A 2012 TAURID BOLIDE IMAGED IN THE FRAMEWORK OF THE SPANISH FIREBALL NETWORK

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Introduction: In 2010 the Spanish Meteor Network (SPMN) started a special program to obtain very precise orbital information on 2P/Encke meteoroids that is currently the focus of the author master thesis [1, 2]. The orbital similitude is a clear evidence on the connection between comets and meteor streams. The continuous sublimation of the ice-rich regions in cometary nuclei produces outgassing capable to release cm to μm-sized particles from cometary nuclei. This is the main way to produce meteoroid streams showers [3,4,5]. Another feasible physical process to produce cometary debris in heliocentric orbit is the disruption of a comet that explains the formation of about ten meteoroid streams [6,7,8]. This second pathway produces far larger particles that sometimes can even be in the meter scale and can explain very bright bolides associated with some meteor showers [8]. Unfortunately, large bolides are rare events so in order to study them a continuous sky monitoring is required which is the only way to collect information on the dynamic origin and physical behavior of large bolides penetrating Earth's atmosphere. So far we have described different cases related to the Taurid complex [1,2]. Several Near Earth Objects (NEOs) have been dynamically associated with the Taurid complex clearly suggesting that the progressive disruption of a larger cometary progenitor is the source of this complex of bodies [9, 10]. In the current abstract we focus in a Taurid fireball named SPMN 201112 recorded on November 20th, 2012 at 2h16m15.6s UTC (Fig. 1).

Methods: 25 CCD and video stations are currently monitoring a surface area of 500,000 km^2. The cameras used are high-sensitivity 1/2" black and white CCD video cameras (Watec, Japan) attached to modified wide-field lenses covering a 120×80 degrees field of view. Coordinate positions of the fireball were obtained by creating a composite image of all frames where the stars coordinates were measured and taken as reference using our software package [11]. The fireball described here was imaged by UHU stations located in Sevilla and La Hita, Spain

Results and discussion: From the sequential measurements of the video frames and the trajectory length, the velocity of the bolide along the path was obtained. From to the astrometric measurements of the images different radiant and orbital parameters were computed and are presented in Table 1. The pre-atmospheric velocity V_∞ was found from the velocity measured at the earliest part of the fireball trajectory, and defines the kinetic energy and consequently, the orbit. Figure 1 shows the magnificence of the bolide which reached an absolute magnitude of -8±1. This fireball started at a height of 95.2 ±0.5km and ended with a bright flare at 66±0.5km so a meteorite fall can be ruled out. On the other hand, from the study of the emission spectrum (Fig. 4) we see that the fireball was produced by a chondritic meteoroid. The spectrum is therefore dominated by the typical emission lines of Fe I, Ca I, Mg I, and Na I [12], but a more detailed analysis is in progress.

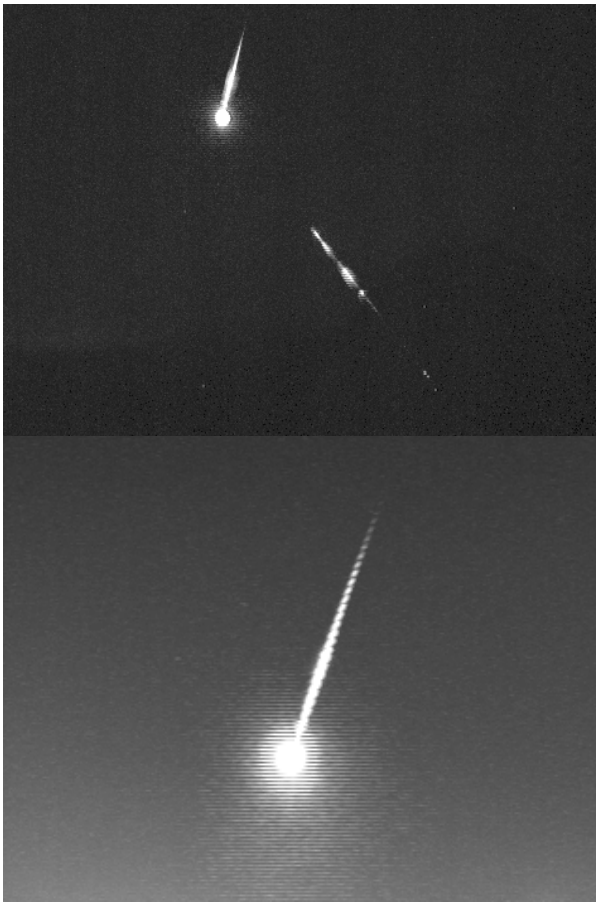

Figure 1. Composite image of the SPMN 201112 fireball imaged from La Hita (top) and Sevilla (bottom).

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	64.2±0.3	62.2±0.3	
Dec. (º)	16.3±0.2	15.1±0.2	
V_∞ (km/s)	28.5±0.3	26.4±0.3	38.5±0.3
Orbital parameters			
a (AU)	2.8±0.1	**ω (º)**	99.1±0.6
e	0.836±0.009	**Ω (º)**	57.97260 ± 10^{-4}
q (AU)	0.466±0.005	**i (º)**	5.3±0.2

Table 1. Radiant and orbital data (J2000).

Conclusions:. The computed radiant and preatmospheric velocities of SPMN 201112 are in agreement with the Taurid complex and the orbital parameters are similar to those of the 2P/Encke comet (Table 1 and Fig. 3). According to the radiant and the initial velocity the bolide can be associated with the South Taurid branch (Fig.2). As we commented [2] we will continue increasing the number of Taurid bolides with reliable orbital parameters in order to learn more on the origin and evolution of short period comets and their meteoroid complexes.

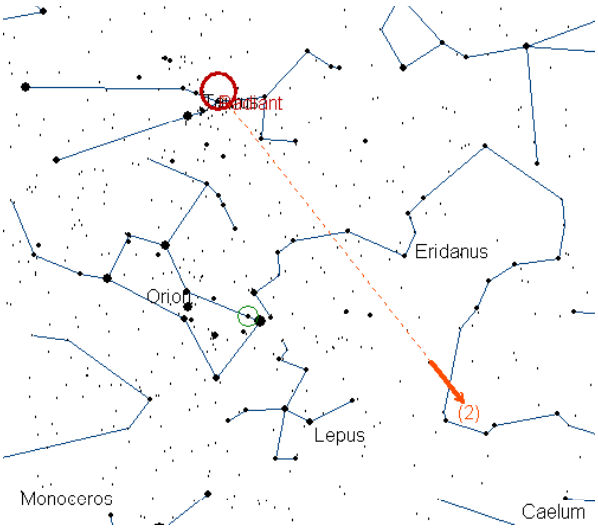

Figure 2. Apparent trajectory of the SPMN 201112 fireball as recorded La Hita Astronomical Observatory. As we see the apparent bolide radiant is in agreement with the South Taurid branch.

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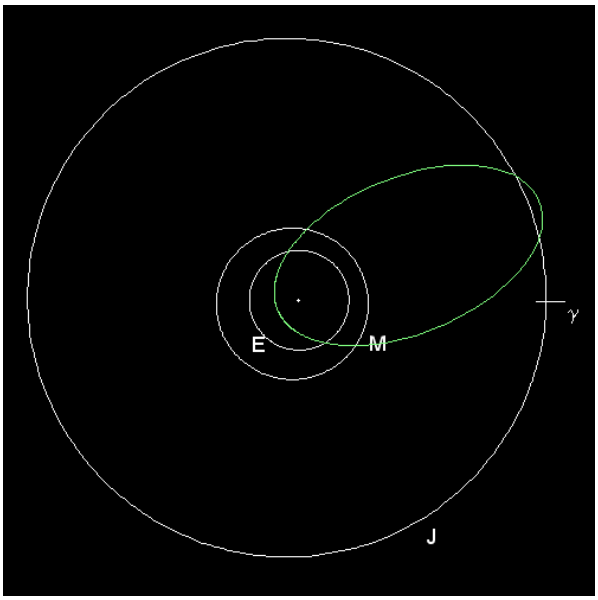

Figure 3. Projection on the ecliptic plane of the orbit of the meteoroid.

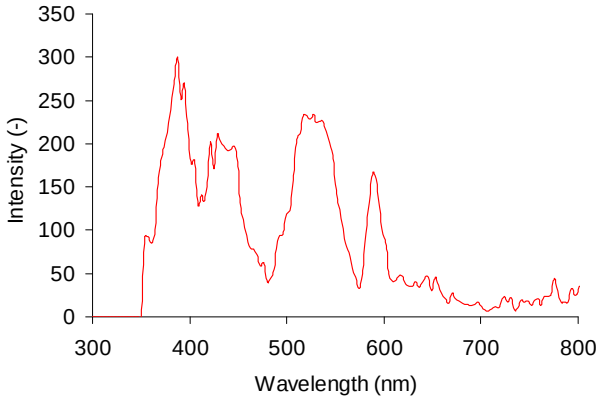

Figure 4. Calibrated emission spectrum of the studied bolide.

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