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A generalized framework for nucleosynthesis calculations TREVOR SPROUSE, MATTHEW MUMPOWER, REBECCA SURMAN, ANI APRAHAMIAN, Univ of Notre Dame — Simulating the astrophysical synthesis of elements is a difficult process requiring a detailed pairing of knowledge from both astrophysics and nuclear physics. Astrophysics guides the thermodynamic evolution of an astrophysical event. We present Portable Routines for Integrated nucleoSynthesis Modeling (PRISM), a nucleosynthesis framework written in Fortran that combines as inputs a thermodynamic evolution and nuclear data to time evolve the abundances of nuclear species. PRISM implements an algorithm we have developed that allows it to include any nuclear reaction in its calculations, including fission reactions with probabilistically distributed daughter products. Furthermore, because these calculations are often very complicated, PRISM dynamically optimizes itself based on the conditions at each time step in order to greatly minimize total computation time. This approach enables PRISM to quickly and accurately model nucleosynthesis in a broad range of astrophysical events. We highlight PRISM's effectiveness by demonstrating its use to model r-process nucleosynthesis, with nuclear fission among the reactions included in its calculations.

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