Influence of variations in the astrophysical conditions and (α, n) reaction rate uncertainties on the nucleosynthesis in neutrino-driven supernova ejecta

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Despite the rapid progress in supernova simulations and experimental nuclear astrophysics the astrophysical and nuclear physics uncertainties are still large and critically affect the nucleosynthesis. Thus, we address both sources of uncertainty and investigate their influence on the nucleosynthesis in neutron-rich neutrino-driven supernova ejecta. Our systematic study of the astrophysical conditions relies on steady-state models due to the high computational costs of hydrodynamic simulations. We present different abundance patterns which can be synthesized in neutron-rich supernova ejecta and give an overview of the potential nucleosynthesis evolution in supernova simulations [1]. Based on the survey of the astrophysical conditions we study the impact of the nuclear physics uncertainties on the nucleosynthesis with our main focus on the (α, n) reactions. (α, n) reactions are essential to redistribute matter and to reach heavier nuclei in neutron-rich ejecta. Their uncertainties arise from the statistical model and its nuclear physics input [2]. We present the results of our Monte Carlo sensitivity study to identify individual critical reactions. The reduction of the uncertainties in these reactions will significantly decrease the influence of nuclear physics uncertainties. Since the nucleosynthesis path evolves close to stability, the critical reactions can be measured with new radioactive beam facilities like FRIB or FAIR in the near future.

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