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Impact of nuclear masses on the r-process nucleosynthesis

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The rapid neutron capture process, or r process, is responsible for the production of half of the elements between iron and uranium found in nature. During the r-process nucleosynthesis, several thousands of neutron-rich nuclei are synthesized in few seconds, powering an electromagnetic transient known as kilonova. Since most of such exotic nuclei have never been experimentally observed due to their exceedingly short half-lives, the estimation of abundances and kilonova light curves must rely upon the theoretical predictions of nuclear properties.

One of the most fundamental nuclear input in modelling the r-process nucleosynthesis are nuclear masses. These determine the energy thresholds of nuclear reactions taking place at all stages of the evolution, shaping the abundance distribution and the kilonova light curve. In this talk, I will present a sensitivity study exploring the impact of masses on the r-process nucleosynthesis. By identifying the nucleonic shell effects responsible for local changes in the binding energies, we isolate the most relevant features of nuclear mass surfaces in shaping abundance distributions and the kilonova light curves. These results provide a guidance to future experiments aimed to measure the properties of exotic nuclei in the region of the nuclear chart relevant for the r process.

session

I. Nuclear Structure and Reactions

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