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Theoretical descriptions of nuclear masses and β-decay half-lives in the r-process studies

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The origin of heavy elements in the universe is an important problem in basic science. The r-process is responsible for about half of the elements heavier than iron. Accurate theoretical predictions of nuclear masses and β-decay half-lives are crucial for understanding the r-process. This talk reports on recent progress in the development of various theoretical models and machine learning methods for predicting nuclear masses and β-decay half-lives. It is found that the accuracies for the description of nuclear masses and β-decay half-lives are remarkably improved. The uncertainties in the r-process abundances introduced by the nuclear mass uncertainties are found to be mainly induced by the variation of the neutron-capture rates, while the β-decay half-lives play an important role in determining the time scale of r-process.

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