SPECTRA OF BOLIDES PRODUCED BY METEOROIDS FROM (3200) PHAETON. A. Moreno[1], J.M. Madiedo[1,2], J.M. Trigo-Rodríguez[3]. [1]Facultad de Ciencias Experimentales, Universidad de Huelva, Huelva, Spain. [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

Introduction: The Geminids is the densest annual meteoroid stream whose parent body is asteroid (3200) Phaethon, which was considered by some researchers as an extinct cometary nucleus rather than a regular asteroid [1]. On the basis of spectral and dynamical similarities, it has been recently proposed that asteroid 2 Pallas is the likely parent body of asteroid (3200) Phaeton [2, 3]. The asteroidal origin of the Geminids suggests that this stream could be a potential meteorite producer. The analysis of several Geminid fireballs observed between 2009 and 2010 from Spain supports this idea [4]. In this work we present the preliminary analysis of four emission spectra produced by meteoroids from the Geminids stream. These were obtained in the framework of the continuous spectroscopic campaign developed by the SPanish Meteor Network (SPMN).

Figure 1. Composite images of the fireballs listed in Table 1. Upper-left: 141210C; Upper-right: 141211A; Lower-left: 151211D; Lower-right: 151211E. Wavelength increases from left to right. The fireball (order zero) is seen in the left side of the images.

Instrumentation: The Geminid observations reported here were made from several video stations operated by the SPMN in the south of Spain. These employ high-sensitivity 1/2" black and white CCD video cameras (models Watec 902H and 902H Ultimate) endowed with fast aspherical optics (f0.8) [4, 5]. These cameras are configured as spectrographs by attaching holographic diffraction gratings (500 or 1000 lines/mm, depending on the device) to the objective lens.

Preliminary results: The recording date and time of the Geminid fireballs considered here is shown in Table 1. Their absolute magnitude ranges from -9 to -6. The emission spectra produced by these bolides were calibrated in wavelengths by identifying typical lines associated to meteor plasmas (Ca, Fe, Mg and Na multiplets). Then, the signals were corrected by taking into account the spectral response of the spectrograph. The results are shown in Figure 2. Most lines correspond to Fe I multiplets and the contribution of atmospheric N_2 bands is seen in the red region of the spectrum. But, as can be noticed, these plots reveal a remarkable diversity in the relative strength of some of the most remarkable emission lines. Thus, these spectra are dominated by the contribution from ionized calcium H and K lines in the ultraviolet, except for event 141210C, where multiplet Mg I-2 (516.7 nm) predominates. Also the intensity of the Na I-1 (588.9 nm) line is lower than that of Mg I-2 (516.7 nm), although both lines are nearly equal in the spectrum of 151211E bolide. These differences could be related to the diversity in the composition of the grains inside 3200 Phaeton and/or the different age of these meteoroids.

SPMN Code	Date	Time (UT) ±0.1 s	Abs. mag.
141210C	Dec. 14, 2010	22:19:49.3	-8±1
141211A	Dec. 14, 2011	03:22:05.1	-9±1
151211D	Dec. 15, 2011	01:22:38.4	-9±1
151211E	Dec. 15, 2011	02:18:56.6	-6±1

Table 1. Magnitude and apparition time of the Geminid fireballs considered here.

Conclusions: Four emission spectra produced by Geminid fireballs have been analyzed. Thus, most prominent emission lines in the spectral region ranging from near ultraviolet to near infrared were identified. These have provided information about the chemical composition of meteoroids produced by 3200 Phaeton, but have also revealed significant differences between the relative intensities of these lines.

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References: [1] Capec, D. and Borovicka, J. (2009) *Icarus*, 202, 361-370 [2] De León, J et al. (2010a) *Astronomy and Astrophysics*, 513 A26, doi:

10.1051/0004-6361/200913609 [3] De León J., et al. (2010b) *Bulletin of the America Astronomical Society*, Vol. 42, 1058.

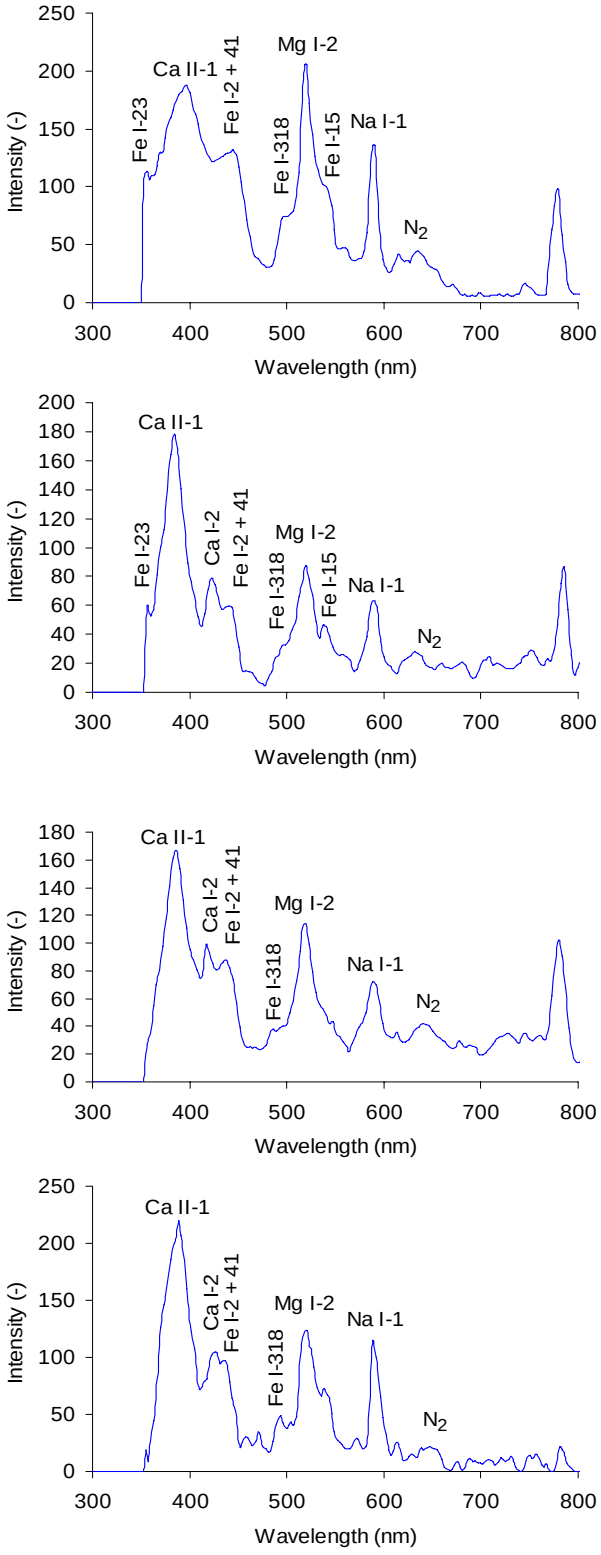

Figure 2. From top to botton, calibrated emission spectrum of the Geminid fiberalls with SPMN code 141210C, 141211A, 151211D and 151211E.