ANALYSIS OF A NORTHERN OCTOBER DELTA ARIETID FIREBALL IMAGED IN 2012. M.F. Palos[1], J.M. Madiedo[2, 3], J.M. Trigo-Rodríguez[4], J. Zamorano[1], J. Izquierdo[1], F. Ocaña[1] and A. Sánchez de Miguel[1]. [1]Dpto. de Astrofísica y CC. de la Atmósfera, Facultad de Ciencias Físicas, Universidad Complutense de Madrid, 28040 Madrid, Spain, jzamorano@fis.ucm.es. [2]Facultad de Ciencias Experimentales, Universidad de Huelva, 21071 Huelva, Spain, madiedo@uhu.es. [3]Dpto. de Física Atómica, Molecular y Nuclear, Facultad de Física, Universidad de Sevilla, 41012 Sevilla, Spain, [4]Institute of Space Sciences (CSIC-IEEC). Campus UAB, Facultat de Ciències, Torre C5-p2. 08193 Bellaterra, Spain, trigo@ice.csic.es.

Introduction: The continuous monitoring of the night sky by means of high-sensitivity CCD video devices provides helpful information about the activity of major and minor meteor showers. In this way, different physico-chemical parameters of meteoroids ablating in the atmosphere can be obtained. These include trajectory, radiant, orbit, mass and tensile strength [1, 2]. One of these minor showers is the Northern October δ Arietds, which is currently included in the IAU list of working meteor showers with code 0025 NOA. So, additional observations of this shower can be very helpful to improve our knowledge about the NOA meteoroid stream. In particular, the calculation of precise orbital parameters is fundamental in order to analyze the origin and evolution of this stream. The determination of such orbits is one of the aims of the SPanish Meteor Network (SPMN). Thus, as a result of our continuous fireball and spectroscopic campaigns, three of our meteor monitoring stations recorded on October 17, 2012 a mag. -8 NOA fireball that was catalogued as SPMN171012. Its emission spectrum was also obtained. This event is analyzed here.

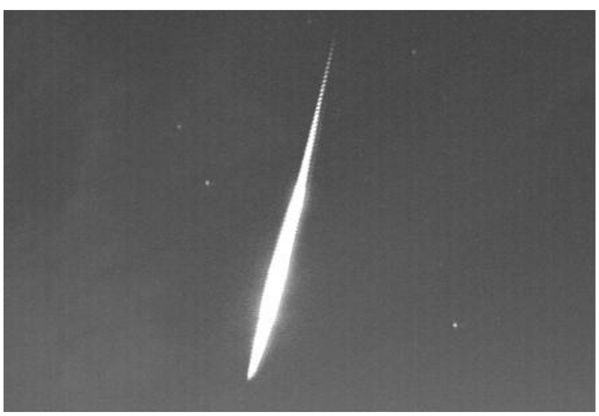

Figure 1. The SPMN171012 fireball imaged from Madrid.

Instrumentation: We have employed an array of high-sensitivity CCD video devices (models 902H and 902H Ultimate, from Watec Co.) to image the fireball analyzed here. These work according to the PAL video standard. A detailed description of these systems is given in [1, 3]. For meteor spectroscopy we have attached holographic diffraction gratings to some of these cameras. In this way, we can obtain information about the chemical composition of meteoroids ablating in the atmosphere [2, 4, 5, 6].

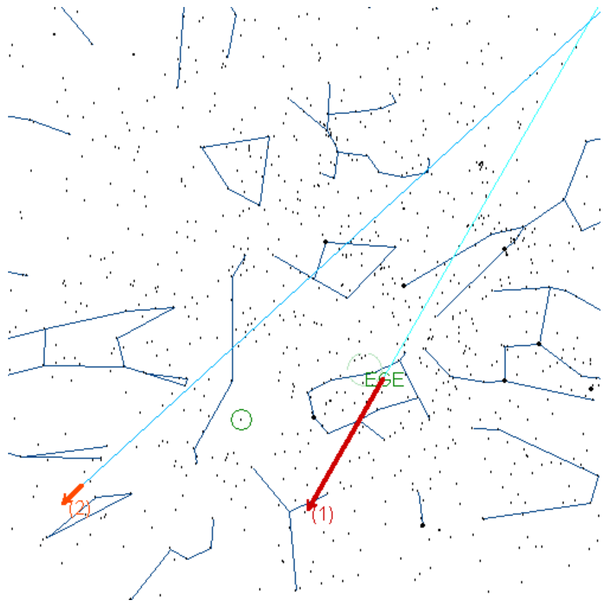

Figure 2. Apparent trajectory of the SPMN171012 fireball as recorded from (1) Madrid and (2) Huelva.

Results and discussion: The fireball analyzed in this work was imaged by five cameras on Oct. 17, 2012 at 1h28m44.5±0.1s UTC. These operated from our meteor stations in Madrid, Villaverde del Ducado (Guadalajara) and Huelva. The event, with SPMN code 171012, exhibited no fulgurations along its atmospheric path (Figure 1). Its apparent trajectory as seen from Huelva and Madrid is shown in Figure 2. Its magnitude, obtained from the photometric analysis of our images, was -9±1. By using the method of planes intersection [7] we could obtain its atmospheric trajectory and radiant. The projection on the ground of this trajectory is shown in Figure 3. The fireball began at 98.2±0.5 km above the ground level, with a preatmospheric velocity V_∞=38.0±0.3 km/s. This velocity was determined from the extrapolation of the velocities measured at the beginning of the meteor trail. The terminal point of the trajectory was reached at a quite low height of 38.8±0.5 km. The geocentric radiant was located at α_G=39.1±0.3º, δ_G=16.6±0.2º. With this information, we calculated the orbit followed by the meteoroid that produced this fireball by applying the procedure described in [4, 5]. Radiant and orbital parameters are summarized on Table 1.

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	40.3±0.3	39.1±0.3	
Dec. (º)	17.2±0.2	16.6±0.2	
V_∞ (km/s)	38.0±0.3	36.3±0.3	39.6±0.3
Orbital parameters			
a (AU)	4.3±0.4	**ω (º)**	309.8±0.26
e	0.954±0.004	**Ω (º)**	203.9266±10^{-4}
q (AU)	0.197±0.004	**i (º)**	2.4±0.4

Table 1. Radiant and orbital data (J2000) for the SPMN171012 fireball.

Figure 3. Projection on the ground of the atmospheric trajectory of the SPMN171012 fireball.

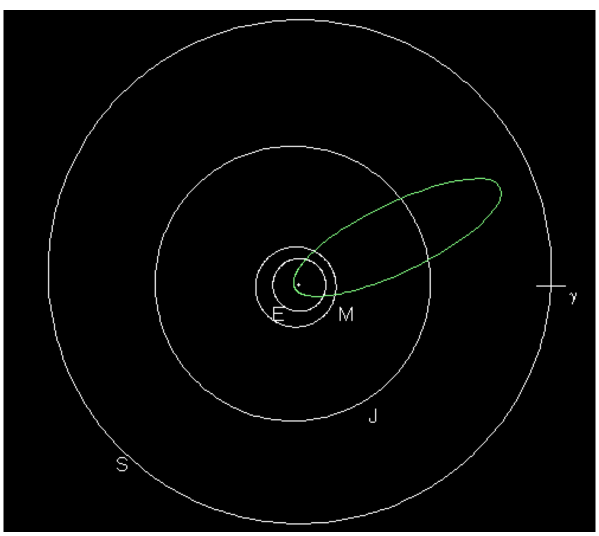

Figure 4. Projection on the ecliptic plane of the orbit of the SPMN171012 fireball.

One spectral camera at Villaverde del Ducado imaged the emission spectrum produced by this event. The identification of several lines in this spectrum (mainly those corresponding to Na I-1 and Mg I-2 multiplets) allowed us to calibrate it in wavelengths. Then, the signal was corrected by taking into account the spectral response of the recording device. The result is shown in Figure 5. As can be noticed, the main contributions correspond to multiplets Mg I-3, Ca I-2, Fe I-41, Mg I-2 and Na I-1. The contribution of atmospheric N_2 is also seen.

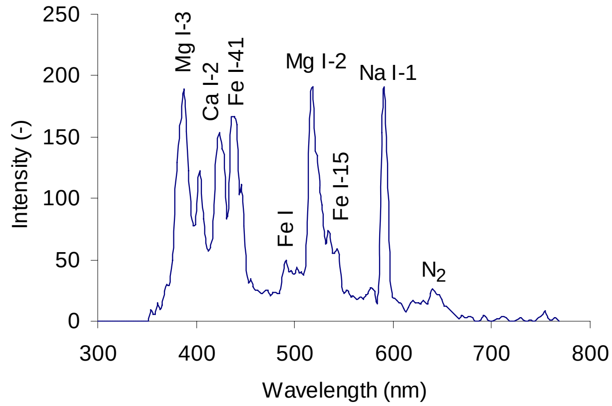

Figure 5. Spectrum of the SPMN171012 bolide. Main emission lines have been highlighted.

Conclusions: As a result of our continuous monitoring of the night sky, a multi-station mag. -9 NOA fireball was imaged. The analysis of this event has provided its atmospheric trajectory and radiant, but also the orbit of the corresponding meteoroid. Its luminous path ending at a height of about 38.8 km suggests that the meteoroid mass was fully extinguished due to the ablation process. In any case, it should be pointed out that larger meteoroids of this stream under similar entry conditions could be firm candidates to produce meteorite-dropping bolides. Consequently, the Northern October δ Arietids should be studied carefully in the future as s presumable source of meteorites. On the other hand, from its emission spectrum we have inferred information about the chemical composition of this particle.

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References: [1] Madiedo J.M. and Trigo-Rodríguez J.M. (2007) *EMP* 102, 133-139. [2] Trigo-Rodriguez J.M. et al. (2009) *MNRAS*. 392, 367–375. [3] Madiedo J.M. et al. (2010) *Adv.in Astron*, 2010, 1-5. [4] J.M. Trigo-Rodríguez J.M. et al. (2003) *MAPS* 38, 1283-1294. [5] Trigo-Rodríguez J.M. et al. (2004) *MNRAS* 348, 802-810. [6] Borovicka J. (1993) *Astron. Astrophys*. 279, 627-645.