

ANALYSIS OF A SPORADIC FIREBALL RECORDED OVER SPAIN IN 2012. C.M. Martínez-Requena¹, J.M. Madiedo^{1,2}, J.M. Trigo-Rodríguez³. ¹Facultad de Ciencias Experimentales, Universidad de Huelva, Huelva, Spain, madiedo@uhu.es. ²Departamento de Física Atomica, Molecular y Nuclear. Universidad de Sevilla. 41012 Sevilla, Spain. ³Institute of Space Sciences (CSIC-IEEC). Campus UAB, Facultat de Ciències, Torre C5-p2. 08193 Bellaterra, Spain, trigo@ieec.uab.es. ⁴Instituto de Astrofísica de Andalucía, CSIC, Apt. 3004, 18080 Granada, Spain.

Introduction: The Spanish Meteor Network (SPMN) is currently performing a continuous monitoring of meteor and fireball activity by means of 25 observing stations located in Spain. The analysis of events simultaneously imaged from, at least, two different locations provides information about meteoroids ablating in the atmosphere. In this way, atmospheric trajectories, radiant, orbital parameters and physico-chemical parameters such as mass and tensile strength can be obtained [1, 2, 3]. Accurate orbital data are, for instance, of a paramount importance in order to infer information about the likely parent body of a given meteoroid stream [4]. Spectroscopic techniques provide also very valuable data about the chemical nature of these particles of interplanetary matter [5, 6, 7]. In this context, we present here the analysis of a double-station sporadic fireball imaged from two of our stations on February 25, 2012 (Figure 1).

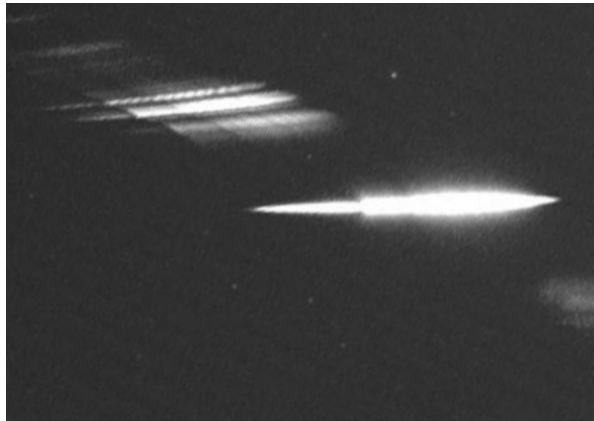


Figure 1. Composite image of the SPMN250212 bolide and its emission spectrum, imaged from El Arenosillo.

Methods: The two meteor observing stations involved in this work (Sevilla and El Arenosillo) employ high-sensitivity CCD video cameras (models 902H and 902H Ultimate, from Wattec Corporation) to monitor the night sky. The operation of these systems is explained in [1, 2]. In addition, these automatic stations perform a continuous spectroscopic campaign by recording the emission spectrum produced by meteoroids ablating in the atmosphere. In this way, we can infer information about the chemical nature of these particles of interplanetary matter [5, 6, 7].

Results and discussion: The above-mentioned meteor observing stations imaged the fireball studied here on February 25, 2012, at 4h57m28.6±0.1s UT (Figure 1). Its apparent trajectory as seen from both stations is shown in Figure 2. The absolute magnitude of this event (code SPMN250212), estimated from the photometric analysis of the images, was -8 ± 1 . The atmospheric trajectory and radiant were calculated with our AMALTHEA software, which employs the method of planes intersection [8]. In this way, we obtained that the luminous phase started at about 99.8 ± 0.5 km above the ground level, with the terminal point located at about 38.3 ± 0.5 km. The preatmospheric velocity, obtained by extrapolating the velocities measured at the beginning of the meteor trail was $V_{\infty} = 29.5 \pm 0.3$ km/s. With this information, the orbit was calculated (Fig. 3). The radiant and orbital parameters (J2000) are summarized on Table 1.

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (°)	202.1±0.5	198.1±0.3	
Dec. (°)	62.8±0.3	63.2±0.2	
V_{∞} (km/s)	29.5±0.3	27.4±0.3	41.2±0.3
Orbital parameters			
a (AU)	9.4±1.9	ω (°)	218.3±0.5
e	0.90±0.01	Ω (°)	335.8254±10 ⁻⁴
q (AU)	0.888±0.002	i (°)	37.8±0.3

Table 1. Radiant and orbital data (J2000) for the SPMN250212 fireball.

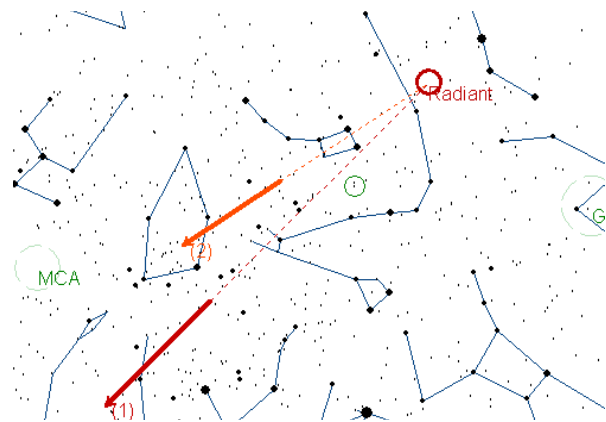


Figure 2. Apparent trajectory of the SPMN250212 fireball as recorded from Sevilla (1) and El Arenosillo (2) meteor observing stations.

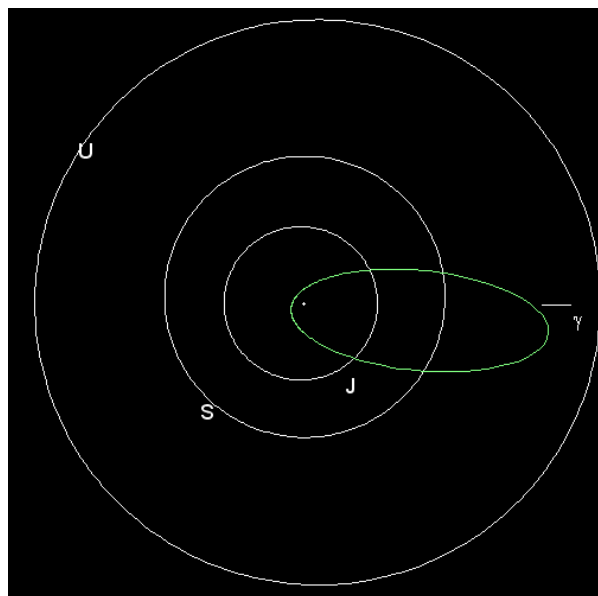


Figure 3. Projection on the ecliptic plane of the orbit of the SPMN250212 fireball.

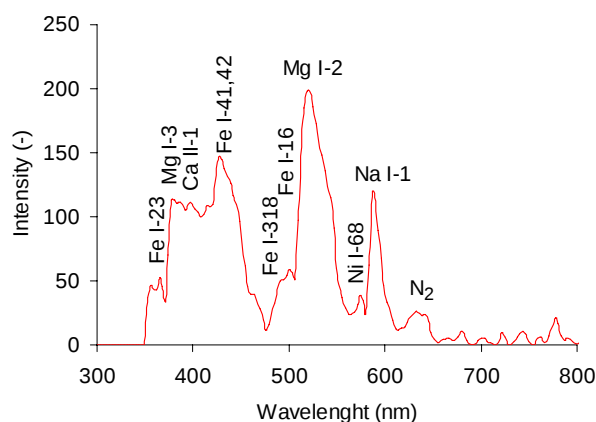


Figure 4. Calibrated emission spectrum of the SPMN250212 fireball.

We also imaged the spectrum of this fireball from one of the spectral cameras that operates from El Arenosillo (Figure 1). This emission spectrum was reduced with our CHIMET software by following the method described in [5, 6]. Thus, the images containing the spectrum were dark-subtracted and flat-fielded. Then, the signal was calibrated in wavelengths by using typical lines appearing in meteor spectra (Ca, Fe, Mg, and Na multiplets) and corrected by taking into account the spectral efficiency of the recording device. The result is shown in Fig. 4, which contains the integrated spectrum. Most lines correspond to several Fe I multiplets, although the signal is dominated by the emission of Mg I-2 (516.7 nm). The contribution from Mg I-3 was also identified. Atmospheric N₂

bands can also be noticed in the red region of the spectrum.

Conclusions: In the framework of our continuous fireball monitoring and spectroscopic campaign we have imaged a mag. -8 ± 1 double-station sporadic bolide. The analysis of this event has provided information about this meteor stream, including the orbital parameters and chemical nature of the meteoroid. Thus, the emission spectrum is consistent with a chondritic nature of the particle.

Acknowledgements: We acknowledge support from the Spanish Ministry of Science and Innovation (projects AYA2009-13227 and AYA2011-26522) and CSIC (grant #201050I043).

References: [1] Madiedo J.M. and Trigo-Rodríguez J.M. (2007) *EMP* 102, 133-139. [2] Madiedo J.M. et al. (2010) *Adv.in Astron*, 2010, 1-5. [3] Trigo-Rodríguez, et al. (2009) *MNRAS*. 392, 367-375. [4] Madiedo J.M. et al. (2012) *MNRAS*, submitted. [5] J.M. Trigo-Rodríguez et al. (2003) *MAPS* 38, 1283-1294. [6] Trigo-Rodríguez et al. (2004) *MNRAS* 348, 802-810. [7] Borovicka, J. (1993) *Astron. Astrophys.* 279, 627-645. [8] Ceplecha, Z. *Bull. Astron. Inst. Cz.* 38, 222-234, 1987.