Meteoroid stream of 12P/Pons-Brooks, December κ-Draconids, and Northern June Aquilids

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Introduction

We studied the meteoroid stream, which is assumed to originate from the nucleus of comet 12P/Pons-Brooks. We modeled its theoretical stream and follow its dynamical evolution in course to identify all observable meteor showers of the comet.

Stream modeling

The use method for the study of the orbital evolution of the modeled theoretical stream associated with a given parent body was suggested by [1].

At first, we integrate the catalog orbit of the parent comet, 12P/Pons-Brooks, backward in time for a period, t_{ev}=500P_o, (where P_o is orbital period of the parent body at the present). The integration is performed by using integrator RA15 developed by [2], which is the part of the Mercury package [3].

In the moment of the perihelion passage of comet we model a theoretical stream with 10,000 particles. The size of the ejection velocity, as 0.001v_p, is equal to 35.26ms^{-1}, where v_p is the magnitude of the orbital velocity in the perihelion.

In the next we use again integrator RA15 to integrate all modeled particles from the past until the present.

When the integration of the particle orbits is completed, we select the particles in the orbits passing around the Earth's orbit at the distance shorter than 0.05AU.

As the last step, we attempt to identify the Earth-orbit approaching particles with the actually observed meteors. For this purpose, we use 3 available databases: the photographical IAU MDC [4], radio-meteor [5]; [6]; [7], and the SonotaCo video-meteor [8] databases.

Prediction of showers from the modeled streams

The stream associated with this comet is modeled for time t_{ev} = 500P_o.. The distribution of the radiants of these particles is shown in Fig.1. We see that the stream approaches the Earth's orbit in four separated filaments, which are labeled as F1, F2, F3, and F4.

The most abundant filament F1 consists of 761 meteors, is relative large and is located on the northern sky. The real counterpart of this filament can be identified to the December κ-Drakonids, No. 336 in the IAU MDC list of establish shower. The geophysical parameters of the filament F1 are*:* α = *173.23° and* δ = *73.79°*. Solar logitude of maximum of the shower activity is, $\lambda_☼$ = *245.96°* and relative high geocentric velocity, v_g = *41.8 kmh*$^{-1.}$ The geophysical parameters for filament F1 separated from SonotaCo(2009) are: α = *184.64°*, δ = *71.01° and* $\lambda_☼$ = *250.68°.*

Filament 3 can, vaguely, be indentified to the Northern June Aquilids, No. 164 in the IAU MDC list of established showers.

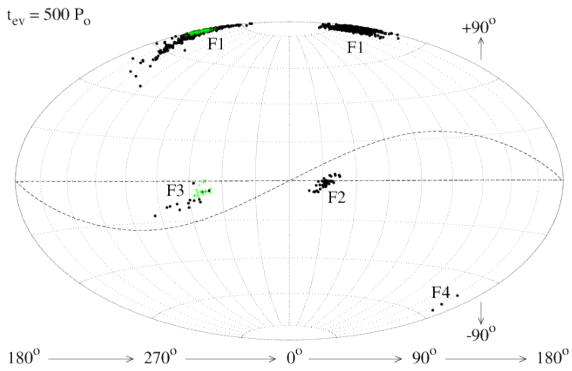

Fig.1 The distribution of geocentric radiants of modeled particles, which approach the Earth's orbit within 0.05AU at the present. These radiants are shown with full black circles. The radiants of the video meteors from the corresponding shower are shown with green crosses.

Filament F3 we can describe the following parameters: $\lambda_☼$ = *87.8°*, α = *297.6°*, δ = *-10.1°* and v_g = *46.6 kmh*$^{-1}$. The geophysical parameters of the meteors selected from video database (SonotaCo, 2009) are: $\lambda_☼$ = *97.8°*, α = *307.6°*, δ = *-5.0°* and v_g = *39.8 kmh*$^{-1}$.

Conclusion

The modeling of stream of meteoroids released from the nucleus of comet 12P/Pons-Brooks and following their dynamical evolution revealed the stream structure.

It occurs that the particles in the stream could approach the Earth's orbit in four discrete filaments. Two of these filaments correspond to the nighttime showers and the corresponding real showers were actually discovered, mainly in the video-meter data.

References

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