Emission spectrum of a sporadic fireball afterglow

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A mag. -11 fireball was imaged over southern Spain on April 14, 2013 at 22:35:49.8 ± 0.1s UTC. Its emission spectrum was also obtained. This event was assigned the SPMN code 140413 after the recording date. By the end of its atmospheric path, it exhibited a very bright flare which resulted in a persistent train whose spectrum was recorded. Here we present a preliminary analysis of this event and focus special attention on the evolution of the main emission lines in the spectrum of the afterglow.

An array of low-lux CCD video devices (models 902H and 902H Ultimate from Watec Co.) operating from our stations at Sevilla and El Arenosillo was employed to record the SPMN140413 fireball. The operation of these systems is explained in [1,2]. Some of these are configured as spectrographs by attaching holographic diffraction gratings (1000 lines/mm) to the objective lens [3]. To calculate the atmospheric trajectory, radiant, and orbit we have employed our AMALTHEA software, which follows the planes intersection method [4]. The spectrum was analyzed with our CHIMET application [5].

The parent meteoroid impacted the atmosphere with an initial velocity of 28.9 ± 0.3 km/s and the fireball began at a height of 104.4 ± 0.5 km. The event ended at 80.7 ± 0.5 km above the ground level, with the main flare taking place at 83 ± 0.5 km. The calculated radiant and orbital parameters confirm the sporadic nature of the bolide.

The calibrated emission spectrum shows that the most important contributions correspond to the Na I-1 (588.9 nm) and Mg I-2 (517.2 nm) multiplets. In the ultraviolet, the contribution from the H and K lines from Ca was also identified. As usual in meteor spectra, most of the lines correspond to Fe I. The train spectrum was recorded during about 0.12 seconds. This provided the evolution with time of the intensity of the emission lines in this signal. The contributions from Mg I, Na I, Ca I, Fe I, Ca II, and O I were identified in the afterglow, with the Na I-1 (588.9 nm) and Mg I-2 (517.2 nm) lines being the most important ones. The brightness of these lines decreased exponentially with time. Additional analyses are currently being performed to establish the conditions in the meteor train.

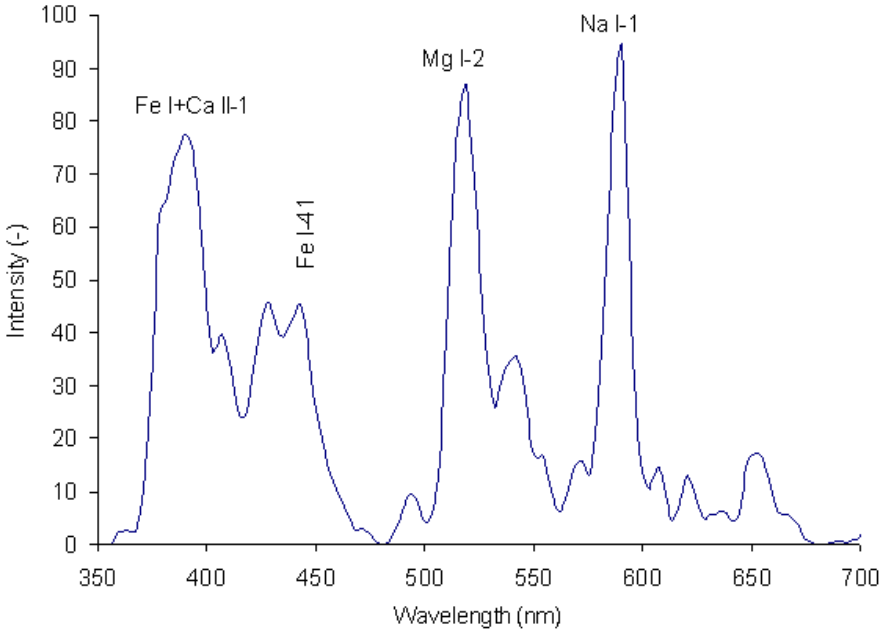

Figure: Calibrated emission spectrum of the SPMN140413 fireball.

References: [1] Madiedo J.M. and Trigo-Rodríguez J.M. (2007) EMP 102, 133–139. [2] Madiedo J.M. et al. (2010) Adv.in Astron 2010 1–5. [3] Trigo-Rodriguez, et al. (2009) MNRAS 392, 367–375. [4] Ceplecha, Z. (1987) Bull. Astron. Inst. Cz. 38, 222–234. [5] Madiedo J.M. et al. (2013) MNRAS 433, 571–580.