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Isospin mixing in nuclear states studied via beta-delayed proton emission

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We discuss a current status of the shell-model calculations with charge-dependent Hamiltonians. In an empirical approach, such a Hamiltonian includes a two-body Coulomb interaction and effective charge-dependent forces of nuclear origin, resulting in five or six additional parameters for an sd or pf shell, respectively.The accuracy of the method is demonstrated on the description of isobaric-mass multiplet splittings. We point out the main sources of uncertainties on theoretical values of the isospin mixing in nuclear states,resulting from the shell-model diagonalisation.

Then, we apply the shell model to study a beta-delayed proton emission process, including the isospin-forbidden particle emission from the IAS in a daughter nucleus. In particular, we show that experimental data on the proton to γ-ray branching ratio for the IAS, supplemented by a simple shell-model input, can be used to extract spectroscopic factors for that isospin-forbidden proton emission. In the case of a well-justified two-level mixing approximation, it is even possible to determine the amount of the isospin mixing in the IAS with robust precision. This conjecture is illustrated by the theoretical analysis of a number of pf shell emitters. The experimentally deduced values of the spectroscopic factors and isospin mixing are
confronted to theoretical values.

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