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Electroweak reactions with quantum Monte Carlo methods

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Precision measurements involving nuclei are at the cutting edges of nuclear physics and testing the Standard Model (SM) of physics. For instance, precision beta decay measurments have the potential to constrain beyond SM physics at TeV scales. To interpret these experiments, it is crucial to have comparably accurate theoretical predictions of relevant quantities along with an accurate understanding of the underlying nuclear dynamics. In this contribution, I will overview recent calculations of electroweak processes with quantum Monte Carlo (QMC) computational methods used to solve the many-body Schrödinger equation. The QMC approach retains the complexity of many-nucleon dynamics and provides highly accurate results for light nuclei. I will discuss calculations of observable quantities with readily available data–such as beta decay, muon capture, and electromagnetic reactions–used to validate models of nuclear many-body interactions and electroweak currents. I will then present QMC calculations of the ^{6}He beta decay spectrum and show that the estimated theoretical uncertainties are comparable to the experimental precision, thus allowing for further constrains of new physics at TeV scales.

session

I. Nuclear Structure and Reactions

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