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Study of Gamow Teller transitions using beta decay and charge exchange reactions

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The study of the properties of nuclei far from stability is one of the main frontiers of modern nuclear physics. Among many possible observables for nuclear structure, the β decay strengths provide important testing grounds for nuclear structure theories far from stability. The mechanism of β decay is well understood and dominated by allowed Fermi (F) and Gamow-Teller (GT) transitions. A successful description of the nuclear structure of the states involved should provide good predictions for the corresponding transition strengths B(F) and B(GT).

Gamow-Teller and Fermi transitions can be studied in two different ways,
namely in β decay mediated by the weak interaction and
in charge exchange(CE) reactions where the strong interaction is
involved.
The β decay has an advantage in that it provides absolute B(GT)
values, the GT transition strengths,
but is limited by the energy window available.
In contrast, CE reactions provide only relative B(GT) values,
but there are no restrictions on the accessible excitation energy in the final nucleus.

An alternative approach is to assume isospin symmetry and to compare
β decay and CE reactions in mirror nuclei.
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Assuming the same GT response in mirror transitions,
one can combine β and CE to produce
a complete picture of the GT strengths in both mirror nuclei.
This is possible when the proton-rich nucleus β decays and the neutron-rich nucleus provides a stable target.

In this talk I will concentrate on two β studies carried out at fragmentation facilities, the first one was carried out at GSI on $T_z = -1$ nuclei and
the second beta-decay at GANIL on the $T_z = -2$ nucleus ^{56}Zn. In both cases the results will be compared with the mirror CE reactions performed at RCNP. In the case of ^{56}Zn a very exotic decay mode at the proton drip-line, β-delayed γ-proton decay, has been observed. This result will be discussed in detail.

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