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Stopping Power and Transport in Warm and Hot Dense Matter[1]

PAUL GRABOWSKI, University of California, Irvine — Stopping power is not only of direct relevance to the heating of fusion-burning plasmas and fast ignition inertial confinement fusion, but also serves as a velocity-resolved probe of the many-body response of plasma. The accuracy of a model for a set of plasma conditions and projectile energy and charge serves as a detailed test of collision operators and their predicted transport coefficients. Classical molecular dynamics studies [1] can tell us much about the relative importance of strong scattering, nonlinear screening, and inter-particle correlations of a uniform plasma. The dominant quantum correction for hot dense matter is quantum diffraction, which can be experimentally confirmed [2]. However, the presence of bound states and inhomogeneous electronic structure in warm dense matter requires more sophisticated models. These models fall into two main classes: the local density approximation [3] and bound-free splitting [3]. High-precision experiments ($\sim 3\%$) can now confirm such approximations [3], but a full survey of parameter space must be done. I will put these models in a unified framework and discuss their relationship.

[1] Grabowski et al., PRL 111, 215002 (2013).
[2] Frenje et al., submitted.
[3] Zylstra et al., PRL, 114, 215002 (2015).

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