

Enhancement of the natural Earth satellite population through meteoroid aerocapture

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ABSTRACT

The vast majority of meteoroids either fall to the ground as meteorites or ablate completely in the atmosphere. However, large meteoroids have been observed to pass through the atmosphere and reenter space in a few instances. These atmosphere-grazing meteoroids have been characterized using ground-based observation and satellite-based infrared detection. As these methods become more sensitive, smaller atmosphere-grazing meteoroids will likely be detected. In anticipation of this increased detection rate, we compute the frequency with which centimeter-sized meteoroids graze and exit Earth's atmosphere. We characterize the post-atmosphere orbital characteristics of these bodies and conduct numerical simulations of their orbital evolution under the perturbing influence of the Sun and Moon. We find that a small subset of aerocaptured meteoroids are perturbed away from immediate atmospheric reentry and become temporary natural Earth satellites.