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Statistical uncertainties of Skyrme-type nuclear energy density functionals and r-process nucleosynthesis[1] TREVOR SPROUSE, University of Notre Dame, R. NAVARRO PEREZ, San Diego State University, R. SURMAN, University of Notre Dame, M.R. MUMPOWER, Los Alamos National Laboratory, G.C. MCLAUGHLIN, North Carolina State University, N. SCHUNCK, Lawrence Livermore National Laboratory — Fully understanding the impact of uncertainties in models of neutron-rich nuclei represents one of several critical steps towards understanding the formation of the heaviest elements via the rapid neutron capture (r-) process of nucleosynthesis. In this work, we consider the statistical uncertainty in the UNEDF1 nuclear energy density functional. We begin by sampling 50 points within the posterior distribution of the UNEDF1 parameter space. For each sample, we calculate nuclear binding energies, along with the nuclear capture, decay, and fission properties necessary for r-process nucleosynthesis calculations. We perform nucleosynthesis calculations for several distinct types of astrophysical conditions in which the r-process is thought to occur using each of these 50 datasets, and we report the resulting range in abundance patterns. Finally, we estimate the ability of future measurements at the Facility for Rare Isotope Beams to reduce statistical uncertainty in the UNEDF1 parameters. We repeat our analysis in order to quantify the resulting improvements to r-process nucleosynthesis simulations.

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Trevor Sprouse
University of Notre Dame

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