ANALYSIS OF LARGE SPORADIC METEOROIDS IN THE FRAMEWORK OF THE SPANISH METEOR NETWORK. J.M. García[1], J.M. Madiedo[1], A.J. Castro-Tirado[2], M. Jelinek[2] and J.M. Trigo-Rodríguez[3]. [1]Facultad de Ciencias Experimentales, Universidad de Huelva, Avenida de las Fuerzas Armadas S/N, 21071 Huelva, Spain, madiedo@uhu.es. [2]Instituto de Astrofísica de Andalucía, CSIC, Apt. 3004, 18080 Granada, Spain. [3]Institute of Space Sciences (CSIC-IEEC). Campus UAB, Facultat de Ciències, Torre C5-p2. 08193 Bellaterra, Spain.

Introduction: The monitoring of very bright fireball events is one of the aims of the SPanish Meteor Network (SPMN), as these allow us to collect very valuable information on the origin and properties of large meteoroids that can give rise to the relatively rare potential meteorite-dropping bolides. Thus, one of the main goals of our meteor network is the analysis of the physico-chemical properties of these meteoroids from multiple station data, as a continuous monitoring of the night sky can provide useful data to improve our knowledge of the mechanisms that deliver these materials to the Earth. In this context, we have imaged on October 13, 2009 a double-station sporadic fireball with an absolute magnitude of about -10±1. The analysis of this event is presented here.

Methods: The sporadic fireball considered here was simultaneously recorded from two SPMN meteor observing stations (Sevilla and El Arenosillo) that employ high-sensitivity monochrome CCD video cameras, most of them manufactured by Watec Corporation [1, 2, 3]. Both stations are separated by a distance of about 70 km and the imaging devices are configured in such a way that the common atmospheric volume monitored by these cameras is maximized.

The AVI video files recorded by the automatic detection software are then processed to calculate the radiant and the atmospheric trajectory of the bolide by using the planes intersection method [4]. This is performed with the Amalthea software [5, 6], which also calculates the preatmospheric velocity V_∞ by fitting the velocity values measured at the earliest part of the fireball's trajectory to a suitable model. Once this velocity and the apparent radiant are known, the orbital parameters of the corresponding meteoroid can be calculated by following the procedure described in [4].

Results and discussion: An absolute magnitude of about -10±1 was estimated for the bolide imaged on October 13, 2009, at 0h31m27.2±0.1s UT (Fig. 1). The fireball (code SPMN131009), that has been named "Tarazona" because of the village over which it reached its maximum brightness, started its luminous phase at a height of 86.3±0.5 km, and finished at about 40.5±0.5 km. So, a meteorite fall seems to be unlikely in this case. The radiant (Fig. 2) and orbital data obtained with the Amalthea software for this sporadic event are shown on table I. This orbit has been plotted in Fig. 3. The results reveal a 3/2 resonance with Jupiter. The preatmospheric velocity calculated from the velocities measured at the beginning of the meteor trail was V_∞=15.0 ±0.3 km/s. The projection on the ground of this event is shown in Fig. 4. With respect to the possible origin of the meteoroid, our ORAS software (ORbital Association Software) indicates that one NEO (object 2007VG3) could be the parent body of this particle, with a value of the Southworth and Hawkins dissimilarity criterion [7] D_{SH}=0.12.

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	300.0±0.2	296.1±0.2	-
Dec. (º)	7.9±0.1	1.6±0.3	-
Ecliptical longitude(º)	-	-	-66.9±0.1
Ecliptical latitude(º)	-	-	5.6±0.2
V_∞ (km/s)	15.0±0.30	10.2±0.4	39.4±0.4

Orbital data			
a(AU)	3.9±0.5	**ω (º)**	186.1±0.1
e	0.74±0.03	**Ω (º)**	200.4681±10^{-4}
q(AU)	0.9951±0.0001	**i (º)**	5.7±0.3
Q(AU)	6.9±1.1		

Table 1. Radiant and orbital data (J2000) for the SPMN131009 sporadic fireball.

Conclusions: We are employing high-sensitivity CCD video devices to obtain radiant and orbital information about large meteoroids ablating in the Earth's atmosphere. This is very useful to fully characterize potential meteorite-dropping events, as meteorites are very valuable samples coming from different objects in the Solar System, but they are usually recovered without information about their parent bodies. Thus, it is important to obtain precise orbital data for events that could give rise to meteorites in order to reach a much better understanding of the different dynamical processes that deliver them to the Earth. In this sense, the analysis of the mag. -10±1 fireball of sporadic origin studied here has provided information about the radiant and the orbit of the corresponding meteoroid. Orbital dissimilarity criteria have also provided the possible identification of its parent body.

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01 and AYA2011-26522) and CSIC (grant #201050I043).

References: [1] Madiedo, J.M. and Trigo-Rodriguez, J.M. (2010) *41st LPSC*, Abstract #1504. [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] Ceplecha, Z. (1987) *Bull. Astron. Inst. Cz.* 38, 222-234. [5] Trigo-Rodriguez J.M. et al. (2009) *MNRAS* 394, 569-576. [6] J.M. Madiedo et al. (2011), *EPSC-DPS Joint Meeting 2011*, Abstract #Vol. 6, EPSC-DPS2011-67. [7] Southworth, R.B., Hawkins, G. S. (1963) Smithson Contr. Astrophys. 7, 261–285.

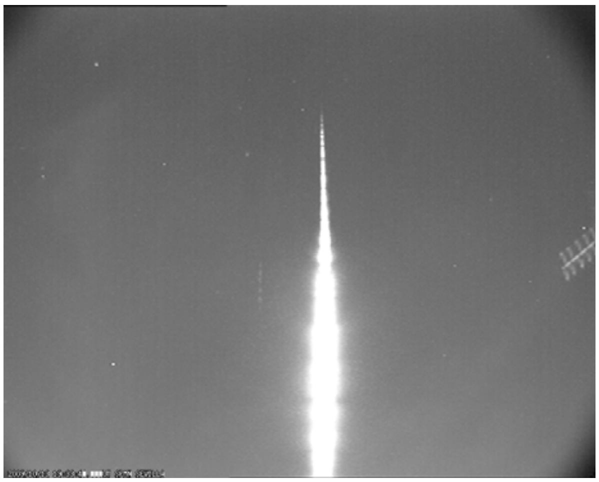

Figure 1. The Tarazona bolide (SPMN131009), with an absolute magnitude of –10±1, imaged from Sevilla.

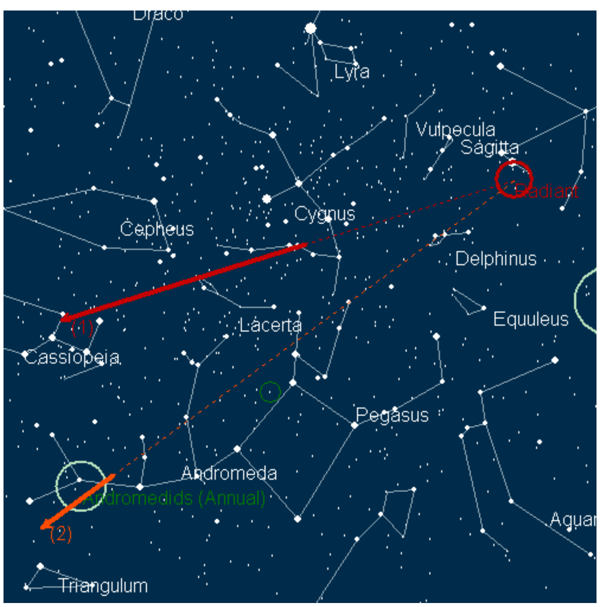

Figure 2. Radiant obtained by performing the astrometric calibration from the two meteor observing stations (1. Sevilla and 2. Arenosillo).

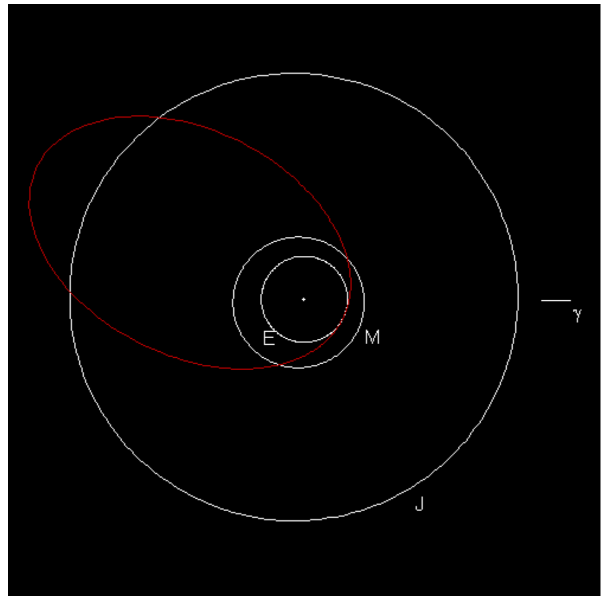

Figure 3. Heliocentric orbit of the SPMN131009 fireball. For comparison, the orbits of Jupiter, Mars and Earth are also shown..

Figure 4. Projection on the ground of the atmospheric trajectory of the Tarazona fireball (SPMN 131009).