Closed Captions

Hello! My name is Sam Dunham and I thank you for taking time to watch this short video about my poster for the 237th AAS meeting: General Relativistic Hydrodynamics with Dynamical Spacetimes in thornado. The ultimate goal of this work is to answer the question, “how do massive stars explode?”. Specifically, we aim to simulate core-collapse supernovae, which are important to study for several reasons, some of which are highlighted in the poster. To that end, we are developing the toolkit for high-order neutrino radiation-hydrodynamics, or thornado. thornado uses the discontinuous Galerkin method (aka, the DG method) to solve the radiation-hydrodynamics equations in a general relativistic framework under the conformally-flat approximation. This is explained more in the poster, which focuses on the coupling between the hydrodynamics and an external finite-element gravity solver, Poseidon. What sets thornado apart from other production codes is a combination of its use of the DG method (which has many features that make it attractive for solving this problem), its approximation to GR, and its fully multi-dimensional nature. We show results from a GR generalization of the Yahil self-similar collapse problem, where we compare our results to their Newtonian counterparts. We also present results from the adiabatic collapse of a realistic 15 solar mass progenitor, all the way to bounce. This benchmarks our code's coupling to Poseidon, our implementation of curvilinear coordinates, and our implementation of a nuclear, tabulated equation of state. We also mention future work, including coupling to the radiation solver, incorporation of mesh refinement, and porting to GPUs. To learn more about any of this, please checkout presentation 551.18! I hope to see you there, and thank you for your time!