BOSTON UNIVERSITY

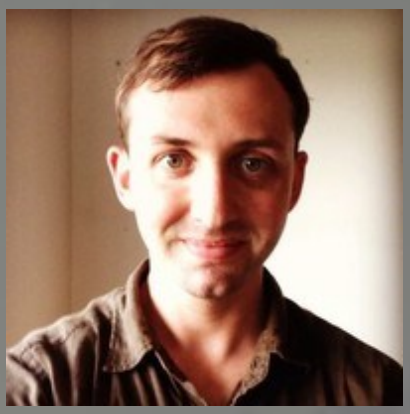
Boston University College of Arts & Sciences
Center for Space Physics

2020—2021 SPACE PHYSICS SEMINAR SERIES

Meteor Ablation: Simulating the basic physics a picosecond at a time

Meteoroids smaller than a microgram constantly bombard the Earth, depositing material in the mesosphere and lower thermosphere. Meteoroid ablation, the explosive evaporation of meteoroids due to erosive impacts of atmospheric particles, consists of sputtering and thermal ablation. Sputtering is the initial stage of ablation where hypersonic collisions between the meteoroid and atmospheric particles cause the direct ejection of atoms from the meteoroid surface. Thermal ablation is the evaporation or sublimation of material due to increasing meteoroid temperature. This talk discusses the first atomic-scale modeling of both sputtering and thermal ablation.

A molecular dynamics simulation provides the energy distribution of the ablated particles as a function of the species, velocity, and angle of the incoming atmospheric particles. The sputtering yield generally agrees with semi-empirical equations at normal incidence but disagrees with the generally accepted angular dependence. The fraction of energy from a single atmospheric particle impact incorporated into the meteoroid was found to be less than one, which is not incorporated into most meteoroid models. This results in a slower meteoroid temperature increase and mass loss rate as a function of altitude. This alteration results in changes in the expected electron line densities and visual magnitudes of meteoroids. The simulations also show that iron meteoroids undergo a phase change to liquid and the sputtering and energy transfer rates are reduced when the meteoroid is in the liquid phase.



Thursday, October 8th

4:00-5:00 p.m.

See website for Zoom information

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