ORBIT AND SPECTROSCOPIC ANALYSIS OF AN α-CAPRICORNID FIREBALL RECORDED IN 2016. J.M. Madiedo[1], J.L. Ortiz[2], J.M. Trigo-Rodríguez[3], J. Aceituno[4], E. de Guindos[4]. [1]Facultad de Ciencias Experimentales, Universidad de Huelva, 21071 Huelva, Spain. [2]Instituto de Astrofísica de Andalucía, CSIC, Apt. 3004, 18080 Granada (Spain). [3]Institute of Space Sciences (IEEC-CSIC), Campus UAB, Carrer de Can Magrans s/n, 08193 Cerdanyola del Vallés (Barcelona), Spain. [4]Centro Astronómico Hispano-Alemán, Calar Alto (CSIC-MPG), E-04004 Almería, Spain.

Introduction: The α-Capricornid meteoroid stream produces an annual display of meteors from about July 19 to August 18, peaking around the end of July [1]. Although most of these meteors are faint, this stream also contains a population of cm-sized meteoroids that give rise to very bright bolides (see e.g. [2]). Unfortunately these events are rare, but a continuous monitoring of the night sky is fundamental in order to register these fireballs. In this way, we can study the physico-chemical properties of these meteoroids. For instance, previous works based on the analysis of α-Capricornid meteors suggested an enhancement in the Mg content of some α-Capricornid meteoroids [2]. In this context we present here a preliminary analysis of an extraordinary mag. -11 α-Capricornid fireball registered on 8 July 2016 in the framework of the continuous fireball monitoring and spectroscopic campaigns developed by the Spanish Meteor Network. This event was included in our fireball database with code SPMN080716.

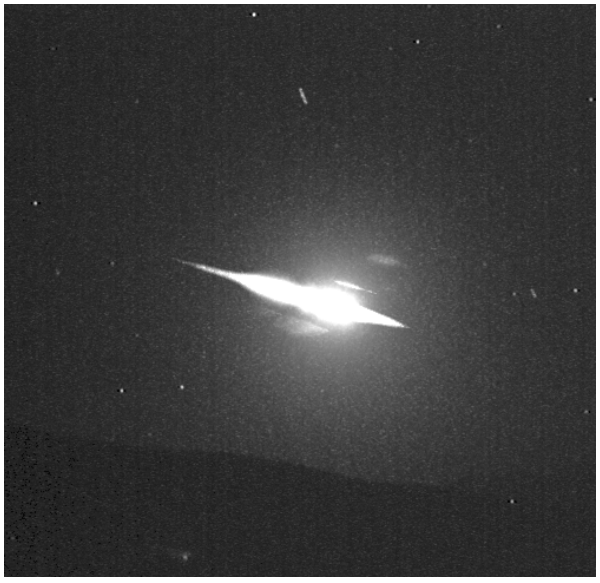

Figure 1. Sum-pixel image of the fireball discussed here.

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). These monitor the night sky and operate in a fully autonomous way by means of software developed by the first author [3]. The atmospheric trajectory and orbital data of the event were obtained with the Amalthea software [4]. The emission spectrum of the fireball was analyzed with the ChiMet software [5].

The 8 July 2016 event: On 8 July 2016 at 21h05m47.6±0.1s UTC a mag. –11±1 fireball (Figure 1) was recorded by several of our meteor observing stations operating from the South of Spain. Namely, those located at Calar Alto, Sevilla, La Hita, Huelva, and La Sagra. The emission spectrum of this bolide was also recorded by two video spectrographs located at La Hita and La Sagra, respectively. These devices operate in the framework of the SMART Project [3, 6].

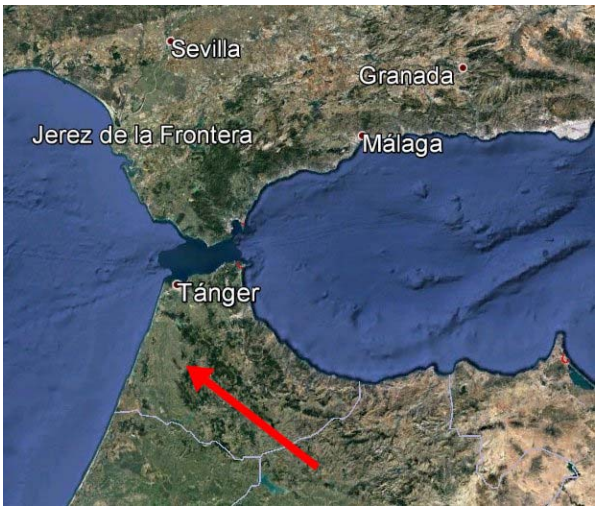

Figure 2. Projection on the ground of the atmospheric trajectory of the fireball analyzed in this work.

a (AU)	2.4±0.1	**ω (º)**	92.9±0.2
e	0.77±0.01	**Ω (º)**	286.95147±10^{-5}
q (AU)	0.548±0.003	**i (º)**	1.86±0.05

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

Atmospheric trajectory, radiant and orbit: The bolide began at an altitude H_b=105.1±0.4 km over Morocco, and the meteoroid hit the atmosphere with an initial velocity V_∞=26.2±0.3 km/s. The apparent radiant was located at the equatorial coordinates α=287.6º, δ=-21.1º. The bolide penetrated till a final height

H_e=71.7±0.4 km. The projection on the ground of the atmospheric trajectory 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.

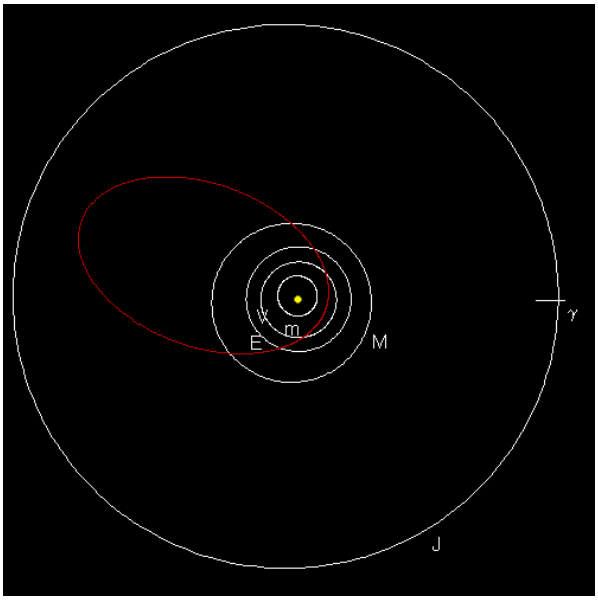

Figure 3. Projection on the ecliptic plane of the heliocentric orbit of the parent meteoroid.

The maximum luminosity of the event was reached as a consequence of a flare that took place at an altitude of 80±1 km above the sea level. The estimated tensile strength of the meteoroid at this stage yields $(9.1\pm0.5)\cdot10^4$ dyn/cm^2.

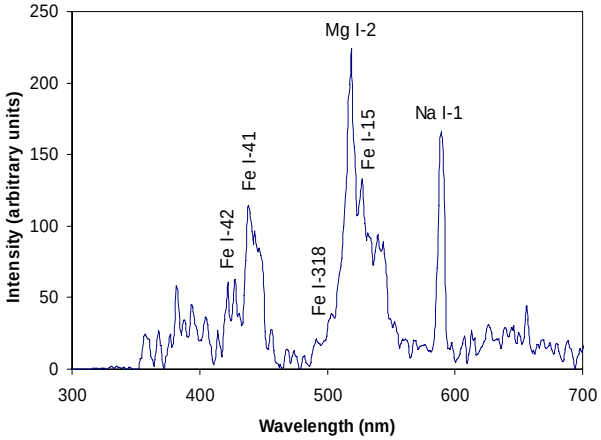

Figure 4. Calibrated emission spectrum of the fireball analyzed in the text.

Emission spectrum: The calibrated spectrum of the SPMN070816 fireball, once corrected for the instrumental efficiency, is shown in Figure 4, where the main emission lines identified in this signal have been highlighted. As usual in meteor spectra, most of these lines correspond to neutral Fe. However, the emission lines of the Na I-1 doublet (588.9 nm) and the Mg I-2 triplet (516.7 nm) are the most prominent ones in this case. The detailed conditions in the meteor plasma are currently under analysis. This will provide an insight into the chemical nature of the progenitor meteoroid. Previous works revealed an enhanced Mg content in some α-Capricornid meteoroids (see, e.g., [2]). This analysis will reveal if this enhancement if found in this particle.

Conclusions: We have presented here the preliminary analysis of a bright fireball (SPMN code 070816) that overflew Morocco on 8 July 2016, reaching an absolute magnitude of –11±1. The event was recorded by several meteor observing stations operating from Spain together with its emission spectrum. In this way the atmospheric path of the fireball and its radiant could be calculated, and the orbital parameters of the progenitor meteoroid were obtained. This meteoroid belonged to the α-Capricornid stream. The main contributions in the spectrum correspond to neutral Mg and Na. The detailed conditions in the meteor plasma are currently under analysis in order to get an insight into the chemical nature of this meteoroid. This will reveal if the content in Mg is enhanced in this meteoroid, as has been previously found in other members of the α-Capricornids.

Acknowledgements: Support from the following projects is acknowledged by the authors: AYA2015-67175-P (MINECO/FEDER), AYA2014-61357-EXP (MINECO), AYA2015-68646-P (MINECO/FEDER), Proyecto de Excelencia de la Junta de Andalucía, J.A. 2012-FQM1776, and from FEDER.

References: [1] Jenniskens P. (2006) *Meteor Showers and their Parent Comets.* Cambridge University Press. [2] Madiedo J.M. et al. (2014) Icarus, 239, 273. [3] Madiedo J.M. (2014), Earth, Planets & Space, 66, 70. [4] Madiedo J.M. et al. (2011), NASA/CP-2011-216469, 330. [5] Madiedo et al. (2015) MNRAS, 433, 571. [6] Madiedo J.M. (2016), Planetary and Space Science, doi: 10.1016/j.pss.2016.12.005.