ANALYSIS OF ATMOSPHERIC FRAGMENTATION DURING THE KOŠICE METEORITE FALL AND THE INFERRED METEOROID STRENGTH. J. Borovička[1], A. Igaz[2], P. Spurný[1], and J. Tóth[3], [1]Astronomical Institute, Academy of Sciences, CZ-25165 Ondřejov, Czech Republic, e-mail: jiri.borovicka@asu.cas.cz. [2]Hungarian Astronomical Association, MCSE, Hungary. [3]Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovakia.

Introduction: The Košice meteorite fall occurred in eastern Slovakia on February 28, 2010, 22:25 UT. Because of bad weather, the bolide was imaged only by three security video cameras from Hungary. Nevertheless, the bolide trajectory, velocity and orbit could be reconstructed from these data and more than hundred meteorites, ordinary chondrites of type H5, were recovered in the predicted fall area [1, 2]. Moreover, detailed radiometric light curve was obtained by Autonomous Fireball Observatories in the Czech Republic. The light curve and velocity data were used for modeling of meteoroid atmospheric fragmentation [2]. Previous study of documented meteorite falls [3] showed that fragmentation behavior of meteoroids varies from case to case even for materials of the same type. In this contribution, we will describe the Košice bolide model and introduce a new concept of average meteoroid strength. Košice will be compared to some other meteoroids in this respect.

Model of the bolide: The model was based on the fact that meteoroid fragmentation leads to a sudden increase of bolide brightness, because total meteoroid surface area increases after the fragmentation. Bright flare is produced if large number of small fragments or dust particles is released. The whole light curve was modeled rigorously by setting up the mass distribution of fragments and/or dust particles released at each fragmentation point. The dust particles were allowed to be released either instantaneously or gradually. The ablation and radiation of individual particles were computed independently and the summary light curve was computed. The deceleration at the end of the trajectory was taken into account as well.

Results: The observed radiometric light curve and the modeled light curve are shown together in Fig. 1. The initial mass of the meteoroid was estimated to 3500 kg (diameter 1.2 m). The initial velocity was 15 km/s. The first significant fragmentation (A) occurred at a height of 55 km under the dynamic pressure of 0.1 MPa only. About 1500 kg was lost. The major fragmentation (B) occurred at the height of 39 km under 1 MPa. Only few (probably three) large compact fragments of masses 20–100 kg survived this disruption. All of them fragmented again at lower heights below 30 km, producing minor flares on the light curve. The last one (C) occurred at 22 km, where the dynamic pressure reached 5.9 MPa.

The atmospheric dynamic pressure acting at the moment of a fragmentation was defined as the strength of the fraction of meteoroid involved in that fragmentation. The mass involved in the fragmentation was defined as the mass before the fragmentation minus the mass of the largest surviving fragment. Only 3% of Košice had strength larger than 3 MPa. The average strength was 0.9 MPa.

Discussion: The severe atmospheric fragmentation of Košice meteoroid high in the atmosphere, also evidenced by the large number of recovered meteorites, is not typical for ordinary chondrites. This meter-sized asteroidal fragment was evidently highly pre-fractured from previous collisions in interplanetary space. The orbital elements with semimajor axis of (2.7 ± 0.2) AU suggest that the origin of the meteoroid was in the central main belt. The application of our new model to more bolides will provide new way of comparison of physical properties of meteoroids.

References: [1] *Meteoritical Bulletin* 100, http://www.lpi.usra.edu/meteor/metbull.php [2] Borovička J. et al. (2012) *Meteoritics & Planet. Sci.,* to be submitted. [3] Popova O. et al. (2011) *Meteoritics & Planet. Sci.* 46, 1525–1550.

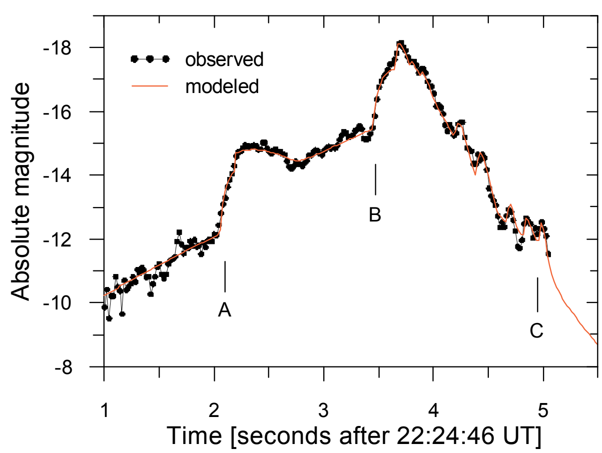

Fig. 1. Observed and modeled light curve of Košice bolide. The positions of important fragmentation discussed in the text are marked by capital letters.