LARGE COMETARY METEOROIDS OBSERVED IN THE FRAMEWORK OF THE SOUTHWESTERN EUROPE METEOR NETWORK. J.M. Madiedo[1], J.L. Ortiz[1], J. Aceituno[2], E. de Guindos[2], A.I. Aimee[3]. [1]Departamento de Sistema Solar, Instituto de Astrofísica de Andalucía (IAA-CSIC), 18080 Granada, Spain. [2]Observatorio Astronómico de Calar Alto (CAHA), E-04004, Almería, Spain. [3]Southwestern Europe Meteor Network, 41012 Sevilla, Spain..

Introduction: The SMART (Spectroscopy of Meteoroids by means of Robotic Technologies) project is being developed since 2006 with the aim to obtain information about the chemical composition of meteoroids ablating in the atmosphere. This survey, which is being conducted by the Southwestern Europe Meteor Network (SWEMN), employs an array of automated cameras and spectrographs deployed at a series of meteor-observing stations in different locations in Spain, including the major astronomical observatories in this country [1-3]. We focus special attention on large meteoroids entering our atmosphere, since under special conditions, if these are tough enough, these may survive and reach the ground as meteorites. Large cometary meteoroids have in general not enough mechanical strength and so they are more prone to be completely ablated at high altitude in the atmosphere, giving rise to high-luminosity events. In both cases, however, these materials can be very useful to determine the flux of large rocks in the Earth-Moon environment, and so their analysis is very important to quantify the impact hazard for our planet. In fact, SMART works in very close connection with the MIDAS survey (Moon Impacts Detection and Analysis System), which is also being conducted by the SWEMN network in order to detect and analyze the impact of large meteoroids with the lunar ground [4]. In this context, we present here a preliminary analysis of an extraordinary fireball that was spotted over the south of Spain on 2022 October 12. Its peak luminosity was equivalent to an absolute magnitude of -15.

Instrumentation and methods: To record the fireball analyzed here we have employed an array of low-lux CCD video cameras manufactured by Watec Co. (models 902H and 902H2 Ultimate). Some of these devices are configured as spectrographs by means of 1000 lines/mm diffraction gratings [5]. CMOS color cameras were also employed [6]. These cameras monitor the night sky and operate in a fully autonomous way by means of software developed by J.M. Madiedo [1, 2]. The atmospheric trajectory and orbital data of the event were obtained with the SAMIA software which was also written by the same researcher [1, 3].

Figure 1. Stacked image of the SWEMN20221012_045043 bolide as recorded from the Calar Alto Astronomical Observatory.

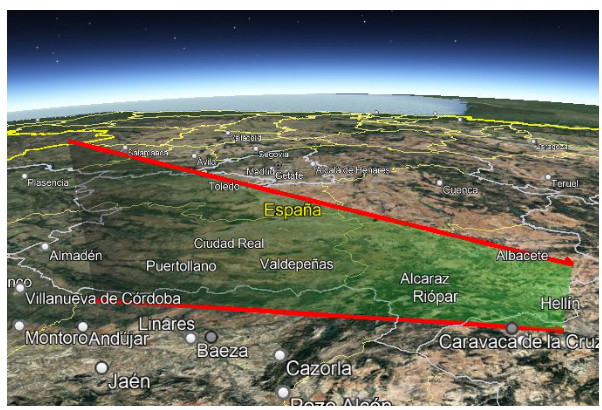

Figure 2. Atmospheric path of the SWEMN20221012_045043 event, and its projection on the ground.

The 2022 October 12 event: This stunning bolide was recorded by the systems operated by the SWEMN network at 4h50m43.0±0.1s UT on 2022 October 12 (Figure 1). Its maximum luminosity was equivalent to an absolute magnitude of -15.0±1.0. It showed a series of flares along its luminous path as a consequence of the sudden break-up of the meteoroid. The code given to the event in the SWEMN meteor database is SWEMN20221012_045043.

It was deduced by calculating the luminous path of the fireball that this event overflew the province of Jaén (Spain). The initial altitude of the meteor yields H_b=80.5±0.5 km, with the terminal point of the luminous phase located at a height H_e=75.2±0.5 km. The equatorial coordinates concluded for the apparent radiant are α=8.09º, δ=9.48º. The entry velocity in the atmosphere inferred for the parent meteoroid was V_{∞}=18.9±0.1 km/s. Figure 2 shows the obtained trajectory in the atmosphere of the fireball. The orbit of the progenitor meteoroid is shown in Figure 3.

a (AU)	2.64±0.03	**ω (º)**	239.5±00.2
e	0.699±0.005	**Ω (º)**	198.582920±10^{-5}
q (AU)	0.795±0.002	**i (º)**	1.21±0.02

Table 1. Orbital data (J2000) of the progenitor meteoroid.

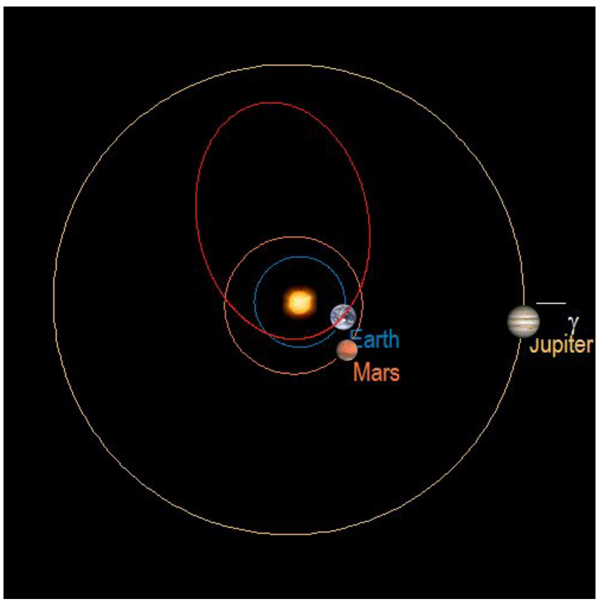

Figure 3. Projection on the ecliptic plane of the heliocentric orbit of the parent meteoroid.

We named this fireball "Reculo", since the bright meteor passed near the zenith of this locality during its final phase. The orbital parameters of the progenitor meteoroid before its encounter with our planet can be found in Table 1, and the geocentric velocity derived in this case was V_g=15.7±0.1 km/s. From the value calculated for the Tisserand parameter referred to Jupiter (T_J =2.99), we found that the meteoroid followed a cometary (JFC) orbit before entering the Earth's atmosphere. These parameters and the derived radiant do not match any of the streams listed in the IAU meteor database. Consequently it was concluded that this bolide was linked to the sporadic background.

Conclusions: We have described an extraordinary mag. -15 fireball event associated with the sporadic meteoroid environment of our planet. It overflew the southeast of Spain. More specifically, the province of Jaén. But as a consequence of its notable brightness it could be observed along the whole Iberian Peninsula and neighboring areas. The terminal height was high, since, despite its low entry velocity in the Earth's atmosphere (18.9 km/s), the event ended at about 75 km over the ground as a consequence of the low tensile strength of the meteoroid. This particle followed a cometary orbit before its encounter with our planet.

Acknowledgements: We acknowledge support from the Spanish Ministry of Science and Innovation (MICIN) and the State Agency for Research (AEI) through project PID2019-105797GB-I00. We also acknowledge financial support from the State Agency for Research of the Spanish MCIU through the "Center of Excellence Severo Ochoa" award to the Instituto de Astrofísica de Andalucía (SEV-2017-0709)". The authors also thank *Fundación AstroHita* for its support in the establishment and operation of the automated meteor observing station located at La Hita Astronomical Observatory (La Puebla de Almoradiel, Toledo, Spain).

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