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Monte Carlo Simulations of Type I X-Ray Bursts* LUKE ROBERTS, Colorado College, MICHAEL SMITH, WILLIAM R. HIX, ORNL, JACOB FISKER, Notre Dame — Type I x-ray bursts (XRB) occur on the surface of a neutron star (NS) in a binary star system. Matter is accreted onto the surface of the NS and becomes extremely hot and dense. Once the envelope reaches a sufficiently high temperature, breakout from steady state CNO cycle thermonuclear burning occurs and a thermonuclear explosion powered by the αp- and rp-processes ensues. Almost all reaction rates involved in theses processes have never been experimentally measured, and theoretically determined rates used in XRB models generally have large uncertainties. To understand how these uncertainties effect final nuclear abundances and energy generation throughout the burst, a Monte Carlo (MC) approach using a post-processing nucleosynthesis code is employed. In the MC simulation, all of the reaction rates are varied simultaneously and independently for each of 48,000 element synthesis calculations. The results are tested for significant correlations between specific reactions and final nuclear abundances. Preliminary results for one zone $-$ which reaches a peak temperature and minimum density of $1.02\,GK$ and $1.166 \times 10^5\,g/cm^3$ $-$ indicate that the rates of several positron decays, proton captures, and (α,p) reactions, as well as $\alpha(2\alpha,\gamma)^{12}$C, have significant correlations with many final abundances. Uncertainty estimates for predicted final nuclear abundances will also be presented. *ORNL is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR2275

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