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Development of statistical tools for studies of the rapid neutron capture process

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The rapid neutron capture process (r-process) is believed to be responsible for the synthesis of the heaviest elements in the Universe and to occur in extreme astrophysical events such as compact binary mergers. Despite a multitude of efforts and developments to understand the workings of the r-process both in nuclear physics and astrophysics, many challenges and unknowns remain. One of such challenges is to quantitatively gauge our understanding of the r-process, in other words, to obtain comprehensive uncertainty estimates in the theoretical reproduction of observable quantities.

Theoretical calculations of r-process observables are known to be sensitive to the choice of nuclear physics inputs, such as mass model, beta-decay rates, neutron capture rates, fission properties, and more. Quantification and incorporation of the uncertainty of nuclear physics inputs in the r-process calculations is still a topic of active investigation. In this talk, applications of several statistical techniques to handle the uncertainty of nuclear physics inputs in the r-process studies will be discussed. Recent developments and applications of nuclear data based on nuclear density functional theory will also be touched upon.

Presenter: Mr SAITO, Yukiya

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