Study of charge symmetry in ^{18}O and ^{18}Ne

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Isospin symmetry in nuclei assumes charge symmetry and charge independence of nuclear forces are evident in nuclei. Whereas charge independence implies that *nn*, *np* and *pp* interactions are the same, charge symmetry states only that the *nn* and *pp* interactions are equal. The latter approximate symmetry is experimentally verified by the comparison of excited levels lying at the same energy in light mirror nuclei, after correction for coulomb effects. Both of these symmetries are broken by the electromagnetic interaction. The neutron facility at the University of Kentucky provides a unique opportunity to examine charge independence [1], and in particular charge symmetry from reduced transition probabilities in neutron cross sections. Here, we use the isospin formalism by Bernstein, Brown and Madsen [2], which relates the proton and neutron matrix elements, M_p and M_n, respectively, for equivalent excited states in $T = 1$ mirror nuclei (T_Z=$\pm$1). In particular, an experimental test of charge symmetry involves the comparison of $E2$ transition M_p strengths to the first $2^+_{T=1}$ levels in mirror nuclei, and if the symmetry holds the relation $\mathrm{M}_p(\mathrm{T}_Z = -1)$=$\mathrm{M}_n(\mathrm{T}_Z = 1)$ must be fulfilled [3].

The nucleus ^{18}O has been studied using the (n,n′) reaction in order to measure the neutron cross sections of the 2^+_1 $T = 1$ state. The proton and neutron matrix elements, M_p and M_n, for excitation of the 2^+_1 $T = 1$ state are related to its cross sections through the experimental matrix element $\mathrm{M}_{n,n'}$. Therefore, using the previously determined proton matrix element for the $T_Z = -1$ mirror nucleus, $\mathrm{M}_p(^{18}\mathrm{Ne})$ [3], along with the measurement of the $M_p(2^+_1)$ and $\mathrm{M}_{n,n'}$ matrix elements in ^{18}O allows an experimental test for charge symmetry in the $A = 18$ mirror system.

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