

Precise data on Taurids fireballs obtained by the European Fireball Network during the enhanced Taurid activity in 2015

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Introduction

The Taurid shower belongs to the most active main meteor showers, and has been doing so at least for several centuries. It is active over a period of almost three months ($\sim 80^\circ$ in solar longitude), with a peak in the first week on November. Such long activity means that it is so dispersed that different parts have been called by different names (i.e. Piscids, Arietids, Taurids or χ -Orionids) and over all this activity, the stream has northern and southern branches [1]. Therefore structure of this stream is very complicated and therefore it is better to speak about the Taurid complex. The shower is known for its spectacular fireballs, which means that it is quite a rich also for larger meteoroids. Exceptionally, Taurid shower has also occasional outbursts [2]. Here we report instrumental observations of the significant enhancement of the activity of Taurid fireballs which was recorded by the European fireball network (EN) mainly during the first two weeks of November 2015.

Instruments and data acquisition

Successful instrumental recording of this extraordinary activity is another tangible result of the systematic operation and modernization of the mainly Czech part of the EN. This network has been modernized several times [3], but the last significant improvement, which was crucial for the presented results, has been realized during the last three years when a high-resolution digital autonomous fireball observatory (DAFO) was developed and gradually installed alongside the older "analog" (using photographic films) autonomous all-sky system (AFO) on all 13 Czech stations and on one station in Slovakia and Austria. Apart from the imaging system, both camera types are equipped with rapid photometers (5000 samples per second) and mechanical (AFO) or electronic (DAFO) shutters with 15, respectively 16 interruptions per second. The sensitivity limit is -4 mag for AFO (about 3 mag lower during a full Moon) and -2 mag for DAFO (with almost no dependence on the lunar phase). Fireball observations made with this new digital autonomous system contain more information especially in the beginning and terminal parts of the luminous trajectory. They are also significantly more efficient, and, when combined with improved analysis techniques, they are more precise than results from any previous system. One of its important advantages is the ability to take usable photographic records also during periods when it is not completely dark (twilight periods) and not completely clear. Thanks to this new observing system and also by the fact that weather conditions were surprisingly good in Central Europe in the beginning of November, we ob-

tained very complex and precise data on a very high number of Taurid fireballs observable over Central Europe.

Results

Since 23 October to 8 December 2015 cameras of the EN in the Czech Republic, Slovakia and Austria recorded more than 150 fireballs which belonged to the Taurid complex (one example is on Fig 1). It is about 10 times higher number of Taurids than we usually record in this period. All of these Taurid fireballs are recorded at least from two stations so all parameters concerning their atmospheric trajectories and heliocentric orbits could be determined. Quality of results is naturally affected by several factors (distance from the cameras, brightness and length of each fireball, weather conditions) and thus differs from case to case, but at least 100 Taurids are determined with very high accuracy and reliability. Most of them have also very good dynamics and photometry including precise and detailed light curves. These cases are very suitable for detailed orbital and physical studies of the material belonging to the Taurid complex, in particular concerning the large and very large meteoroids. Our dataset contains meteoroids from several grams to several kilograms with one extreme of almost 2 tons, which produced a superbolide of -19 absolute magnitude! One almost Earth grazing Taurid with duration of about 10 seconds was also recorded. These results will be summarized in the talk.



Fig 1 Southern Taurid fireball of -14 mag recorded by the DAFO at the Czech station Kocelovice on 25 October 2015.

References

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