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**Coupled-Cluster and Configuration-Interaction Calculations for Heavy Nuclei**[1] M. HOROI, Department of Physics, Central Michigan University, Mount Pleasant, MI 48859, J.R. GOUR, M. WLOCH, M.D. LODRIGUITO, Department of Chemistry, Michigan State University, East Lansing, MI 48824, P. PIECUCH, Department of Chemistry, and Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, B.A. BROWN, Department of Physics and Astronomy and National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, MI 48824 — We compare coupled-cluster (CC) and configuration-interaction (CI) results for $^{56}$Ni obtained in the $pf$-shell basis, focusing on practical CC approximations that can be applied to systems with dozens or hundreds of correlated fermions. The weight of the reference state and the strength of correlation effects are controlled by the gap between the $f_{7/2}$ orbit and the $f_{5/2}, p_{3/2}, p_{1/2}$ orbits. Independent of the gap, the CC method with $1p$-$1h$ and $2p$-$2h$ clusters and a non-iterative treatment of $3p$-$3h$ clusters is as accurate as the more demanding CI approach truncated at the $4p$-$4h$ level.

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