PHYSICO-CHEMICAL PROPERTIES OF SPORADIC METEOROIDS INFERRED FROM THE CONTINUOUS MONITORING OF METEOR AND FIREBALL ACTIVITY. L.A. González-Reina[1], J.M. Madiedo[1, 2], J.M. Trigo-Rodríguez[3] and F.M. Toscano[4]. [1]Facultad de Ciencias Experimentales, Universidad de Huelva, Huelva, Spain, madiedo@uhu.es. [2]Departamento de Fisica Atomica, Molecular y Nuclear. Universidad de Sevilla. 41012 Sevilla, Spain. [3]Institute of Space Sciences (CSIC-IEEC). Campus UAB, Facultat de Ciències, Torre C5-p2. 08193 Bellaterra, Spain, trigo@ice.csic.es. [4]Facultad de Química. Universidad de Sevilla. 41012 Sevilla, Spain.

Introduction: Sporadic meteoroids make up the bulk of the meteoroids striking the Earth. The combined action of gravitational and radiation forces have reduced the coherence of the initial orbits of these particles to such a degree that they have become so diffuse as to be no longer recognizable as streams and merge them together into the sporadic meteoroid complex. The development of a continuous meteor and fireball monitoring campaign is fundamental to characterize the physico-chemical properties of sporadic meteoroids. In this context, we present here the preliminary analysis of a sporadic bolide simultaneously imaged in July 2012 from two meteor observing stations operated by the SPanish Meteor Network (SPMN).

Instrumentation: We have employed CCD video devices (902H and 902H Ultimate from Watec Corporation) to image the bolide described in the text. These operated at two SPMN meteor observing stations in Andalusia: El Arenosillo and Sevilla. Both stations work in an autonomous way by means of software developed by us [1, 2]. Some of the above-mentioned cameras have attached holographic diffraction gratings (1000 lines/mm) for meteor spectroscopy.

Results and discussion: The fireball analyzed here (SPMN code 030712) was imaged by four CCD cameras (Figure 1). Two of these were located at Sevilla and the other two at El Arenosillo. The latter ones are configured as spectrographs by attaching a holographic diffraction grating to the objective lens. The absolute magnitude, obtained from the photometric analysis of the images, was -6±1. The event was recorded at 2h24m50.8±0.1s UTC. By using the method of planes intersection [3] we could obtain its atmospheric trajectory and radiant. In this way we inferred that the preatmospheric velocity was of about 13.5 km/s. Besides, the event began its luminous path at a height of 98.5±0.5 km, and disappeared from the field of view of our cameras when it was located at 54.8 km above the ground level. The terminal point of the trajectory could not be recorded. The radiant and orbital parameters (J2000) are summarized on Table 1. As can be seen in Fig. 1, the fireball experienced a fulguration that was determined to take place at 64.7 km above the ground level and when the velocity was of about 12.5 km/s. With these values we determined that this fulguration took place under an aerodynamic pressure of $2.4\pm0.1\times10^4$dyn/cm^2 [4].

On the other hand, we could also infer information about the chemical nature of the meteoroid by following the procedure described in [5, 6, 7]. Thus, two of the spectral cameras at El Arenosillo recorded the emission spectrum produced by this event. This spectrum was calibrated in wavelengths by using typical metal lines appearing in meteor spectra and then corrected by taking into account the spectral response of the instrument. The resulting signal is plotted in Fig. 5, where the main emission lines have been highlighted. As can be noticed, atmospheric N_2 emission is present. Most prominent lines correspond to several Fe I multiplets, but also to Mg I-3 (382.9 nm), Ca I-2 (422.6 nm), Mg I-2 (516.7 nm) and Na I-1 (588.9 nm).

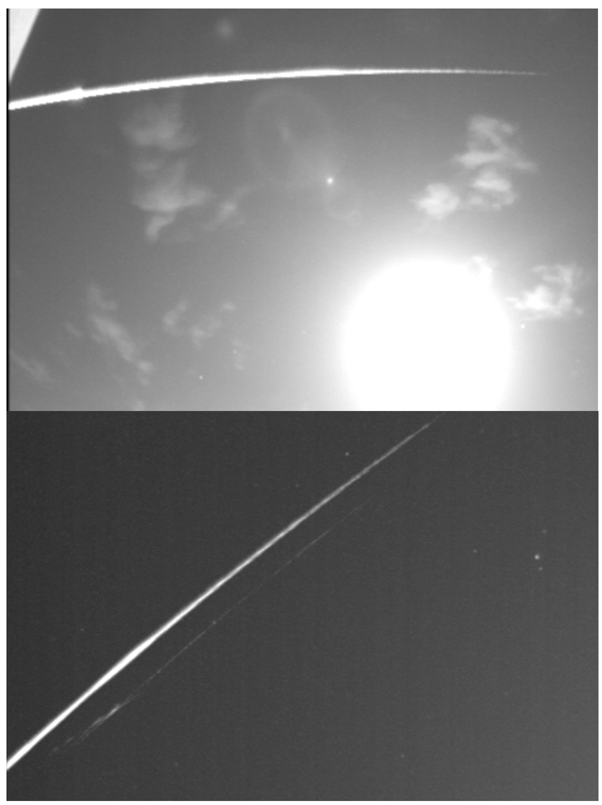

Figure 1. Composite images of the beginning of the atmospheric path of the SPMN030712 fireball imaged from Sevilla (top) and El Arenosillo (bottom).

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	221.2±0.2	200.7±0.4	
Dec. (º)	23.2±0.2	5.0±0.3	
V_∞ (km/s)	13.5±0.3	8.2±0.5	37.3±0.5
Orbital parameters			
a (AU) 2.9 ±0.2		**ω (º)**	183.3±0.4
e 0.59±0.03		**Ω (º)**	101.3701±10^{-4}
q (AU) 1.0160±0.0002		**i (º)**	2.7±0.5

Table 1. Radiant and orbital data (J2000) for the SPMN030712 fireball.

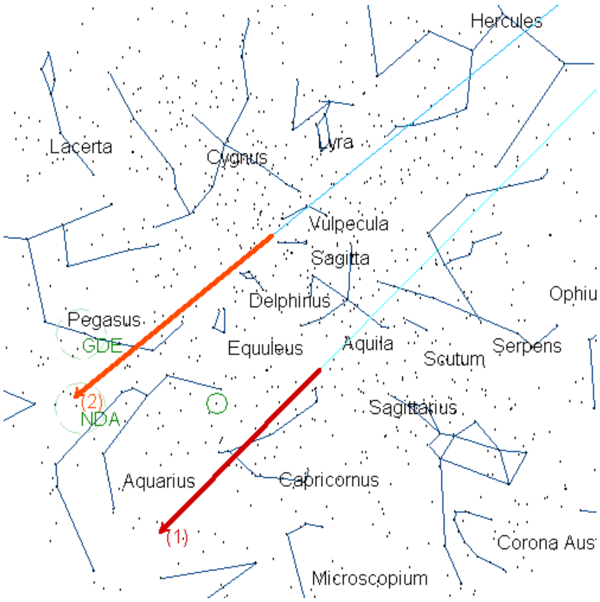

Figure 2. Apparent trajectory of the SPMN030712 fireball as recorded from (1) Sevilla and (2) El Arenosillo meteor observing stations.

Figure 3. Projection on the ground of the atmospheric trajectory of the SPMN030712 fireball.

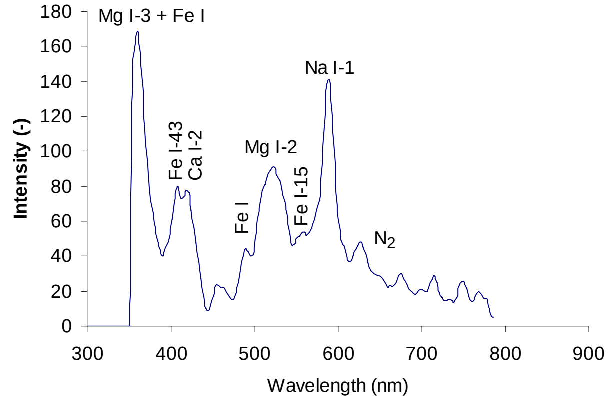

Figure 5. Calibrated spectrum of the SPMN030712 fireball, with main emission lines.

Conclusions: As a result of our continuous fireball monitoring and spectroscopic campaign, we have imaged a double-station mag. -6±1 sporadic fireball on July 3, 2012. Its emission spectrum provided information about the chemical nature of the meteoroid. Precise trajectory, radiant and orbital information has also been obtained.

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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] Ceplecha Z. Bull. Astron. Inst. Cz. 38, 222-234, 1987. [4] Bronshten V. A., 1981, *Geophysics and Astrophysics Monographs*. Reidel, Dordrecht. [5] Trigo-Rodriguez J.M., et al. (2009) *MNRAS*. 392, 367–375. [6] Trigo-Rodríguez J.M. et al. (2003) *MAPS* 38, 1283-1294. [7] Trigo-Rodríguez J.M. et al. (2004) *MNRAS* 348, 802-810.