

Fireball fragmentation in the first half of the atmospheric trajectory

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Photographic observation of fireballs in the Czech part of the European Fireball Network was extended by video observation by wide-field of view (fov) internet protocol (IP) cameras and narrow-fov Fireball Intelligent Positioning System (FIPS) cameras in recent years. The purpose of IP cameras is to provide direct observation of fireball fragmentation, spectrum, and velocity measurement in cases of distant fireballs or fireballs with small angular velocity. FIPS cameras follow the motion of long-duration fireballs to record fragmentation in the terminal part of the atmospheric trajectory. Almost the same appearance of fireballs has been observed in the first half of the atmospheric trajectory in few cases: a quick creation of wake, its growth, and subsequent disappearance. The fireball flight proceeds then without wake and the fireball has a spherical shape. The wake appears at height between 90 and 60 km under dynamic pressure of the order of 0.01 MPa. The creation of the wake is associated with the meteoroid fragmentation. In this work we describe heights, velocities, and sizes of meteoroids, deduced from our Digital Autonomous Fireball Observatories (DAFO), where these wakes form and disappear. We compare derived fireball parameters with fragmentation heights derived on the basis on light curve modelling. The aim of the work is to determine the type of the fragmentation and propose its possible source. The studied fireballs also fragment in the last part of the atmospheric trajectory in few cases. The dynamic pressure of this fragmentation is of the order of 1 MPa.