CSU PHYSICS COLLOQUIUM

"Exploring Inertial Confinement Fusion with Multiscale Modeling "

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Monday October 11th at 4:00pm

120 Engineering (Hammond Auditorium)

Abstract

At the National Ignition Facility, high-powered laser beams are used to compress a small target to generate fusion reactions. To achieve this, it is crucial to understand the initial mixing of the interface between the hydrogen fuel and the plastic ablator that encapsulates the target. Mixing occurs at various length-scales, ranging from atomic inter-species diffusion to hydrodynamic instabilities. Consequently, extant models are insufficient to fully explore the various aspects of the evolution, such as the state of the interface when the main shock arrives, the role of electric field generation at the interface, and the character and time-scales for diffusion. To address this need, we present a multiscale approach to model these processes, which combines molecular dynamics to capture the ionic degrees of freedom with orbital-free density functional theory to calculate the electronic structure. By exploiting disparate time-scales and symmetries at various length-scales, simulations that are many orders of magnitude beyond current approaches can be achieved. Finally, we discuss implications of these results to the underlying assumptions made in corresponding hydrodynamic models.

Biography

Dr. Stanton received his PhD in Applied Mathematics from Northwestern University in 2009, after which, he did his postdoc at Lawrence Livermore National Laboratory (LLNL), where he focused his research on mathematical modeling in high energy-density physics (HEDP). He joined LLNL as a staff scientist in 2012, and as of 2018, is now an assistant professor of applied mathematics at San Jose State University (SJSU). At SJSU, Dr. Stanton continues his research in HEDP as well as broader areas of non-equilibrium statistical mechanics, such as the dynamics of cellular membranes and oncogenic proteins.