SPECTRAL AND ORBITAL ANALYSIS OF AN OCTOBER DELTA AURIGID FIREBALL. J. Izquierdo[1], J.M. Madiedo[2,3], J.M. Trigo-Rodríguez[4], J. Zamorano[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@ieec.uab.es.

Introduction: The SPanish Meteor Network (SPMN) is currently performing a continuous monitoring of meteor and fireball activity over the Iberian Peninsula and nearby areas by means of 25 observing stations. This coverage, together with favourable weather conditions in our country in comparison with other areas in Europe, is providing a huge amount of helpful information about the activity of major and minor meteoroid streams, but also about events with a sporadic origin. The analysis of events simultaneously imaged from, at least, two different locations allows for the determination of atmospheric trajectories, radiants and orbital data, but also the calculation of physico-chemical parameters such as masses and tensile strengths [1, 2, 3]. Spectroscopic techniques provide also very valuable data about the chemical nature of meteoroids ablating in the atmosphere [3, 4, 5, 6]. As an example of our observational effort, we present here the preliminary analysis of a multi-station October δ-Aurigid fireball recorded in 2012 (Figure 1).

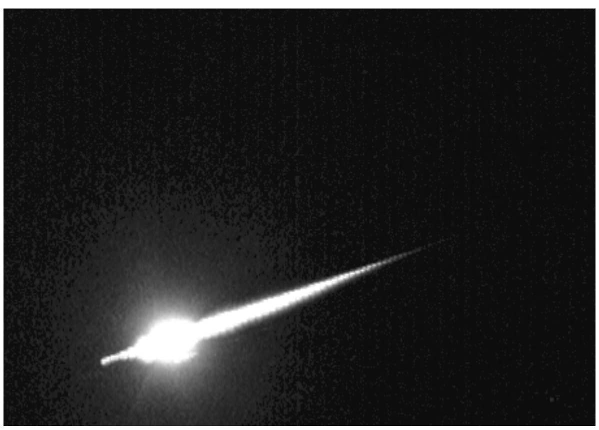

Figure 1. Composite image of the bolide as observed from Majadahonda.

Instrumentation and methods: We have employed an array of low-lux CCD video cameras (models 902H and 902H Ultimate, from Watec Corporation) to image the fireball considered in this work. These cameras operated from three SPMN meteor monitoring stations located in center Spain: Madrid, Villaverde del Ducado and La Hita. The operation of these stations has been explained elsewhere [1, 2]. For meteor spectroscopy we have attached holographic diffraction gratings to some of these devices to monitor the night sky. Besides, one of the spectrographs operating from Madrid was based on a colour CCD Watec camera (model 231S). For data reduction we have used our AMALTHEA software, which follows the planes intersection method to determine the atmospheric trajectory and radiant of meteors [7].

Figure 2. Projection on the ground of the atmospheric path of the fireball.

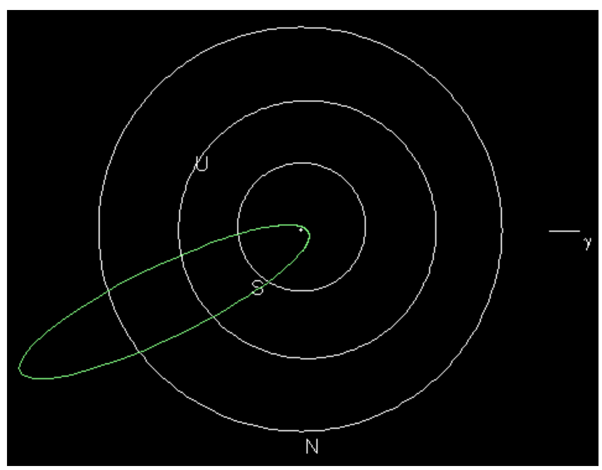

Figure 3. Projection on the ecliptic plane of the orbit followed by the parent meteoroid.

Atmospheric trajectory, radiant and orbit: The mag. -7±1 bolide studied here received the code SPMN021012. It was recorded on October 2, 2012 at 5h00m42.5±0.1s UTC (Figure 1). The fireball began at

125.2±0.5 km above the ground level and ended at 76.2±0.5 km. The preatmospheric velocity, obtained by extrapolating the velocities measured at the beginning of the meteor trail was V_∞=63.8±0.5 km/s. The projection of this trajectory on the ground is shown in Figure 2. With this information, the orbit in the Solar System of the parent meteoroid was calculated (Fig. 3). The radiant and orbital parameters are summarized on Table 1. On the other hand, Figure 1 shows that this meteoroid suffered a disruption by the end of the luminous path. Thus, the bright flare exhibited by the fireball took place at a height of about 85.2 km. The aerodynamic pressure under which this break-up took place, calculated in the usual way [8], yields 2.2±0.2×10^{4}dyn/cm^2.

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	77.9±0.4	76.9±0.4	
Dec. (º)	51.8±0.4	51.8±0.4	
V_∞ (km/s)	63.8±0.5	62.8±0.5	41.7±0.3

Orbital parameters			
a (AU)	30±5	**ω (º)**	231.4±1.5
e	0.97±0.03	**Ω (º)**	189.2350±10^{-4}
q (AU)	0.814±0.007	**i (º)**	126.6±0.6

Table 1. Radiant and orbital data (J2000).

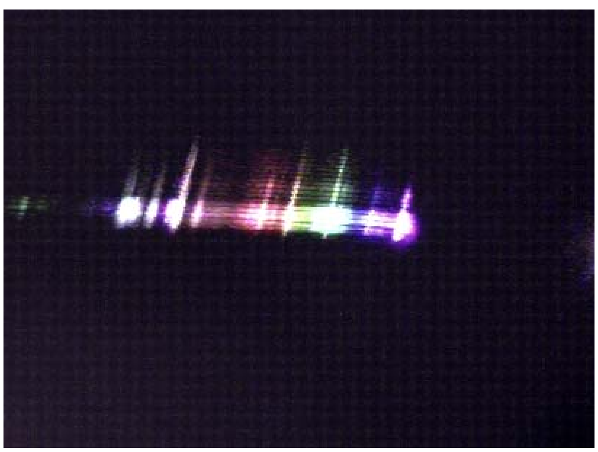

Figure 4. Raw emission spectrum, as imaged from Madrid.

Emission spectrum: The spectrum of the fireball was recorded from Madrid by a colour CCD video spectrograph, which simplified the lines identification process (Figure 4). It was also imaged by a b&w CCD video camera operating from Villaverde del Ducado. The signal, once calibrated in wavelengths and corrected for the spectral response of the device, is shown in Figure 5. Most lines correspond to Fe I multiplets, although the spectrum is dominated by the contributions from ionized calcium H and K lines in the ultraviolet and by the O I triplet at 777.4 nm in the infrared. Atmospheric N_2 bands are prominent in the red region of the spectrum, a situation that is also found for Perseid meteors [9]. The contributions from Mg I-2 (516.7 nm) and Na I-1 (588.9 nm) are also very important.

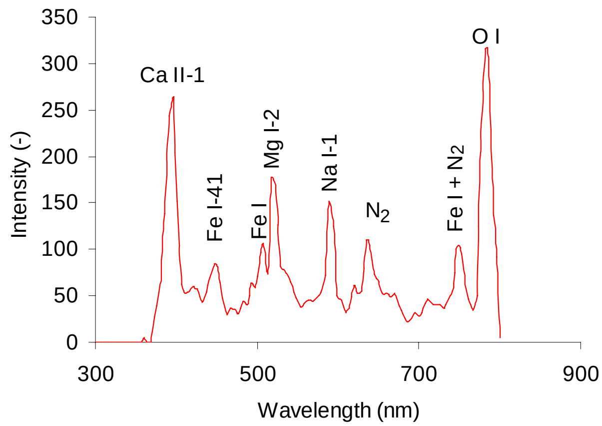

Figure 5. Calibrated emission spectrum.

Conclusions: In the framework of our continuous fireball monitoring and spectroscopic campaign, we have imaged a mag. -7±1 three-station October δ-Aurigid bolide. The atmospheric trajectory of the fireball was characterized and the orbit of the parent meteoroid was calculated. The emission spectrum, obtained by two spectrographs, has provided information about the chemical nature of this particle.

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