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A meteorite dropping bolide recorded over Catalonia by OAdM all-sky camera on 2012 January 31

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Abstract

A zenith-pointed all-sky camera was installed in September 2011 at the *Observatori Astronomic del Montsec (OAdM)*, at Àger, Catalonia. Since then this system has been performing continuous operations during non-day hours, with the main aim of collecting images of bright bolides entering the Earth's atmosphere. A general view of the observing setup is given, and exemplified with the description of a superb meteorite-dropping bolide recorded from several SPMN stations on 2012 Jan. 31.

1. Introduction

Extremely bright fireballs are astonishing examples of the existence of meter-sized rocks that are continuously crossing Near Earth vicinity. From time to time the entry geometry, and initial mass of these particles is favorable to produce surviving meteorites. Fireball networks have the main goal to collect the maximum information of meteorite dropping events in order to infer the exact fall locations, and to determine the heliocentric orbits that can provide clues on the origin and dynamic mechanisms that are throwing these interplanetary rocks to the Near Earth space. The SPanish Meteor Network (www.spmn.uji.es) is using different instruments in order to monitor the sky over the Iberian Peninsula, and neighboring countries. One of these instruments is a really sensitive and state-of-the-art all-sky digital camera that was developed in 2002 [1, 2], and then applied to meteor, and fireball detection [2, 3]. We demonstrated previously that its capacity, and accuracy to detect unexpected meteor outbursts is also remarkable [4-5]. We present here the capabilities of a mixed all-sky + video monitoring by presenting the results obtained on a -10 magnitude slow-moving fireball recorded as it was experiencing multiple flares over central Catalonia on 2012 January 31 at an entry time of 20h58m35.1s UTC.

2. Experimental setup and reduction procedure

A continuous monitoring of the night sky all over Spain is currently being made from 30 stations. This observational challenge involves the monitoring over a surface area of ~500,000 km^2. In order to achieve this goal, state-of-the-art CCD and video cameras are operated by members and collaborators of the Spanish Meteor and Fireball Network (SPMN). All-sky CCD cameras provide a complete view of events occurring at an usual distance of ~600 km from the observing stations [2]. We also use high-sensitivity 1/2" black and white CCD video cameras (Watec, Japan) attached to modified wide-field lenses that provide GPS controlled timing to get accurate entry time for the bolides [6]. Coordinate measurements on the images were obtained for comparison stars and the bolide by using our implemented software packages [7]. From the sequential measurements of the video frames and the trajectory length, the velocity of the bolide along the path was obtained. The pre-atmospheric velocity V_∞ is measured at the earliest part of the bolide trajectory.

Figure 1: Composite image of the bolide from SPMN Folgueroles video station in Osona, Barcelona. Moon is visible in the top.

3. Discussion and first results

From the astrometric reduction of the fireball track in reference with background stars, the trajectory and orbit determination has been obtained (Table 1). For the Folgueroles video record (Fig. 1) the astrometric accuracy was ~10 arcmin, while for the CCD allsky image (Fig. 2) reached 1 arcmin due to its higher resolution. The orbital determination was achieved by using our own tested software [7]. We plan to compute from a dynamic model the initial and ending masses, but the measured bolide ending height at 22.3 km is clearly suggestive of meteorite survival.

Table 1: Radiant and orbital data.

SPMN310112 "Tremp"			
Radiant data			
	Observed	**Geocentric**	**Heliocentric**
R.A. (º)	46.69±0.22	38.3±0.4	42.12±0.11
Dec. (º)	35.86±0.22	32.5±0.3	4.11±0.11
V_∞(km/s)	14.8±0.2	10.1±0.3	39.9±0.3
Orbital parameters (V_∞=14.8±0.2 km/s)			
a (AU)	4.3±0.4	**ω (º)**	182.03±0.21
e	0.769±0.025	**Ω (º)**	311.24060
q (AU)	0.9849±0.0001	**i (º)**	4.11±0.12
Q (AU)	7.55±0.93		

Acknowledgements

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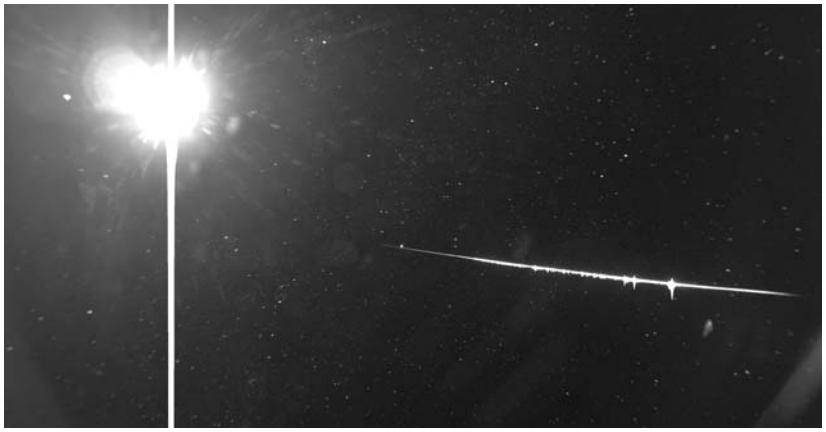

Figure 2. A small area of the all-sky image recorded from OAdM showing the SPMN310112 "Tremp" bolide. Note the different flares recorded along its path, and the overwhelming presence of the Moon on the left side.