Dust Trail Observations of Comet 17P/Holmes and Predictions for 2021-2022

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Presentation highlights

- *A comprehensive model capable of describing the evolution of the dust trails produced by the 2007 outburst of comet 17P/Holmes.*
- *Continuous observations of the dust trails in common nodes for 0.5 and 1 revolutions.*
- *Predictions for the two-revolution dust trail behavior near the explosion point for the years 2021 and 2022.*

Background

Comet 17P/Holmes’ outburst

When the comet 17P/Holmes' outburst took place on 2007 October 23-24 a large amount of dust particles and gas were ejected from the comet [1][7]. Comet was a rare spectacle to the observers (Fig. 1).

The dust particles ended up on elliptic orbits around the Sun and seemingly vanished. However, there are two common nodes of their orbits, where dust particles converge and form the possibility to directly observe the dust telescopically in the visible light spectrum [2].

Individual dust particle orbits are affected mainly by solar radiation pressure effects and Jupiter gravitational disturbance.
We made predictions of dust observability in visible light, when the dust converges near the outburst point in the future, starting from fall 2021.

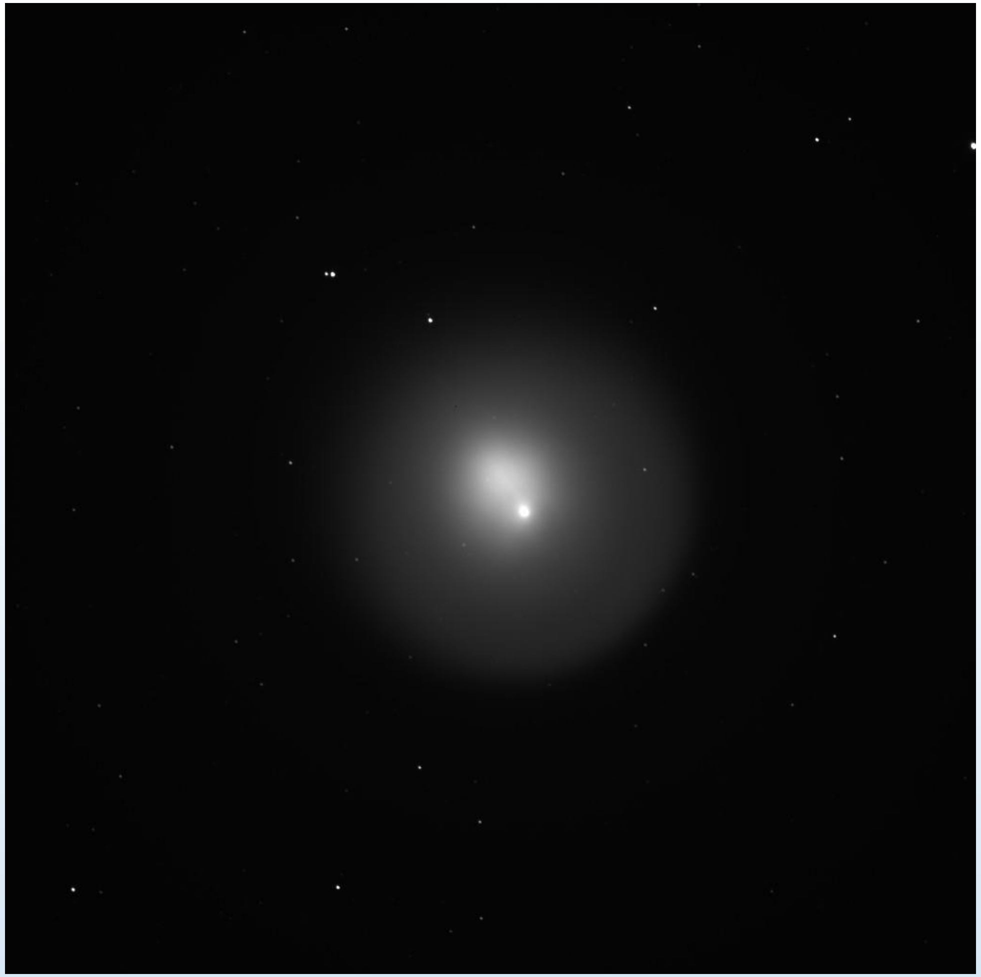

Figure 1. Comet 17P/Holmes observed in Hankasalmi Observatory 2007 November 4.

First Trail Observations (February 2013)

Our first observations of the dust were made at the Siding Spring Observatory. The modeling results show that all particle sizes (correlating with the parameter β) modeled were still present in the dust trail. The observed part of the dust trail was situated already towards the end part of the trail. The second observation made in August 2013 showed a dust trail, which had small and middle sized particles, but not any more big particles (Fig. 2 & 3).

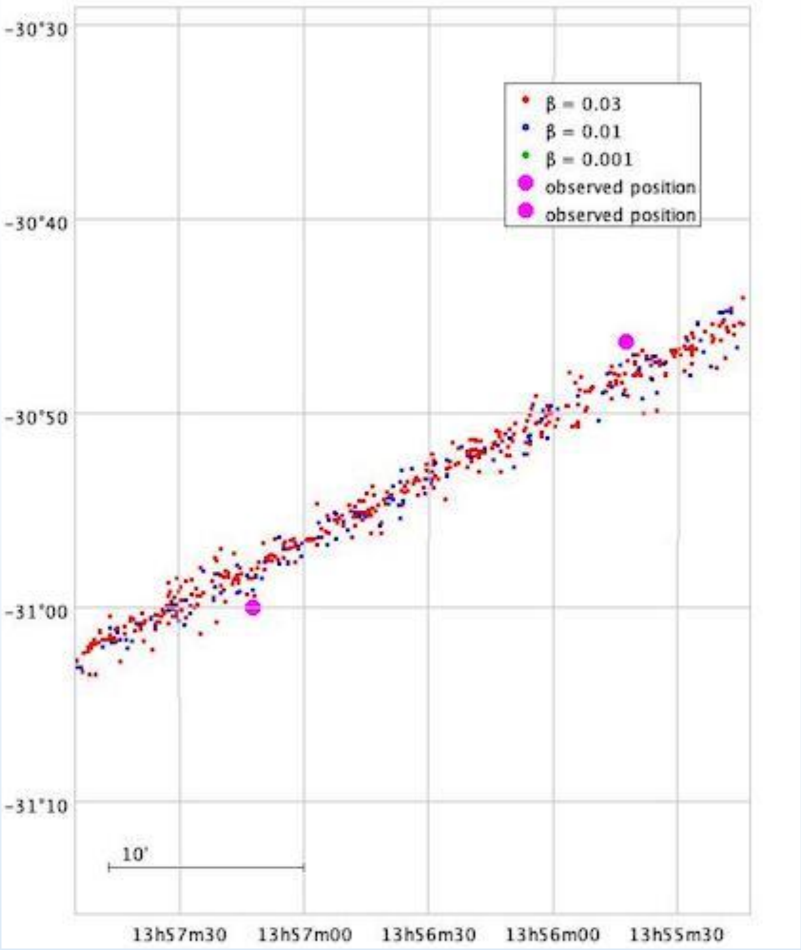

Figure 2. Modeling of observation 2013 August 24. Plotted in the figure are also the observed position points, which are corrected by adjusting time of the observation to match the timestamp used in the model using a coordinate list [6]. Sky coordinates.

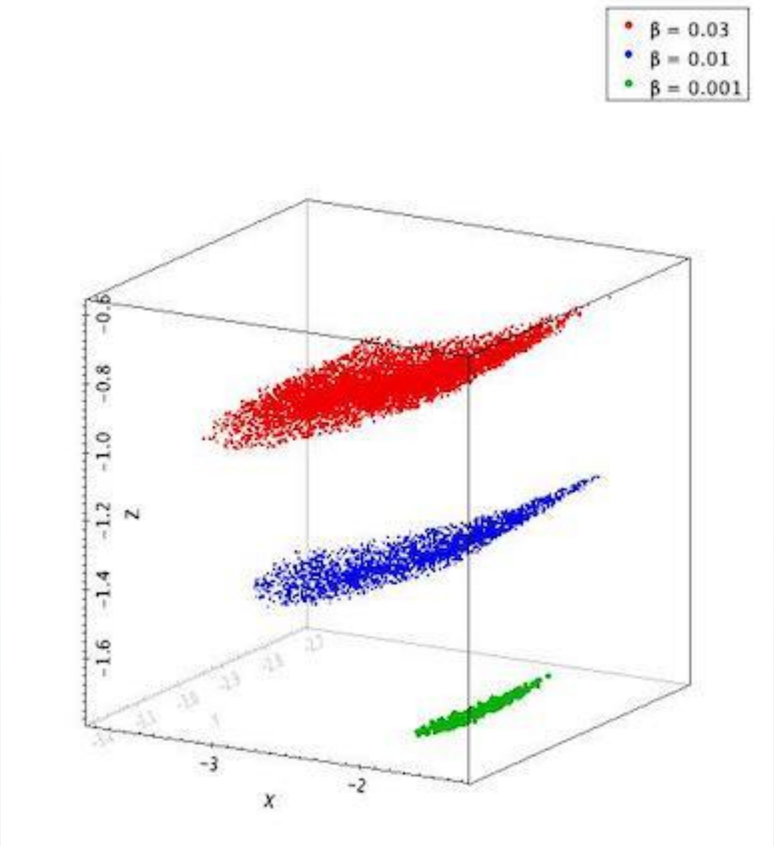

Figure 3. Modeling of observation 2013 August 24. Cartesian coordinates.

Trail in September 2014

Observations were continued in the Northern Hemisphere at the Auberry Sierra Remote Observatory and at the New Mexico Skies observatory in September 2014, when the comet itself was located on top of the dust trail as seen from Earth. All particle sizes were present during the observation with the comet itself (Fig. 4). Observations continued in Hankasalmi Observatory, Finland. In February 2015 dust trail was visible without image subtraction [3][4][5](Fig. 5).

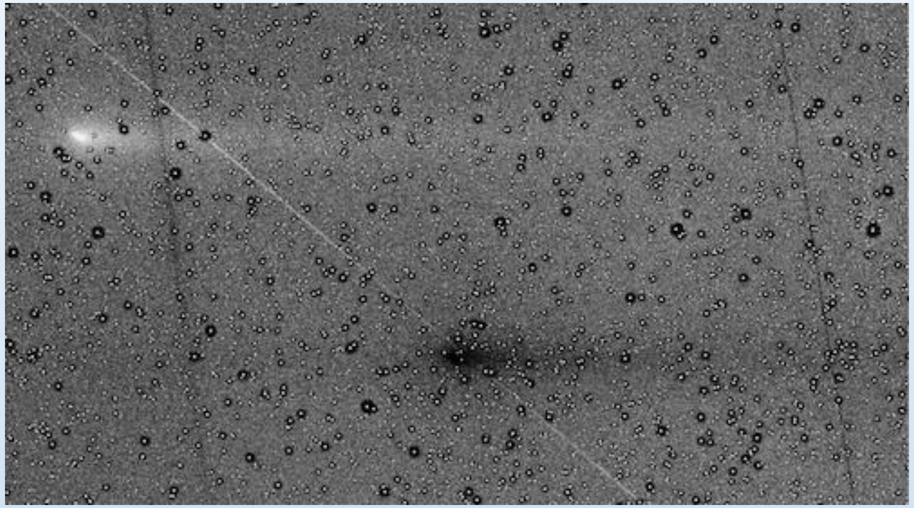

Figure 4. Comet 17P/Holmes pictured when traveling on top of the dust trail. Image subtraction. 2014 September 3-4.

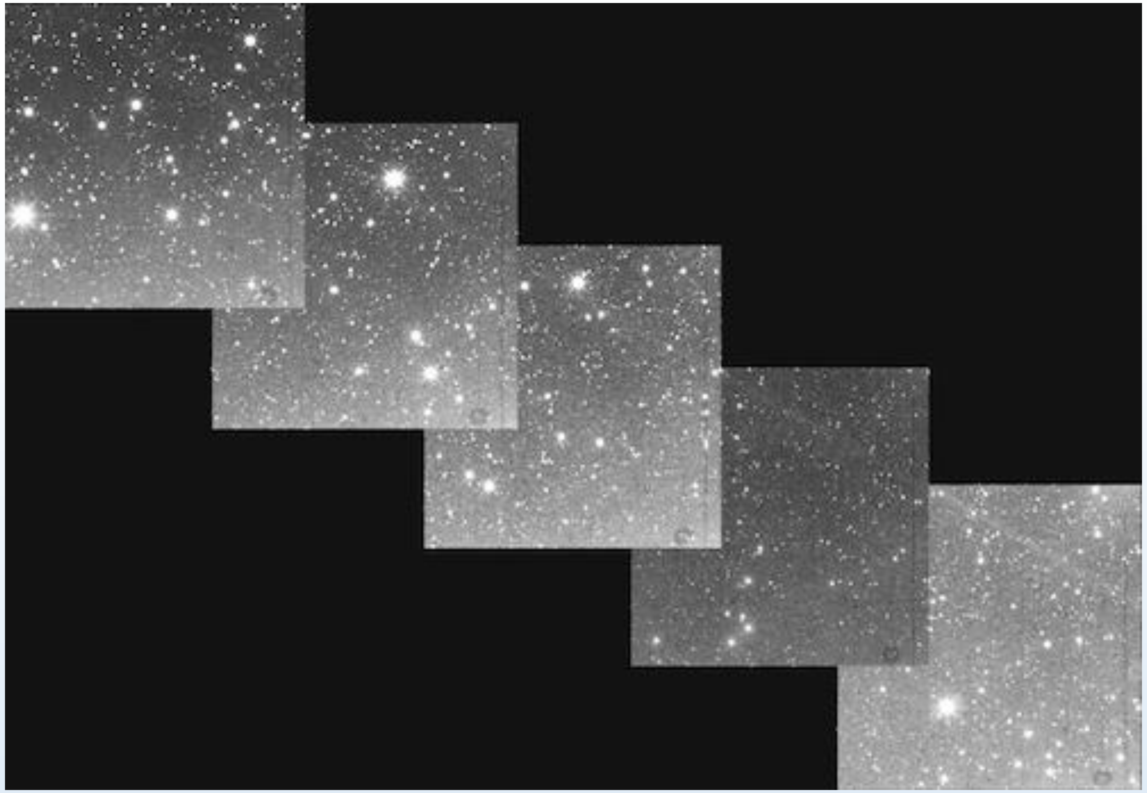

Figure 5. Observation 2015 February 14 in Hankasalmi Observatory. Without image subtraction. Dust trail is several telescopic fields at length.

Summary

The dust trail particle is modelled using our software named the ‘Dust Trail kit’ that comprises multiparticle Monte Carlo modeling including the solar radiation pressure effects, gravitational disturbance caused by Jupiter, and also gravitational interaction of the dust particles with the parent comet itself. This model can be used also for calculating predictions for meteor streams that hit Earth’s atmosphere [8].

According to our theoretical results the dust trail will be detectable in visible light even when observed by modest aperture telescopes, although it may require the use of image subtraction. Interplanetary dust at the predicted time and coordinates will also be bright in mid infrared (Fig. 6 & 7).

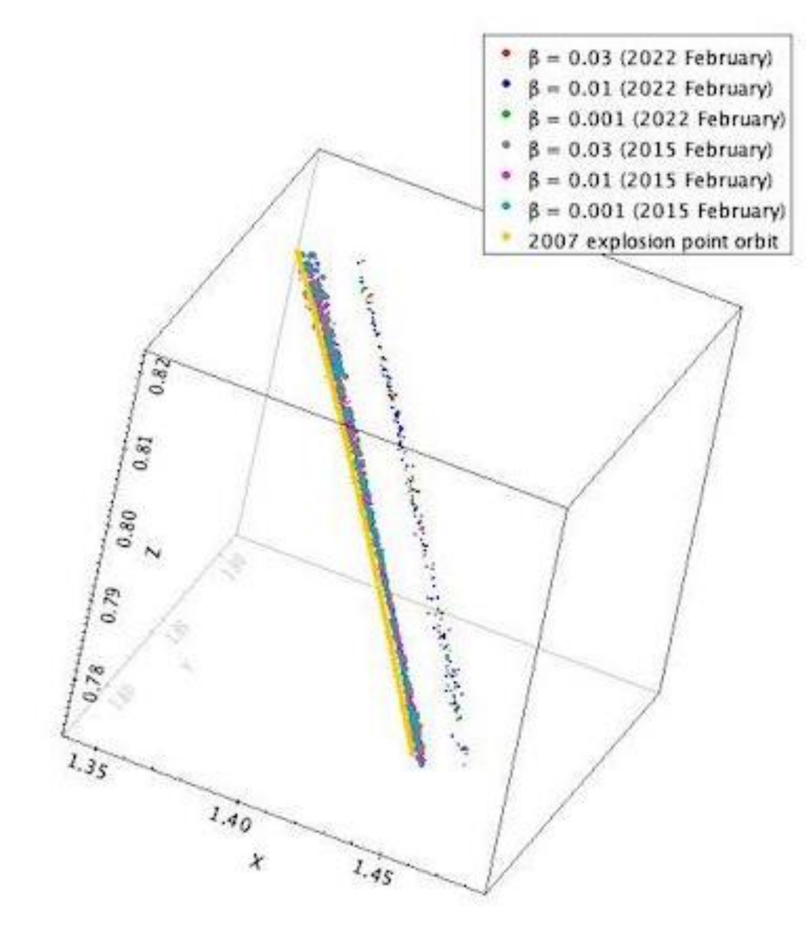

Figure 7. Prediction of the dust trail in February 2022 near the outburst point. Marked in the picture is 17P/Holmes orbit at outburst event, modeled 2015 February trail and 0.01 AU further away modeled 2022 February trail. Density in the model is 15000 particles for each beta for 2015 and 4000 particles for each beta for 2022.

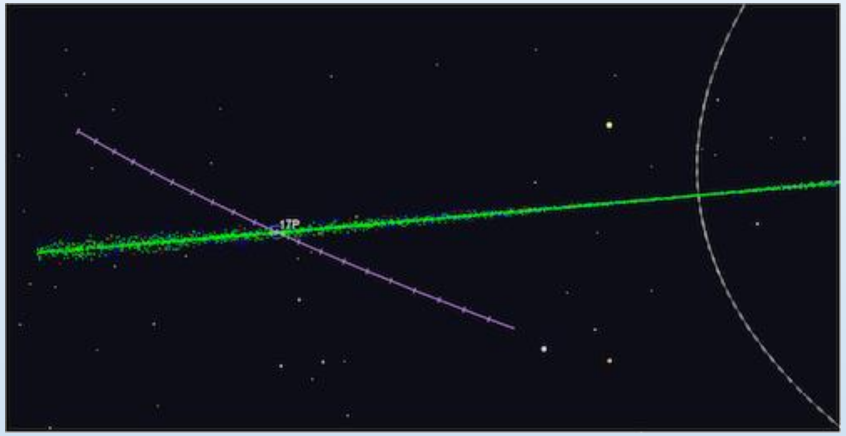

Figure 6. Comet 17P/Holmes plotted on top of the modeled trail for 2021 September 6. Also convergence point location movement in the sky is shown in the picture.

Acknowledgements and References

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