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Projections of discovery potentials for future neutrinoless double beta decay experiments

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The most promising strategy for demonstrating the Majorana nature of neutrinos is to observe neutrinoless double beta decay ($0\nu\beta\beta$). Measurement of the $0\nu\beta\beta$ lifetime will provide direct insight into the absolute mass scale of neutrinos and probe the neutrino mass ordering. The next generation of $0\nu\beta\beta$ experiments targets to probe the inverted mass ordering (IO) and enter the normal ordering (NO) regions. Estimation of the experimental specifications and their cost-effectiveness is becoming increasingly important as these experiments generally require tonne-scale of enriched isotopes and decade-long efforts to realize. We perform a quantitative study of the projected experimental sensitivities in terms of the discovery potentials — prior to the experiments are performed. The sensitivity of counting analysis is derived with complete Poisson statistics and compared with its continuous approximation. Additional measurable signature such as energy can boost the sensitivity and this is incorporated via a maximum likelihood analysis. The roles and effects of uncertainties in background predictions are examined. The results reinforce and quantify the vital role of background suppression in future $0\nu\beta\beta$ projects with sensitivity goals of approaching and covering NO.

Reference
M. K. Singh, H. T. Wong et al., Phys. Rev. D 101, 013006 (2020).

Submitted on behalf of a Collaboration?

No

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