Abstract Submitted
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Title: Reaction Rate Sensitivity of the Production of γ-ray Emitting Isotopes in Core-Collapse Supernova[1] KIRBY HERMANSEN, National Superconducting Cyclotron Laboratory, MSU, SEAN COUCH, Michigan State University, LUKE ROBERTS, HENDRIK SCHATZ, National Superconducting Cyclotron Laboratory, MSU, MACKENZIE WARREN, North Carolina State University — Radioactive isotopes produced in core-collapse supernovae (CCSNe) provide useful insights into the underlying processes driving the collapse mechanism and the origins of elemental abundances. Here we identify the key nuclear reaction rates to the nucleosynthesis of observable radioactive isotopes in explosive silicon-burning during CCSNe. We evolve temperature-density-time profiles of the innermost 0.45 $M_\odot$ ejecta from the core collapse and explosion of a 12 $M_\odot$ star. Individually varying 3403 reaction rates by factors of 100, we identify 141 reactions which cause significant differences in the isotopes of interest, namely, ^{43}K, ^{47}Ca, ^{44,47}Sc, ^{44}Ti, ^{48,51}Cr, ^{48,49}V, ^{52,53}Mn, ^{55,59}Fe, ^{56,57}Co, and ^{56,57,59}Ni. For each of these reactions, we present a novel method to extract the temperature range pertinent to the nucleosynthesis of the relevant isotope; the resulting temperatures lie within the range $T = 0.47$ to 6.15 GK. Limiting the variations to within 1σ of standard reaction rate uncertainties further reduces the identified reactions to 48 key rates, which can be used to guide future experimental research.

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