



Department of Physics and Astronomy
SPRING 2026 Colloquium Series

“A Window into the Interior of Stars: Multidimensional Hydrodynamic Simulations with LLNL’s Marbl Code”

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Reliable stellar models are crucial to interpreting the large amounts of stellar data produced by ongoing NASA missions like TESS, and the upcoming ESA mission PLATO. In this seminar, we describe an Arbitrary Lagrangian-Eulerian (ALE) code called Marbl, which employs a mesh that moves and is remapped as the flow evolves. The Marbl code is a next-generation high-order multi-physics code under development at LLNL. Applying ALE methods enables the study of fluid mixing in stars that are nonspherical or changing in shape, including rapid rotators, close binaries, and variable stars. Multi-material models in Marbl allow us to study the feedback of chemical burning and nucleosynthesis on thermal convection. We present new multi-material Marbl simulations of an ideal main-sequence star with a convective core. Such simulations contribute to the 321D link, the effort to improve 1D stellar structure and evolution models using 2D and 3D global hydrodynamic simulations of the stellar interior.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-ABS-2015597.

Thursday, March 5, 2026

4:00 - 5:20PM

MND1015

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