Scaling relations for radiation effects due to impacts of large cosmic objects

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This work is a part of a project dedicated to the development of a calculator for the consequences of the fall of large space bodies. This calculator makes it possible to get a quick estimate for all hazardous effects arising. Such effects cannot be fully investigated in the laboratory, and numerical modeling of even one fall takes a lot of time and requires high computer power. Therefore, most estimates are based on approximation dependencies obtained in one way or another.

Radiation produced due to the interaction with the atmosphere of a cosmic object and due emissions from the resulting is one of the main dangerous consequences of a crater-forming impacts. This thermal radiation can be strong enough to be dangerous to people, to ignite fires and even to melt rocks. The effects of the radiation may be estimated based on the data on nuclear explosions or based on the especially elaborated model. Recently, numerical simulations of thermal effects, which occurs from the impact of stone and ice bodies of different sizes (300 m, 1 km and 3 km) with different angles and speeds of entry into the atmosphere. Based on these calculations results scaling relations for the most important parameters of the thermal radiation are constructed. These dependences allow us to estimate the characteristics of thermal radiation, relying only on the properties of the impactor. The proposed approximation ratios are a convenient and accurate tool for quick estimates, they can be used in the internet application – calculator, intended to evaluate all the effects of space-body impacts. Our ratios are used in the developed calculator, whose test version is located at http://www.AsteroidHazard.pro.