A JUPITER-FAMILY METEORITE-DROPPER BOLIDE RECORDED ON OCTOBER 4th 2018 IN THE FRAMEWORK OF THE SPMN NETWORK J.M. Trigo-Rodríguez[1], J.M. Madiedo[2,3], E. Blanch[4], M. Chioare[5], V. Tilve[5], J. Llorca[6], M.J. Herrero-Pérez[1], S. González[7], M. Jover Benjumea[8], P. Pujols[9], L. Morillas[10], J. Ribas-Carrasco[11], M.M. Mérida-Díaz[11], J.M. Petit[12], R. Balaguer[12], and M. Aznar[13]. [1]Institute of Space Sciences (CSIC-IEEC). Campus UAB, c/Can Magrans s/n, 08193 Cerdanyola del Vallès, Barcelona, Catalonia, Spain. [2]Facultad de Ciencias Experimentales, Universidad de Huelva (UHU), Huelva, Spain [3]Departamento de Fisica Atomica, Molecular y Nuclear. Universidad de Sevilla. 41012 Sevilla, Spain. [4]Observatori de l'Ebre (OE, CSIC - Universitat Ramon Llull), Horta Alta, 38, 43520 Roquetes, Tarragona, Spain [5]Observatorio Astrofísico de Javalambre (OAJ), Centro de Estudios de Física del Cosmos de Aragón, Plaza San Juan 1, planta 2, 44001 Teruel, Spain [6]Institute of Energy Technologies, Dep. Chem. Engineering and Barcelona Research Center in Multiscale Science and Engineering, Universitat Politècnica de Catalunya-BarcelonaTECH, Catalonia, Spain [7]Antarctic group, AEMET, Barcelona, Spain. [8]Dep. Environmental Sciences, Faculty of Sciences, University of Girona, 17071 Girona, Catalonia, Spain [9]Agrupació Astronómica d'Osona (AAO), Carrer Pare Xifré 3, 3er. 1a. 08500 Vic, Barcelona, Catalonia, Spain. [10]IES Cañada de las Fuentes. Ctra. de Huesa, 25. 23487 Quesada, Jaén, Spain [11]Agrupacio Astronómica d'Eivissa, Eivissa, Spain [12]AstroGirona, Centre Cultural Can Roig, C/ Lleó I, núm. 2, 17240 Llagostera, Catalonia, Spain. [13]Astrosedetania (Agrup. Astronómica de Huesca), Centro Astronómico Aragones, WALQA-HUESCA, Spain.

Introduction: The Spanish Meteor Network (SPMN) consists of 30 stations distributed around continental Spain and Balearic islands, and giving a scientific and rational explanation to very bright and mediatic fireball events. Our cooperative network has been growing and operational for the last twenty years, and has a special program to obtain very precise orbital information on meter-sized sporadic meteoroids that are potential candidates to deliver meteorites [1, 2]. There is growing evidence that Jupiter Family Comets (JFCs) and periodic and much evolved comets can produce meter-sized meteoroids that are potential meteorite droppers [3-4]. There is reasonable evidence that JFCs produce meteorite-dropping bolides [5-6]. In addition, a plausible heliocentric orbit of the CI chondrite Orgueil was inferred from contemporary visual reports during its fall on May 14, 1864 [7]. Even when meteoroid streams associated with comets are mainly produced by outgassing that releases μm to cm-sized meteoroids [8], there are other physical processes capable to produce much larger cometary debris. An example is the sudden disruption of comets that currently explains the formation of about ten meteoroid streams [8-10]. This second pathway produces meter-sized rocks and explains very bright bolides associated with some meteor showers [9]. In this abstract we focus in a sporadic fireball named SPMN041018 recorded on October 4th, 2018 at 20h24m01.6s UTC (see Fig. 1).

Methods: About 30 CCD and video stations are currently monitoring a surface area of 600,000 km^2. The cameras used are high-sensitivity 1/2" black and white CCD video cameras (Watec, Japan) attached to modified wide-field lenses covering a 120×80 degrees field of view. Coordinate positions of the fireball were obtained by creating a composite image of all frames where the stars coordinates were measured and taken as reference using our software packages [11-12]. The fireball emission spectrum was also nicely recorded by Folgueroles (AAO-IEEC-CSIC) station (Table 1) and is being reduced with our sequential method [13].

N #	Station (Province)	Longitude (E)	Latitude (N)	Alt. (m)
1	Montsec Obs (Lleida)	00º 43´ 46"	42º 03´ 05"	1570
2	Folgueroles (Barcelona)	02º 19´ 33"	41º 56´ 31"	580
3	Puig des Molins (Eivissa)	01º 25´ 45"	38º 54´ 21"	60
4	Sant Antoni de Calonge (Girona)	03º 06´ 08"	41º 51´ 34"	40
5	Observatorio de La Hita	-03º 11´ 00"	39º 34´ 06"	674
6	Miraflores (Zaragoza)	-0º 52´ 46"	41º 38´ 32"	239
7	Torroella de Montgrí (Girona)	03º 07´ 55"	42º 03´ 07"	300

Table 1. SPMN stations involved in the detections. At Montsec a low-scan-rate CCD all-sky camera was used, while wide field video cameras were used in the others. Station #8 was a casual astrophotography.

Results and discussion: From the astrometric measurements of the video frames and the trajectory length computed, the velocity of the bolide along the path was obtained. Radiant and orbital parameters were computed and are presented in Table 2. The pre-atmospheric velocity V_∞ was inferred from the velocity measured at the earliest frames of the video data. Figure 1a,b shows the bolide which reached an absolute magnitude of -13±1. The fireball started at a height of 98.0±0.5 km and ended at 25.3±0.5 km with a bright flare occurred at 26±1 km so a meteorite survival is likely. The fireball was also detected by forward-scatter from Jaén by Lorenzo Morillas, providing an unusually extended 10 seconds duration echo.

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	348.0±0.4	347.3±0.4	311.4±0.5
Dec. (º)	45.4±0.4	45.6±0.4	26.5±0.4
V_∞ (km/s)	25.5±0.5	23.9±0.5	38.3±0.4
Orbital parameters			
a (AU)	2.89±0.27	**ω (º)**	244.1±0.8
e	0.737±0.024	**Ω (º)**	75.4±0.8
q (AU)	0.761±0.003	**i (º)**	29.9±0.6

Table 2. Radiant and orbital data (J2000).

Figure 1. Composite image of the SPMN 041018 from a) Torroella de Montgrí (M. Jover), and b) Montsec Astronomical Observatory (OAdM).

Conclusions:. The computed radiant and preatmospheric velocities of SPMN 041018 are in agreement with a meteoroid released from a JFC (Table 2 and Fig. 3). The bolide deepening in the atmosphere supports survival of meteorites, but the luminous phase exhibits a strong fragmentation event so probably very small meteorites (if any) survived. Several meteorite searches have being organized, but not meteorites have been found. We will continue studying fireballs associated with JFCs to learn about the origin and evolution of comets and their ability to produce meteorites [4].

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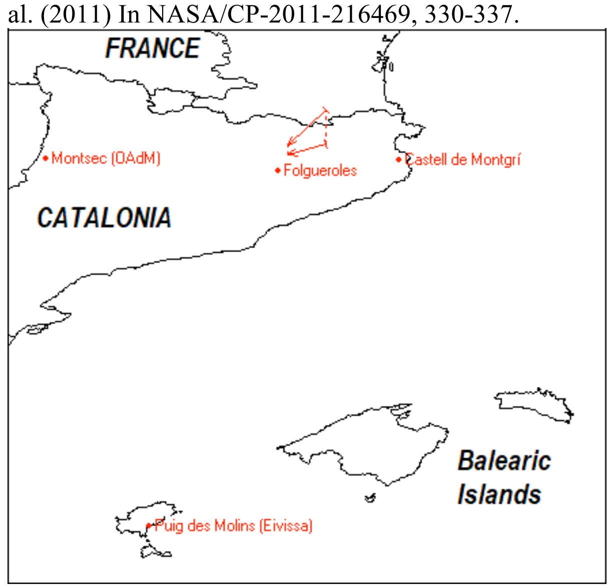

Figure 2. Atmospheric trajectory of the SPMN 041018 fireball as recorded from nearby stations.

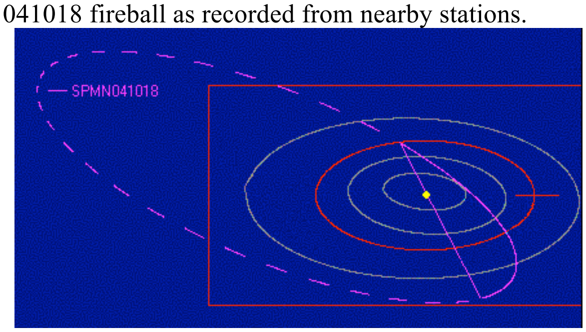

Figure 3. The orbit of SPMN041018 compared with the orbit of Earth (in red) and inner planets.