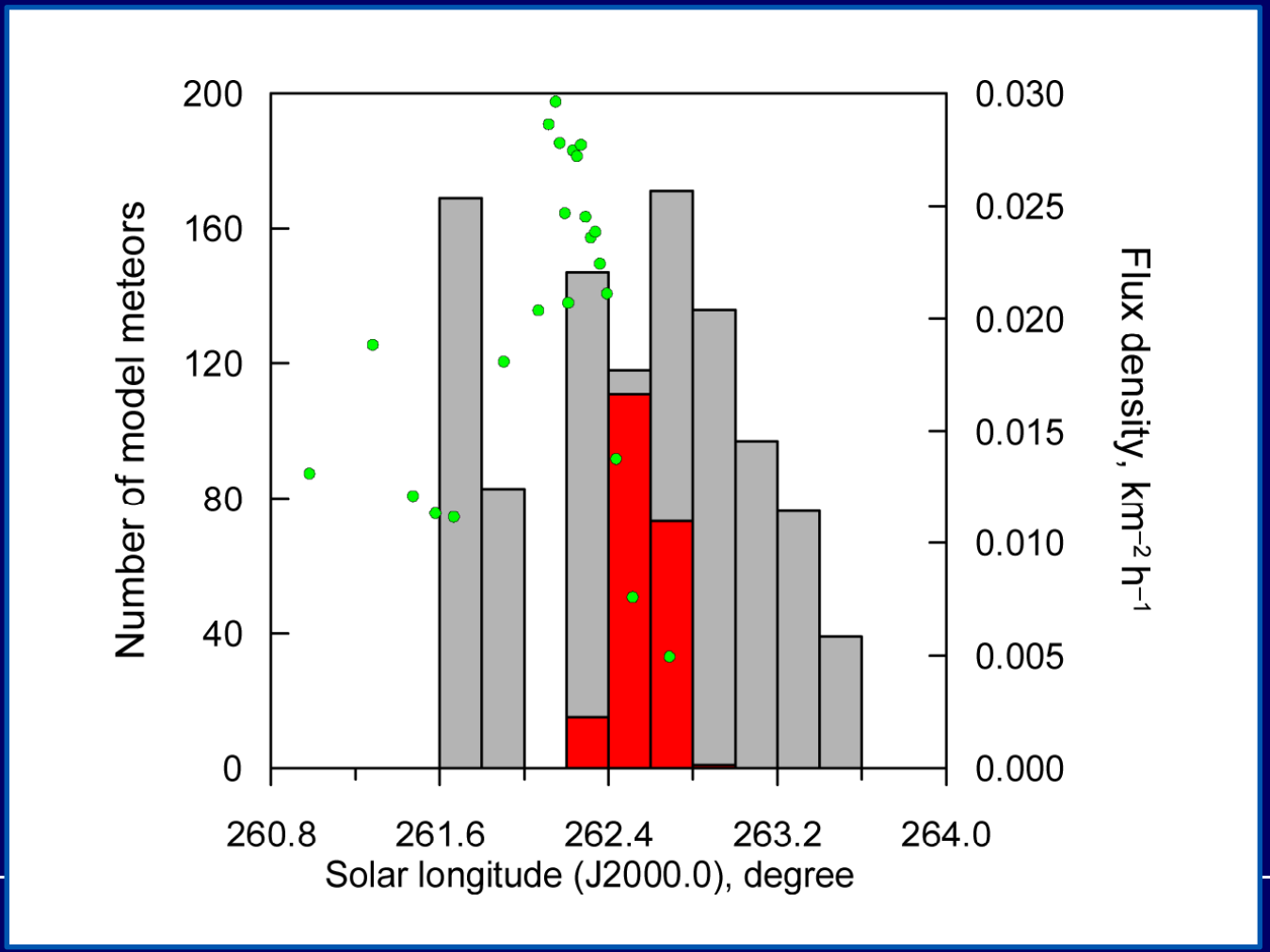
What was found

- Swarm approach the Earth in 2014 (278 particles), 2017 (1036), 2018 (8), 2020 (326)
- $\Delta r \geq 0.018$ AU
- In all cases the swarm behaves in much the same way



2017: Δr : 0.018 – 0.030 AU, nodes — 0.1 AU

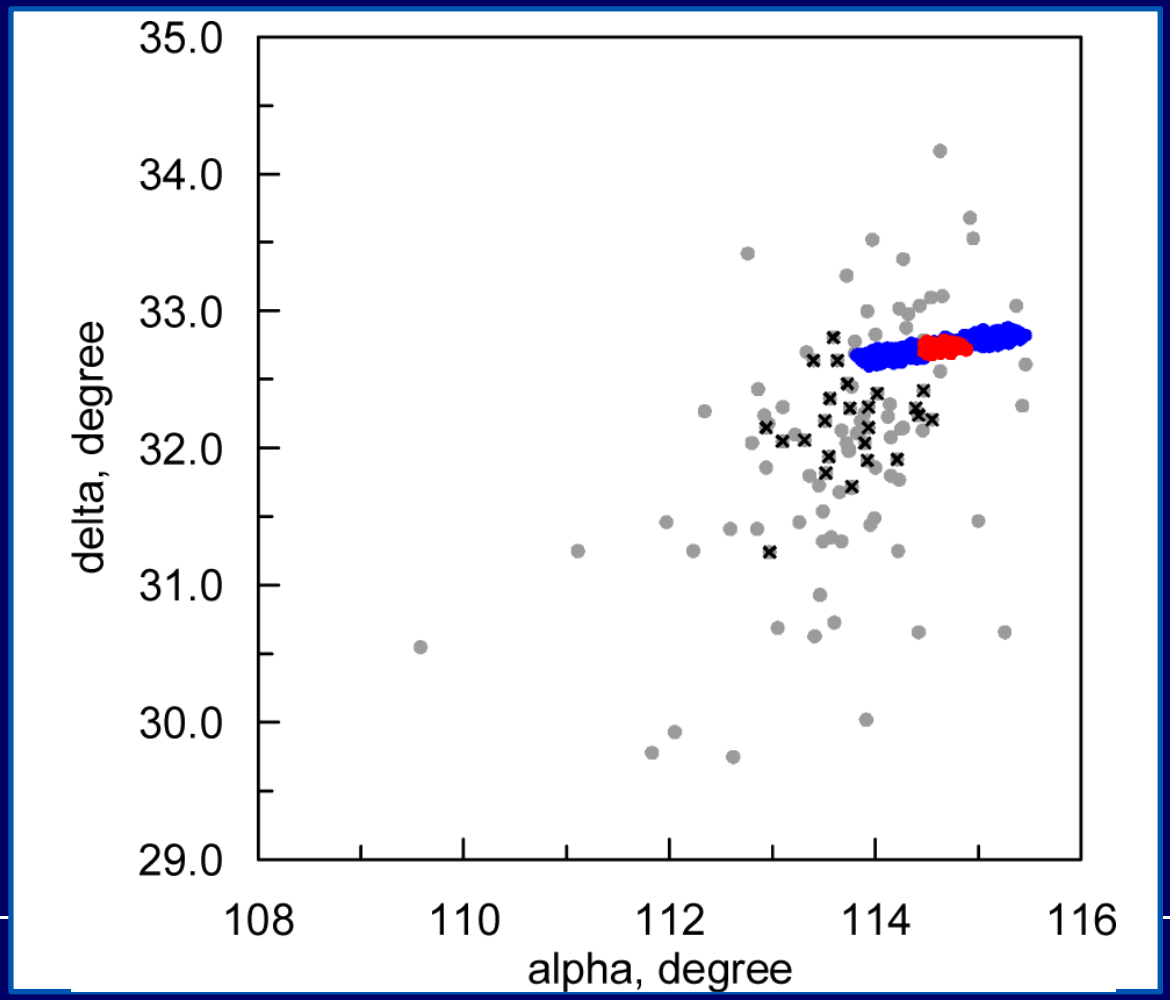
Activity profile



Activity profile

- The outburst may take place at 262°.5
- To exceed the usual level of activity mass of the 2009 swarm should exceed approximately 2×10^{8} kg.
- The upper limit of dust production by Phaethon due to thermal fracture is estimated about 10^{10} kg

Radiant


35.0
34.0
33.0
32.0
31.0
30.0
29.0
delta, degree
108
110
112
114
116
alpha, degree

Radiant

- Small spot:

  $\alpha \approx 114°.65 \pm 2°.5$, $\delta \approx 32°.7 \pm 0°.1$

- Feature: concentration of radiants of meteors of various magnitudes in this spot
- Problem: the fine structure of the Geminid's radiants

Summary:

- Minimal distance ≥ 0.018 AU,
  Earth Influence sphere ≈ 0.03 AU $\Rightarrow$
  possible, but the probability is not high
- Probability increases with time
- Problem: the observational bias calls for investigation

Ryabova G.O. MNRAS. 2012. Vol. 423. P. 2254–2259.