Isospin symmetry of isobaric triplets along the $N \sim Z$ line*

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A careful measurement of the lifetime of the first $2^+_{T=1}$ state in ^{42}Sc has allowed an experimental test of isospin purity in the A=42 isobaric triplet by using the isospin formalism [1]. In the case of testing charge independence of $T = 1$ nuclear structures, the experimental test involves the comparison of $E2$ strengths of $2^+_{1\,(T=1)} \rightarrow 0^+_{1\,(T=1)}$ transitions in isobaric triplets [2]. A lifetime of 69 (18) fs has been determined for the $2^+_{1\,(T=1)}$ state in ^{42}Sc, giving an isoscalar matrix element of 6.9(9) (W.u.)$^{1/2}$ [3]. Previous measurements of the lifetimes in the mirror nuclei ^{42}Ca and ^{42}Ti provided an isoscalar matrix element of 7.1 (5) (W.u.)$^{1/2}$, which is very close to the measured value for ^{42}Sc. This agreement suggests that charge independence is conserved in the $A = 42$ isobaric triplet.

Globally, the systematics of isoscalar matrix elements, M_0, present a well-defined trend for isobaric triplets ranging from $A = 18$ to $A = 42$. Shell model calculations have been carried out using the m-scheme numerical code ANTOINE [4] in order to understand this particular trend. The $2^+_{1\,(T=1)} \rightarrow 0^+_{1\,(T=1)}$ transition energies, reduced transition probabilities and isoscalar matrix elements are reproduced to a high degree of accuracy [5]. The equality of M_0 values between mirror pairs and $T_Z = 0$ nuclides supports our shell model calculations. The predicted results reproduce the isoscalar trend from A=18 to A=42; the variation of M_0 along the *sd* shell is explained in terms of the dynamic shell structure, tying together the results from recent experiments. Discrepancies may arise at the extremes of the *sd* shell for the $A = 18$ and $A = 38$ isobaric triplets, and might be explained in terms of the occupancy of the orbits at the extremes of the shell.

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