ANALYSIS OF A JUNE LYRID FIREBALL. M. Granados[1], J.M. Madiedo[1,2], J.M. Trigo-Rodríguez[3]. [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]Instituto de Astrofísica de Andalucía, CSIC, Apt. 3004, 18080 Granada, Spain.

Introduction: The June Lyrids (JLY) were first observed by Dvorak in 1966 [1]. Its activity period was determined to extend from June 11 to June 21, peaking on June 16 with a zenithal hourly rate of about 9. However, evidence for its existence has been virtually zero since the 1970s. So, additional observations of this shower are necessary to improve our knowledge about the poorly known June Lyrid stream. In this sense, the development of a continuous observing campaign from different observing stations can be very helpful to record multi-station events, as these may provide precise orbital and radiant information. Here we present the preliminary analysis of a bright multi-station JLY bolide imaged in the framework of the SPanish Meteor Network (SPMN) in 2012 (Figure 1). As a result of our spectroscopic campaign, we have also obtained the emission spectrum produced by this event. This has provided an insight into the chemical nature of JLY meteoroids.

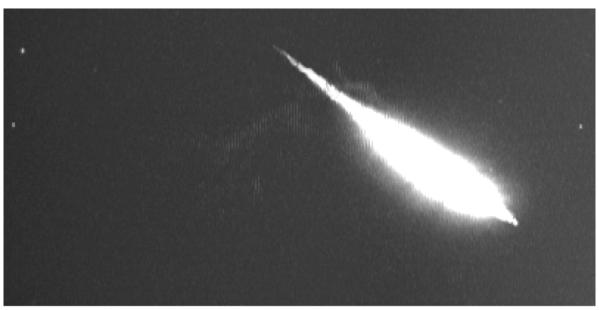

Figure 1. The SPMN120612 June Lyrid bolide imaged from Sevilla.

Instrumentation: Three SPMN meteor observing stations participated in the observation of the JLY event discussed here: Sevilla, El Arenosillo and La Hita. These have employed high-sensitivity CCD video cameras (models 902H and 902H Ultimate, from Watec Corporation) to monitor the night sky. They work in a fully autonomous way by means of software developed by us [2, 3]. 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 [4, 5, 6, 7].

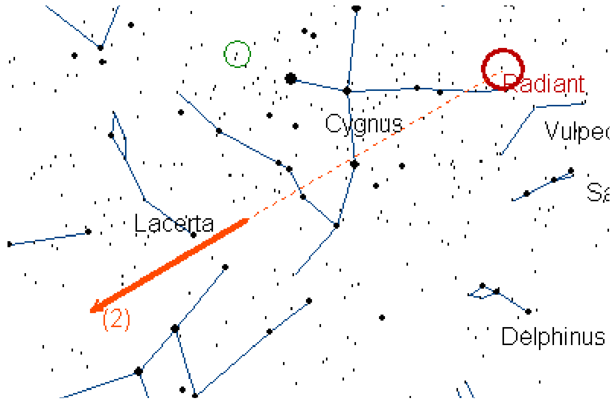

Figure 2. Apparent trajectory as observed from Sevilla.

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

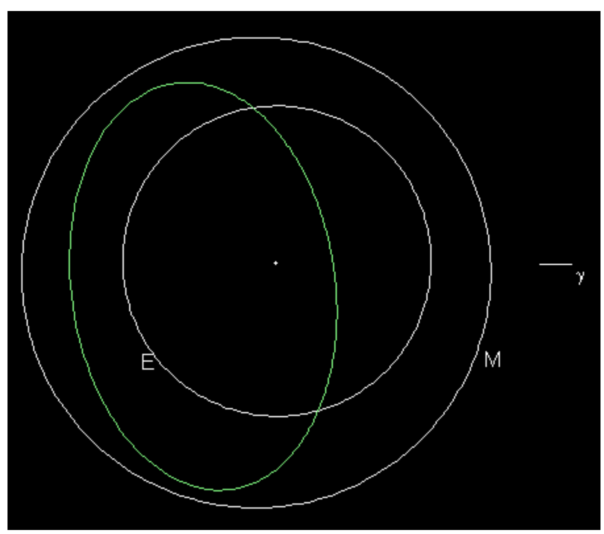

Figure 4. Projection on the ecliptic plane of the orbit of the meteoroid.

Atmospheric path, radiant and orbit: On June 12, 2012, at 0h08m10.3±0.1s UTC, three CCD video devices operating from the above mentioned SPMN stations imaged the mag. -9 fireball shown in Figure 1. The apparent path as seen from Sevilla is shown in Figure 2. Its trajectory in the atmosphere and apparent radiant position were analyzed by following the method of planes intersection [8]. According to this analysis the event began at 100.1±0.5 km above the ground level, with the meteoroid striking the atmosphere with an initial velocity V_∞=35.2±0.3 km/s. The bolide penetrated till a height of about 40.7±0.5 km. The projection on the ground of this trajectory is shown in Figure 3. The apparent radiant was located at α=291.2º, δ=29.4º. The orbit of the meteoroid is shown in Figure 4. Orbital and radiant parameters are summarized on Table 1. On the other hand, the light curve (Figure 4) is rather smooth, indicating that no violent disruption took place.

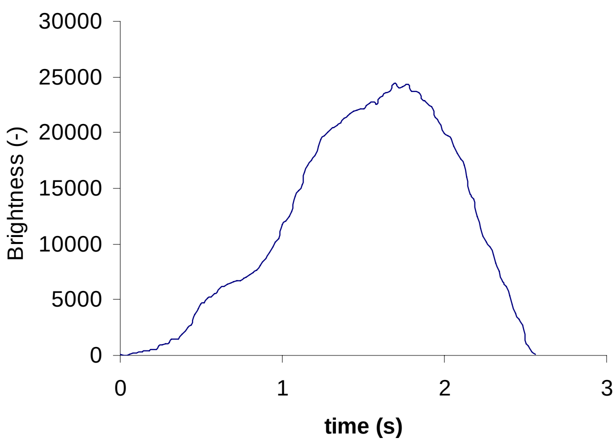

Figure 4. Light curve (pixel brightness, in arbitrary units, vs. time) of the fireball.

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	291.2±0.4	290.8±0.4	
Dec. (º)	29.4±0.2	29.3 ±0.2	
V_∞ (km/s)	35.2±0.3	33.2±0.3	34.6±0.3
Orbital parameters			
a (AU)	1.61±0.05	**ω (º)**	263.8±1.3
e	0.57±0.01	**Ω (º)**	81.2734±10^{-4}
q (AU)	0.684±0.005	**i (º)**	57.6 ±0.5

Table 1. Radiant and orbital data (J2000).

Emission spectrum: The spectrum was obtained by two of our spectral cameras operating from La Hita and El Arenosillo. The signal, calibrated in wavelengths and corrected for the instrument spectral sensitivity, is shown in Figure 5. As can be noticed, this spectrum is dominated by the emission of the Mg I-2 (516.7 nm) multiplet. The ionized calcium H and K lines are also detected, together with several Fe I multiplets. The emission from Na I-1 (588.9 nm) is also prominent. In the red region of the spectrum, the contribution of atmospheric N_2 is also seen.

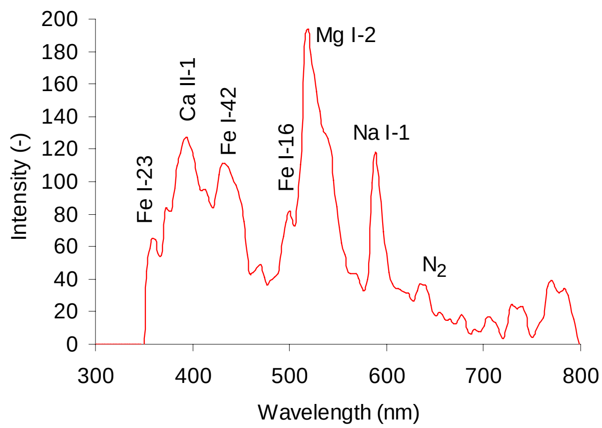

Figure 5. Calibrated spectrum, with main identified emission lines.

Conclusions: Optimal weather conditions in Spain favour de development of our continuous fireball monitoring and spectroscopic campaigns. As a result of this, we are registering data that provide helpful information to improve our knowledge about minor meteoroid streams. Thus, the June Lyrid bolide studied in this work has provided orbital and chemical data about the meteoroid that produced this event. Its atmospheric trajectory and radiant were calculated, and a smooth light curve resulted from the photometric analysis of the images. The emission spectrum was dominated by a strong emission from the Mg I-2 multiplet.

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References: [1] Dvorak, S. (1966) Sky & Telescope, Oct., p. 237. [2] Madiedo J.M. and Trigo-Rodríguez J.M. (2007) *EMP* 102, 133-139. [3] Madiedo J.M. et al. (2010) *Adv.in Astron*, 2010, 1-5. [4] Trigo-Rodriguez J.M. et al. (2009) *MNRAS*. 392, 367–375. [5] Trigo-Rodríguez J.M. et al. (2003) *MAPS* 38, 1283-1294. [6] Trigo-Rodríguez J.M. et al. (2004) *MNRAS* 348, 802-810. [7] Borovicka J. (1993) *Astron. Astrophys*. 279, 627-645. [8] Ceplecha Z. (1987) *Bull. Astron. Inst. Cz.* 38, 222-234.