A NORTHERN MAY OPHIUCHID FIREBALL IMAGED IN 2012 IN THE FRAMEWORK OF THE SPANISH METEOR NETWORK. P. Aranda[1], J.M. Madiedo[1,2], J.M. Trigo-Rodríguez[3] and F.M. Toscano[4]. [1]Facultad de Ciencias Experimentales, Universidad de Huelva, Huelva, Spain, madiedo@uhu.es. [2]Departamento de Fisica Atomica, Molecular y Nuclear. Universidad de Sevilla. 41012 Sevilla, Spain. [3]Institute of Space Sciences (CSIC-IEEC). Campus UAB, Facultat de Ciències, Torre C5-p2. 08193 Bellaterra, Spain, trigo@ice.csic.es. [4]Facultad de Química. Universidad de Sevilla. 41012 Sevilla, Spain.

Introduction: The Northern May Ophiuchids is a poorly known annual meteor shower whose activity period extends from April, 25 to May, 31, peaking around May 13 [1]. It is included in the IAU list of working meteor showers with code 149 NOP. Thus, the development of a continuous observing campaign can provide helpful data to increase or knowledge about this shower. In particular, multi-station events would be useful to calculate precise orbital data and different physico-chemical properties of meteoroids belonging to the NOP stream. Besides, the chemical nature of these particles of interplanetary matter can be inferred from the analysis of the emission spectrum produced when they ablate in the atmosphere. Here we present the analysis of a NOP fireball recorded in the framework of the fireball monitoring and spectroscopic campaign organized by the SPanish Meteor Network (SPMN).

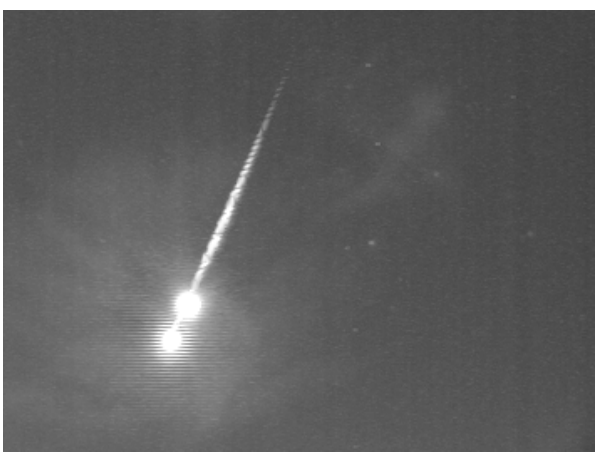

Figure 1. Composite image of the SPMN270512 fireball and its emission spectrum, imaged from Sevilla.

Instrumentation: Three SPMN automatic meteor observing stations recorded the bolide analyzed here. These employ high-sensitivity 1/2" b&w CCD video cameras (from Watec Co., Japan). Their operation has been explained in [2, 3]. For meteor spectroscopy we have used holographic diffraction gratings (1000 lines/mm) attached to the objective lens of some of these video devices.

Results and discussion: Out stations at El Arenosillo, La Hita and Sevilla imaged a mag. -7 NOP fireball (code SPMN270512) on May 27, 2012 at 0h03m41.1±0.1s UT. As can be seen in Figure 1, it suffered two bright fulgurations along its atmospheric path. Figure 2 shows the apparent trajectory of the bolide as recorded from Sevilla and El Arenosillo. By using the method of planes intersection [4] we have obtained its atmospheric trajectory and radiant. According to this, the parent meteoroid struck the atmosphere with an initial velocity V_∞=29.1±0.3 km/s. The fireball began at a height of about 99.6±0.5 km, with a terminal point located at 80.1±0.5 km above the ground level. The projection on the ground of this atmospheric trajectory is shown in Figure 3. The radiant and orbital parameters are summarized on table 1 and the projection of the orbit of the parent meteoroid on the ecliptic plane can be seen in Figure 4. We also could infer the value of the aerodynamic pressure under which the bolide experienced the above-mentioned fulgurations [5]. These took place at 83.3 km and 80.1 km above the ground level. Thus, by using the average atmospheric density from the US standard atmosphere [6], we have obtained $7.0\pm0.3\times10^3$dyn/cm^2 and $1.2\pm0.3\times10^4$dyn/cm^2, respectively.

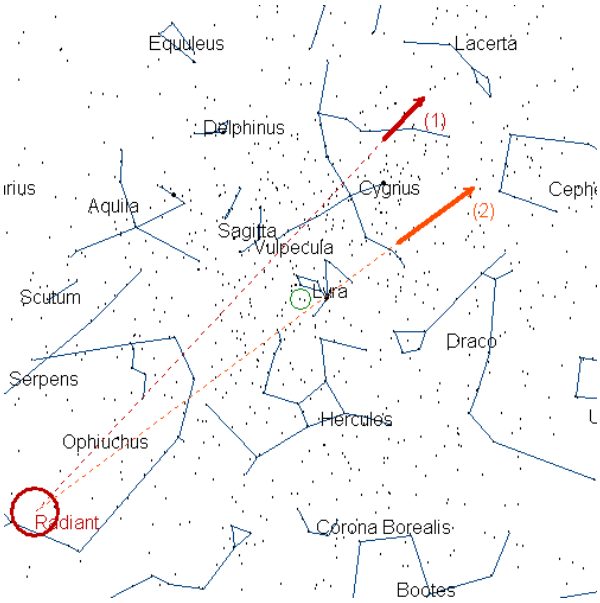

Figure 2. Apparent trajectory of the SPMN270512 fireball as recorded from (1) El Arenosillo and (2) Sevilla.

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	249.7±0.3	248.7±0.3	
Dec. (º)	-8.5±0.2	-10.4±0.2	
V_∞ (km/s)	29.1±0.3	26.9±0.3	38.7±0.3
Orbital parameters			
a (AU)	3.5±0.2	**ω (º)**	274.1±0.6
e	0.85±0.01	**Ω (º)**	65.94194 ± 10^{-4}
q (AU)	0.512±0.004	**i (º)**	10.7±0.2

Table 1. Radiant and orbital data (J2000) for the SPMN270512 fireball.

Figure 3. Projection on the ground of the atmospheric trajectory of the SPMN270512 fireball.

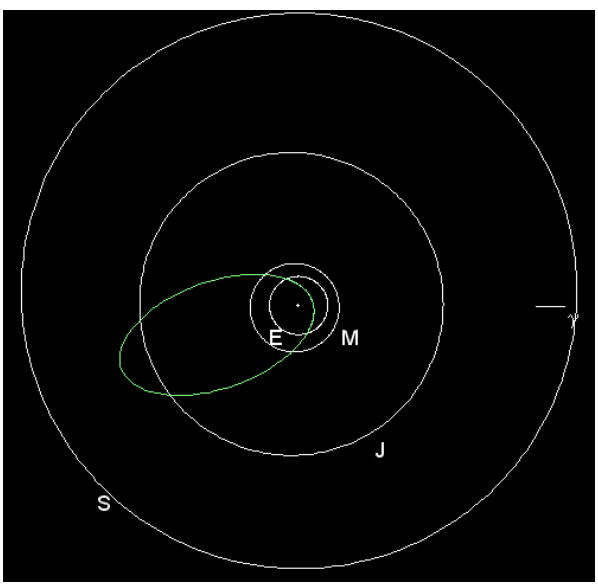

Figure 4. Projection on the ecliptic plane of the orbit of the meteoroid that produced the SPMN270512 fireball.

On the other hand, the emission spectrum obtained by one of our spectral cameras operating at El Arenosillo was reduced by using the technique described in [7, 8]. The calibrated signal, obtained by taking into account the efficiency of the instrument, is shown in Figure 5. As can be noticed, this spectrum is dominated by the emissions from Mg I-2 (516.7 nm) and Na I-1 (588.9 nm) multiplets. In the ultraviolet, the contribution from ionized calcium H and K lines is also very important. Atmospheric N_2 bands were also identified in the red region. Other prominent lines correspond to Ca I-2 (422.6 nm) and several Fe I multiplets.

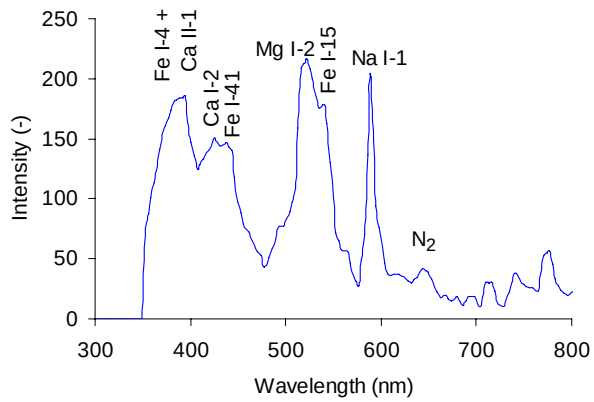

Figure 5. Calibrated emission spectrum of the SPMN270512 bolide. Most important multiplets have been highlighted.

Conclusions: A three-station North. May Ophiuchid fireball was recorded in the framework of our continuous meteor monitoring and spectroscopic campaigns. Its atmospheric trajectory was characterized. Precise radiant and orbital information was also obtained. Besides, from its emission spectrum, which exhibits a strong emission from Mg I-2 and Na I-1 multiplets, we have inferred information about the chemical nature of meteoroids in this stream.

Acknowledgements: We thank *Fundación Astro-Hita* for its support in the establishment and operation of the meteor observing station located at La Hita Astronomical Observatory (La Puebla de Almoradiel, Toledo, Spain). We also acknowledge support from the Spanish Ministry of Science and Innovation (projects AYA2009-13227 and AYA2011-26522).

References: [1] Jenniskens, P. (2006) *Meteor Showers and their Parent Comets.* Cambridge University Press. [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. Bull. Astron. Inst. Cz. 38, 222-234, 1987. [5] Bronshten V. A., 1981, *Geophysics and Astrophysics Monographs*. Reidel, Dordrecht. [6] U.S. Standard Atmosphere (1976), NOA-NASA-USAF, Washington. [7] J.M. Trigo-Rodríguez et al. (2003) *MAPS* 38, 1283-1294. [8] Trigo-Rodríguez et al. (2004) *MNRAS* 348, 802-810.