Quantitative Implication of the New Empirical Isospin Non-Conserving Hamiltonian on Superallowed Fermi 0+ -> 0+ beta-Decay

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Résumé

We develop a microscopic approach to describe the isospin-symmetry breaking effects in sd and pf shell nuclei. Within the shell model, we construct an effective isospin-nonconserving Hamiltonian with a charge-dependent part, represented by the Coulomb interaction and Yukawa-type meson exchange potentials. Recently, new experimental data of higher precision on nuclear mass excess, level schemes, and nuclear radii, etc, have been obtained for most of the sd and pf shell nuclei. The extended currently available experimental data allow us to renew a database of experimental isobaric multiplet mass equation coefficients, used further to adjust the parameters of the charge-dependent part of the Hamiltonian. Moreover, we consider recently developed approaches to treat the short-range correlations in calculation of two-body matrix elements of Coulomb force and Yukawa type potentials using harmonic oscillator wave functions. These advances in recent experimental and theoretical situation, permitted us to construct a highly accurate set of globally-parametrized INC Hamiltonians for sd and pf shell model calculations. We present their quantitative implication on calculations of nuclear structure corrections to superallowed Fermi 0+ -> 0+ beta-decay, and on the evaluation of Vud of Cabibbo-Kobayashi-Maskawa matrix.

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