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Ab initio no-core configuration interaction calculations of electromagnetic observables for p-shell nuclei using natural orbitals[1] CHRYSOVALANTIS CONSTANTINOU, MARK A. CAPRIO, University of Notre Dame, JAMES P. VARY, PIETER MARIS, Iowa State University — The goal of *ab initio* nuclear theory is to provide quantitative predictions of nuclear observables, by solving the many-body problem starting from the internucleon interaction. The solution of the many-body problem involves large spaces with dimensions that grow fast with the number of nucleons and single-particle states included in the space. Convergence of nuclear observables in the employed space using an adequate set of single-particle orbitals is essential for making quantitative predictions. Long-range nuclear observables, such as the matrix elements of the $E2$ operator, converge slowly when conventional oscillator single-particle orbitals are used for no-core configuration interaction (NCCI) calculations. Natural orbitals, obtained by diagonalizing the one-body density matrix from an initial NCCI calculation in the harmonic oscillator basis, provide accelerated convergence since they are adapted to the properties of the many-body wave function of the nucleus under study. We explore the convergence of electromagnetic observables of p-shell nuclei obtained using natural orbitals for NCCI calculations.

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