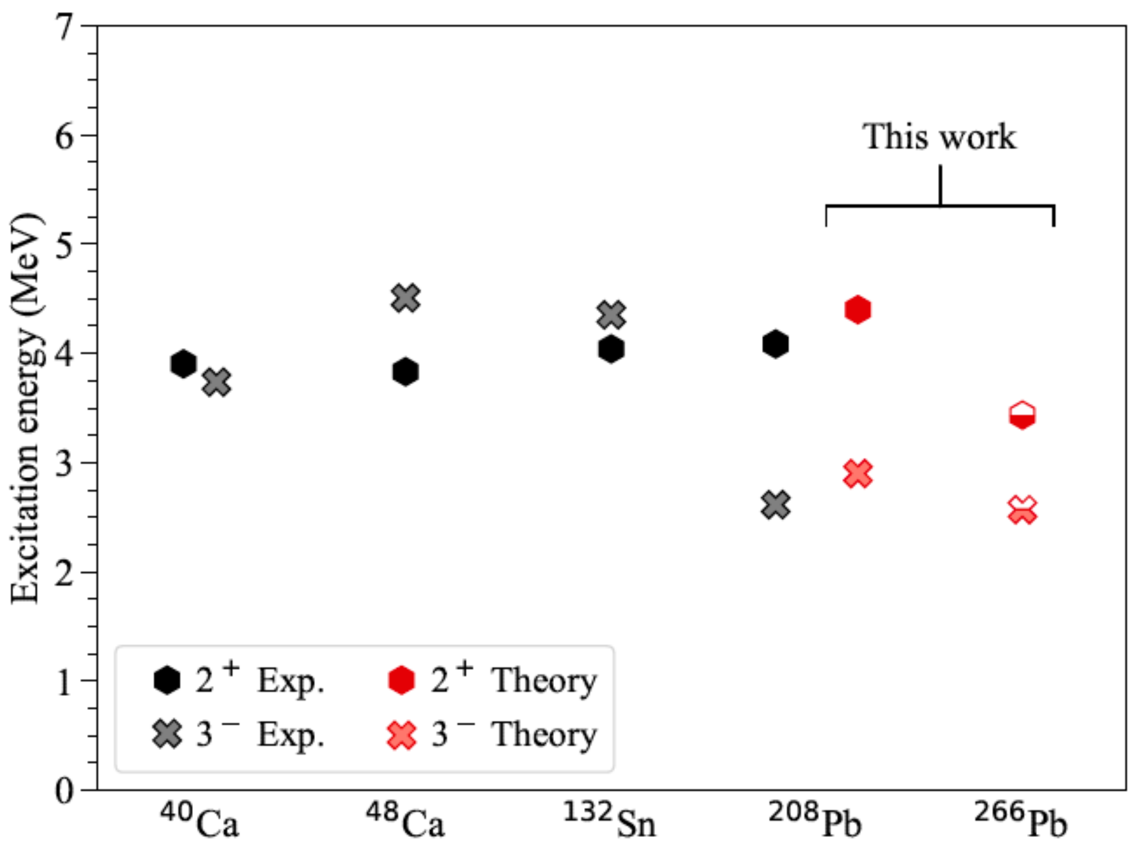
Structure of the doubly magic nucleus ^{266}Pb

U.S. DEPARTMENT OF ENERGY | Office of Science

NUCLEI — Nuclear Computational Low-Energy Initiative

Objectives

- Predict the structure of the superheavy, extremely neutron-rich nucleus ^{266}Pb (82 protons, 184 neutrons), which is supposed to be a doubly-magic nucleus, i.e. more strongly bound and compact than other nuclei with similar numbers of protons and neutrons.
- Advance *ab initio* computations to superheavy nuclei.
- Test predictive power of nuclear interactions tuned to properties of light nuclei in this superheavy region.



Excitation energies of ^{266}Pb (on the right) compared to other known doubly-magic nuclei. Red points are theoretical results, and black points are data for states with spin/parity $J^{\pi}=2^{+},3^{-}$.

Impact (as of now)

- Accurate reproduction of essential features of the well-known doubly-magic nucleus ^{208}Pb demonstrates quality of nuclear interactions.
- ^{266}Pb is predicted to be doubly magic with a significant energy gap between the ground state and excited states.
- Just adding a single neutron to ^{266}Pb yields a nucleus that is not bound and will decay via neutron emission.
- Extended reach of ab initio computations to superheavy nuclei.

Accomplishments (as of now)

- F. Bonaiti, G. Hagen, T. Papenbrock, arXiv:2508.14217; DOI: 10.48550/arXiv.2508.14217

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