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Defeating The Sign Problem in the Auxiliary-Field Monte Carlo Method for Nuclear Structure: The Shifted-Contour Method[1] GERGANA STOITCHEVA, ERICH ORMAND, Lawrence Livermore National Laboratory —
Configuration interaction (CI) methods, which rely on diagonalizing the Hamiltonian within a basis, are often used to develop a fully microscopic description for quantum many-body systems. CI methods, however, are limited in their applicability because the basis dimension grows dramatically with particle number. Since the computational effort for the Auxiliary-field Monte Carlo (AFMC) method scales more gently with particle number, it is a natural approach for large-scale problems. But, AFMC is often crippled by the notorious sign problem, which essentially makes the Monte Carlo sampling impossible. The sign problem substantially limits the efficacy of the AFMC method, and has limited nuclear applications to only even-particle systems with simple schematic interactions or the extrapolation method. We report a novel, but straightforward, solution to the sign problem: the shifted-contour method. We show exact results for sd- and fp-shell nuclei with fully realistic interactions without reliance on extrapolations.

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William Ormand
Lawrence Livermore National Laboratory

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