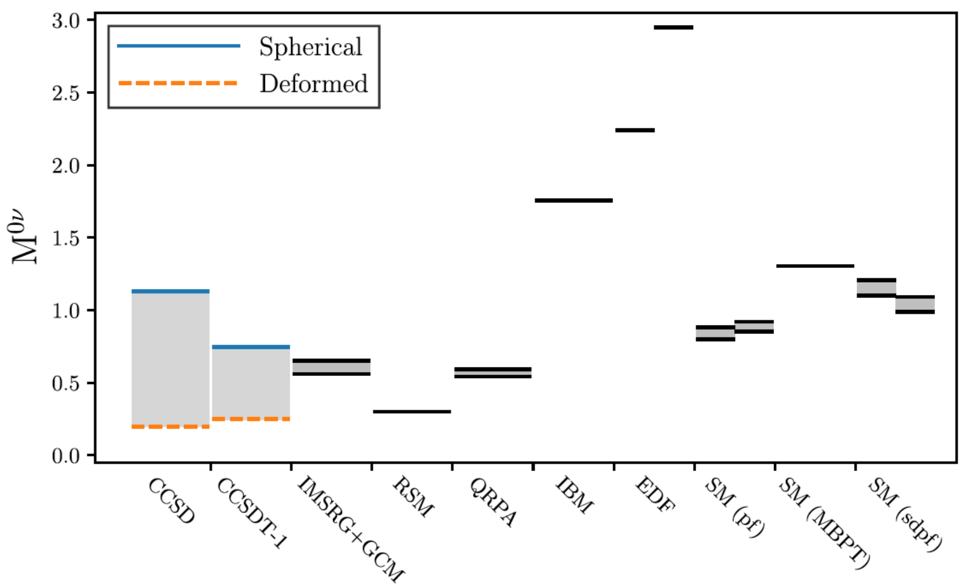
Neutrinoless double β-decay of ^{48}Ca

Objectives

- Address the long-standing question regarding the uncertainties of nuclear matrix elements for neutrinoless double beta decay
- Utilize state-of-the-art interactions from chiral effective-field-theory and computational methods to compute the matrix element for the decay ^{48}Ca → ^{48}Ti
- Explore the role of the different structures of the iunitial and final nuclei

Impact

- The nuclear matrix element links the lifetime of this decay (if observed) to the neutrino mass scale
- Observation of neutrinoless double beta decay would indicate lepton number violating processes that are beyond the standard model of particle physics
- The computation of this decay in ^{48}Ca sets the stage for computations in heavier nuclei that are detector materials



Accomplishments

- Computed the nuclear matrix element of neutrinoless double beta decay from first principles.
- Estimated the role that an unknown contact interaction plays in the decay.
- Reproduced the known matrix element for the observed double beta decay that involves two neutrinos

Caption: Nuclear matrix element for neutrinoless double beta decay computed in this work (first two results from the left) and compared to previous computations. The uncertainty bands in our results reflect the effects of deformations in the final nucleus.

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Reference: S. Novario *et al.*, Phys. Rev. Lett. (2021)
https://doi.org/10.1103/PhysRevLett.126.182502

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