ORBIT AND EMISSION SPECTRUM OF A MAG. -12 METEOR EVENT RECORDED ON 2019 FEBRUARY 6. J.M. Madiedo[1], J.L. Ortiz[1], J. Aceituno[2], E. de Guindos[2]. [1]Instituto de Astrofísica de Andalucía, CSIC, Apt. 3004, 18080 Granada (Spain). [3]Centro Astronómico Hispano-Alemán, Calar Alto (CSIC-MPG), E-04004 Almería, 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 spectrographs deployed at 10 meteor-observing stations in Spain [1, 2]. In this way we can determine the atmospheric trajectory of meteors and the orbit of their parent meteoroids, but also the evolution of the conditions in meteor plasmas from the emission spectrum produced by these events [3-18]. In this work we present a preliminary analysis of a very bright fireball that was spotted over the south of Spain on 2019 February 6.

Figure 1. Sum-pixel image of the fireball discussed in the text as recorded from: (up) La Hita Astronomical Observatory; (down) La Sagra Astronomical Observatory.

Instrumentation and methods: To record the fireball analyzed here and its emission spectrum we have employed an array of low-lux CCD video cameras manufactured by Watec Co. (models 902H and 902H2 Ultimate), some of which are configured as spectrographs by means of 1000 lines/mm diffraction gratings. CMOS color cameras were also employed at La Hita Astronomical Observatory [19]. 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 Amalthea software, which was also written by the same researcher [20].

The 2019 February 6 meteor event: On 2019 February 6 at 0h33m25.5±0.1s UTC a mag. –12±1 fireball (Figure 1) was spotted from the meteor-observing stations operated by SWEMN at the astronomical observatories of Calar Alto, Sierra Nevada, La Sagra, and La Hita. The emission spectrum of this event was also recorded by three spectrographs located at La Hita, La Sagra and Calar Alto.

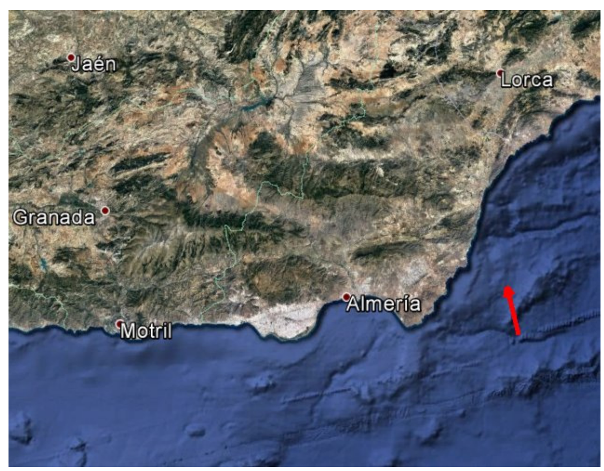

Figure 2. Projection on the ground of the atmospheric trajectory of the fireball analyzed in this work.

a (AU)	4.6±0.6	**ω** (º)	121.6±0.5
e	0.945±0.007	**Ω** (º)	136.64101 ± 10^{-5}
q (AU)	0.255±0.004	**i** (º)	6.8±0.1

Table 1. Orbital data (J2000) of the progenitor meteoroid before its encounter with our planet.

Atmospheric trajectory, radiant and orbit: The fireball begun at an altitude H_b=116.2±0.5 km over the sea. The meteoroid hit the atmosphere with an initial velocity V_∞=37.2±0.4 km/s and the apparent radiant was located at the equatorial coordinates α=152.7º, δ=7.70º. The bolide penetrated till a final height H_e=58.5±0.5 km. The projection on the ground of the atmospheric trajectory of this event is shown in Figure 2. The orbital parameters of the parent meteoroid before its encounter with our planet are listed in Table 1. The projection on the ecliptic of this heliocentric orbit is shown in Figure 3. According to the value of the Tisserand parameter with respect to Jupiter (T_J=1.1), the meteoroid followed a cometary orbit.

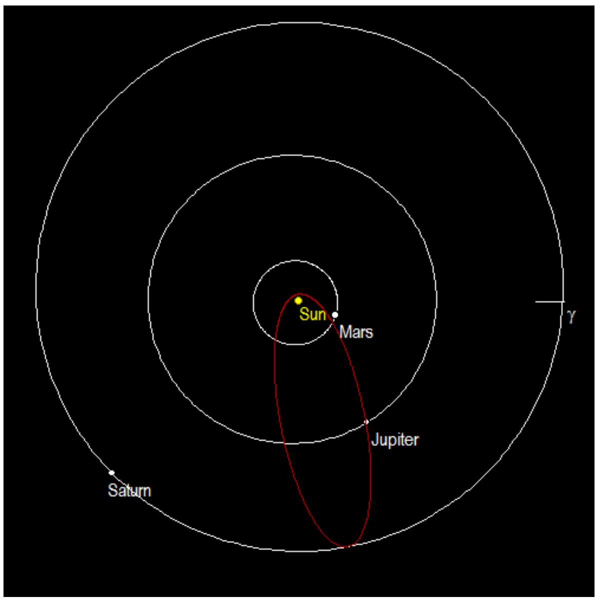

Figure 3. Projection on the ecliptic plane of the heliocentric orbit of the parent meteoroid.

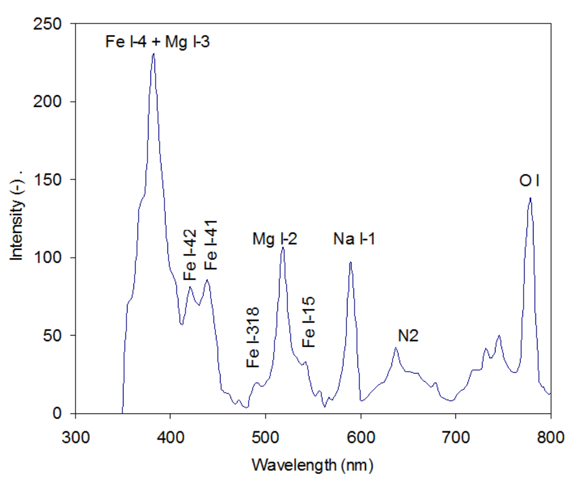

Figure 4. Emission spectrum of the fireball.

Emission spectrum: The emission spectrum of the fireball was recorded by means of three videospectrographs operated by the SMART project [1, 2]. This spectrum is shown in Figure 4, where the most important contributions to the signal have been highlighted. As usual in meteor spectra, most lines identified in this signal correspond to neutral Fe. Thus, as Figure 4 shows, several multiplets of this element have been identified. The most important contribution in this signal comes from the emission from Fe I-4 and Mg I-3, which appear blended. The emission lines of the Na I-1 doublet (588.9 nm) and the Mg I-2 triplet (516.7 nm) are also very prominent. The detailed conditions in the meteor plasma are currently under analysis. For this purpose, the relative intensities of Mg I-2, Na I-2 and Fe I-15 will be compared, as has been done with previous events [1-17]. This will provide an insight into the chemical nature of the progenitor meteoroid.

Conclusions: This work presents a preliminary analysis of a very bright (mag. -12) and deep-penetrating fireball recorded over Spain on 2019 February 6. The progenitor meteoroid followed a cometary orbit before its encounter with our planet. The event penetrated the atmosphere till and ending altitude of about 58.5 km. The emission spectrum of the bolide was also recorded, and contained as main contributions those of Mg I-2, Na I-1 and several Fe I multiplets.

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