Analysis of the January 7, 2015, superbolide over Romania

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Introduction

An extremely bright bolide illuminated the skies over Romania on January 7, 2015, 1:06 UT (3:06 am local time). Despite the late night time, the bolide caused wide attention in the country, including news media. A number of videos, mostly from security cameras, showing the intense illumination lasting for about two seconds, were published on the Internet. Fortunately, the bolide was also photographed, close to horizon, by two cameras of the European Fireball Network (EN) located in Stará Lesná, Slovakia. Part of the bolide can be seen even on the photo from station Lysá hora, Czech Republic, where the bolide was more than 700 km distant. In addition, good radiometric light curve was obtained by the EN cameras.

Superbolides are rare events with limited scientific coverage. Most of them occur in remote areas and are only observed by infrasound stations or US Government Sensors [1] over large distances and with limited accuracy of trajectory, velocity and other parameters. Here we take advantage of the existing data and study in detail the January 7 superbolide. The results can be compared with the US Government Sensors data for this superbolide as given in [1].

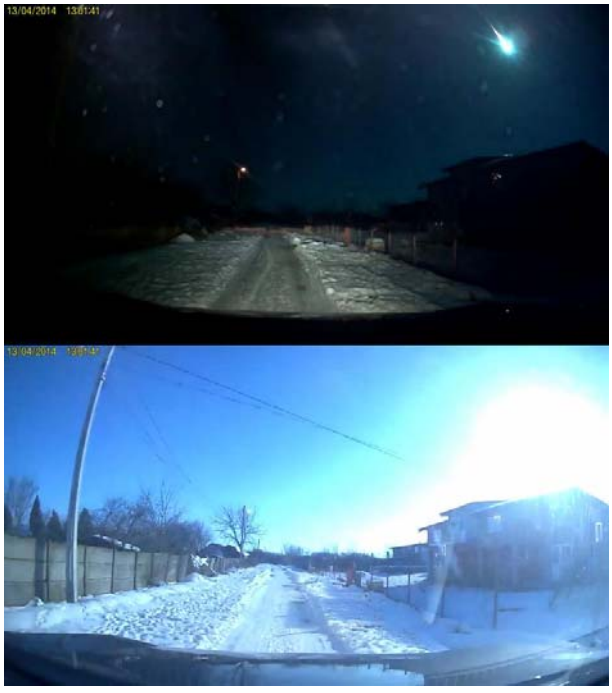

Fig 1 Two frames from the dashboard video taken by Adrian Pascale in Fierbinti showing the bolide in flight (top) and during the maximum luminosity (bottom). Source: youtube.com

Analysis

We used two images (one digital and one analog) from Stará Lesná and five video records taken at various sites in Romania (showing directly the bolide) to derive the trajectory and velocity. The videos were calibrated in situ by taking stellar images at the positions of the video cameras following the method of [2] and/or by taking images containing bright celestial objects (Moon, Jupiter) directly by the original video cameras at known times. All used videos were from security cameras with low resolution but with fixed and well known positions. There is also a high resolution video taken by a dashboard camera from moving car (Fig. 1), which shows more details, but could not be calibrated.

Results

The bolide was remarkable by the fact that it terminated by a bright broad flare covering the heights 47 – 39 km. The maximum brightness was reached at 42.8 km. Only one small fragment, seen only on the high resolution video, emerged from the flare and disappeared at a height of about 36 km. These heights are quite high for such a large body. Using the energy from [1], the initial mass of the meteoroid was computed to be 4000 kg. The low penetration ability and intensive atmospheric fragmentation suggest that the body was not a solid rock or iron but a weaker material. Nevertheless, we cannot confirm the purely cometary orbit from [1]. The pre-impact orbit had in fact the Tisserand parameter relative to Jupiter close to 3.0.

If some material reached the ground, it was only in the form of small fragments or dust. Brief meteorite searches and interviews with local people were performed in the suspected impact area to the west of the city of Focsani on March 26 and on April 3, 2015, with negative results.

The model of atmospheric fragmentation and a comparison with other superbolides caused by weak bodies, such as the Maribo meteorite fall and the EN311015 Taurid bolide, will be presented in the talk. These studies will provide information about the structure of meter-sized bodies composed from other materials than ordinary chondritic.

References

[1] Brown, P., Wiegert, P., Clark, D., Tagliaferri, E., Icarus, Vol. 266, pp. 96-111, 2016.
[2] Borovička J., Proceedings IMC 2013, Poznań, Poland, pp. 101-105, 2014.