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P5.2006 Kinetic effects in high-energy-density plasmas

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Experiments are indicative of substantial kinetic effects in high-energy-density plasmas during the course of a spherical implosion. The effects appear as the plasma mean-free-path grows relative to the background scale making standard rad-hydro single-fluid description invalid. To understand their mechanics and implications it is convenient to consider the thermal and suprathermal particles separately. For the former, sharp gradients can drive the inter-ion-species diffusion, so the fuel composition no longer remains constant unlike what the standard, single-fluid codes assume [1-4]. Atomic mix at interfaces is, fundamentally, due to the same diffusion process. For the latter, the mean-free-path is much larger than that of their thermal counterparts, so their distribution function may be far from Maxwellian, even if thermal ions are nearly equilibrated. It is these suprathermal, or tail, ions that fuse in subignited implosions. Their distribution is thus the key to proper interpretation of nuclear diagnostics employed in HEDP experiments in general and to correct fusion yield prediction in particular [5]. Furthermore, suprathermal electron distribution shows similar behavior, affecting the X-ray diagnostics [6]. Basic mechanisms behind and practical consequences of these groups of effects in ideal and non-ideal HED plasmas will be discussed.

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