

The properties of cm-sized iron meteoroids

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We will present the results of our study of relatively large iron meteoroids observed by the newly developed Spectral Digital Autonomous Fireball Observatories (SDAFO). SDAFOs are run within the European Fireball Network and extend the spectral observation of this network. Iron meteoroids are easily distinguished using their spectra by the absence of lines of Na, Mg, Ca and other usually bright lines of meteoritic origin.

Recent studies of Campbell-Brown (2015), Čapek & Borovička (2017), and Čapek et al. (2019) focused on the population of small iron meteoroids. The population of iron meteoroids decreases with increasing brightness of meteors. Among 107 fireball spectra observed by SDAFOs in 2015 – 2018 and containing at least 5 spectral lines, only four were irons. On the other hand, we can study these larger bodies in more detail. The study of larger iron bodies can help us better understand the whole population of this type of meteoroids.

We will present the spectra, atmospheric trajectories, light curves, and heliocentric orbits of the iron fireballs. The maximal brightness of all fireballs was between magnitude -7 and -10. Three fireballs were classified as type IIIA and one fireball was classified as type IIIB in the classification of Ceplecha and Mc Crosky (1976), pointing out, at least formally, to fragile bodies comparable in strength to cometary meteoroids. We will show that the application of the newly developed model of ablation of small iron meteoroids (Čapek et al. 2019), based on spraying of liquid iron from the meteoroid surface, cannot be applied to these larger bodies. Their short trajectories can be explained only by fragmentation. The orbits are asteroidal and will be compared with orbits of small millimetre sized iron meteoroids observed in our previous study (Vojáček et al. 2019).