PHYSICO-CHEMICAL PROPERTIES OF METEOROIDS FROM THE ALPHA-CAPRICORNID STREAM.

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.**Introduction:** Several objects have been proposed as the parent body of the α-Capricornid meteoroid stream. Among these we can find the short period comets 141P/Machholz and 45P/Honda-Mrkos-Pajdusakova, but also asteroids such as (2101) Adonis, 2002 EX12(=169P/NEAT) and (9162) 1987 OA [1-5]. This stream produces an annual display of meteors from about July 19 to August 18, peaking around the end of July [5]. Although most of these meteors are faint, this meteoroid stream also presents a population of large (cm-sized) meteoroids that give rise to very bright bolides. Thus, for instance, the brightest event recorded in 2006 by the SPanish Meteor Network SPMN was associated with this meteor shower [6]. 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 and also obtain precise orbital information to establish which is the parent body of this stream. We present here the analysis of four α-Capricornid fireballs registered in July 2012 in the framework of our continuous fireball monitoring and spectroscopic campaigns.

Instrumentation: Four SPMN meteor observing stations (Sevilla, El Arenosillo, Sierra Nevada and La Hita) were involved in the recording of the α-Capricornid bolides analyzed in this work (Table 1). All of them were simultaneously registered from, at least, two of these locations. These automated stations employ an array of high-sensitivity Watec CCD video cameras (Watec Co., Japan) to monitor the night sky [7, 8]. Transmission diffraction gratings are attached to some of these devices to obtain the emission spectrum produced by events brighter than mag. -4/-5.

SPMN Code	Date	Time (UT) ±0.1 s	Abs. mag.
120712	July 12, 2012	00:08:56.1	-8±1
190712	July 19, 2012	22:39:22.4	-8±1
270712	July 27, 2012	23:54:00.5	-7±1
280712	July 28, 2012	22:17:12.9	-6±1

Table 1. α-Capricornid fireballs analyzed in this work.

Results and discussion: Our AMALTHEA software was used for data reduction. This employs the planes intersection method to determine the atmospheric trajectory and radiant of multi-station fireball events. The preatmospheric velocity (V_∞) is determined from the velocities measured at the beginning of the meteor trail. Trajectory and geocentric radiant data, including beginning (H_b) and terminal (H_e) heights, are summarized in Table 2. The orbital parameters (J2000) are shown in Table 3. As can be seen in Fig. 1, all these events experienced a catastrophic disruption at the end of their atmospheric path. Fireball SPMN120712, however, also exhibited a bright fulguration in the first half of its trajectory. The aerodynamic pressure under which the final disruption took place [9] can be found in Table 2.

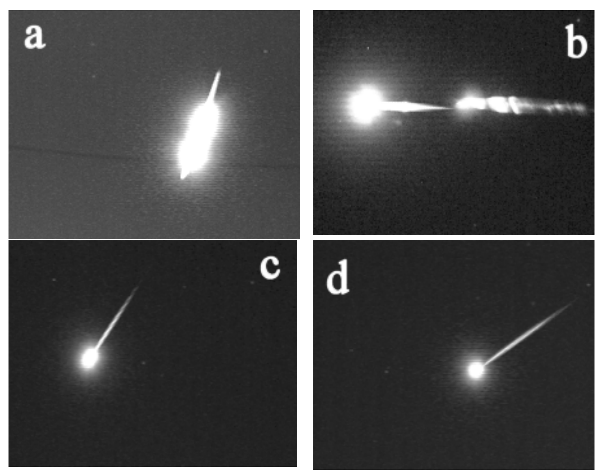

Figure 1. Composite images of the fireballs listed in Table 1: a) 120712; b) 190712; c) 270712; d) 280712.

SPMN Code	H_b (km) ±0.5	H_e (km) ±0.5	α_G (º) ±0.3	δ_G (º) ±0.2	V_∞ (km/s) ±0.3	V_G (km/s) ±0.3	P (dyn/cm^2) ±0.1
120712	90.1	49.7	284.5	-10.4	24.6	22.0	$1.7\cdot10^5$
190712	90.0	74.3	299.5	-19.4	25.3	22.5	$1.7\cdot10^4$
270712	92.8	78.3	304.7	-8.5	25.1	22.5	$1.0\cdot10^4$
280712	92.0	78.8	302.6	-16.0	24.6	21.9	$9.0\cdot10^3$

Table 2. Radiant (J2000), trajectory data and aerodynamic pressure values at final break-up for the bolides listed in Table 1.

The emission spectra were reduced with our CHIMET software by following the procedure described in [10]. The calibrated signal is plotted in Fig.

2. Several Fe I multiplets have been identified. The emissions from Mg I-2 (516.7 nm) and Na I-1 (588.9 nm) are also very significant. Besides, the contribution of atmospheric nitrogen is highlighted.

SPMN Code	a (AU)	e ±0.01	q (AU)	i (º)	ω (º)	Ω (º) ±10^{-4}
120712	3.1±0.2	0.79	0.651±0.004	8.4±0.2	259.0±0.5	109.8833
190712	2.3±0.2	0.75	0.564±0.004	0.9±0.2	271.8±0.6	117.3754
270712	2.4±0.1	0.75	0.582±0.005	8.1±0.2	269.3±0.6	125.1462
280712	3.0±0.2	0.79	0.630±0.004	2.7±0.2	261.8±0.5	126.0193

Table 3. Orbital data (J2000) for the bolides analyzed here.

Conclusions: We have recorded several fireballs during the activity period of the α-Capricornids. Four of these events have been analyzed here. This has provided information about their atmospheric trajectory and radiant. We have also obtained the orbit and tensile strength of the corresponding meteoroids, together with chemical information inferred from the emission spectra produced during the ablation of these particles in the atmosphere.

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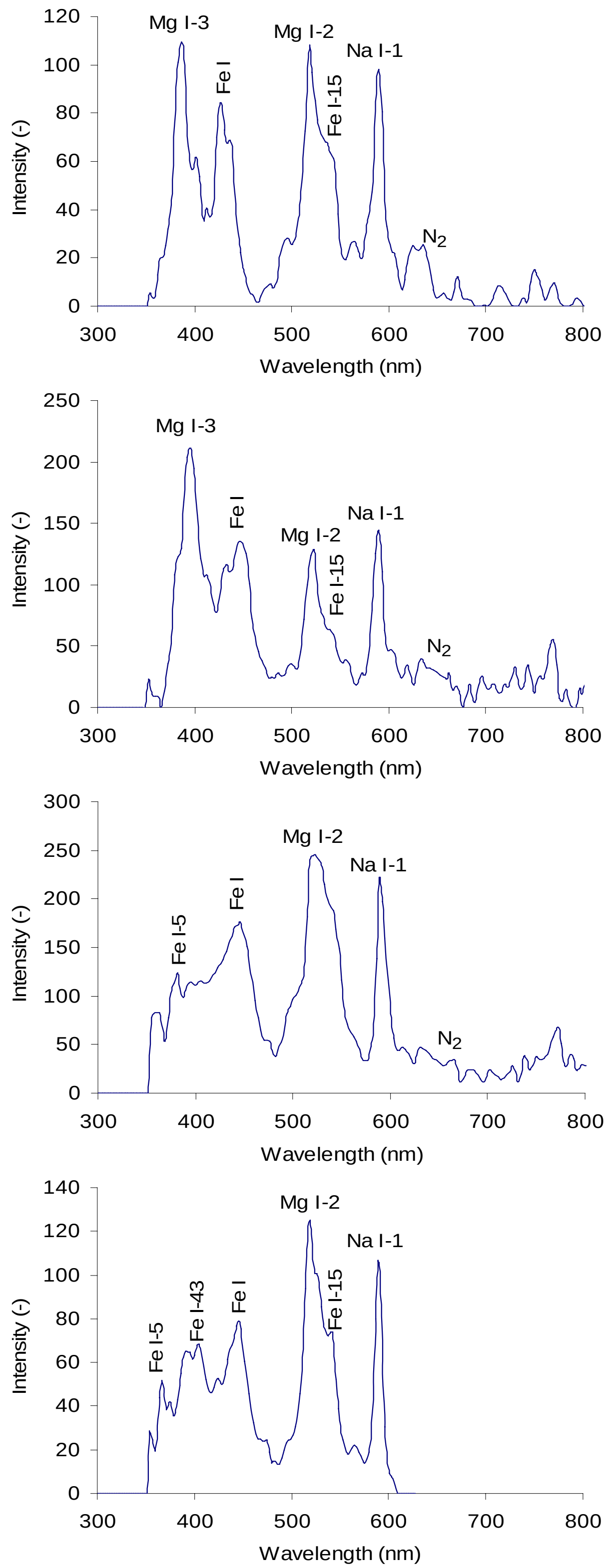

Figure 2. From top to bottom: calibrated emission spectra of fireballs with SPMN code 120712, 190712, 270712 and 280712.