# A COMPARISON OF $^{37}$C(p,n) CROSS SECTIONS TO $^{37}$Ca $\beta$-DECAY

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The measurement of Gamow-Teller (GT) transition strength at high excitation energy has fundamental significance to nuclear physics. For example, the calibration of radiochemical neutrino detectors requires knowledge of GT strength at high excitation energy, and the sum of nuclear GT strength is sensitive to nucleon internal degrees of freedom. In general, $\beta$-decay studies of Gamow-Teller transition strength are limited by the low excitation energies accessible to $\beta$-decay. It is believed that forward angle (p,n) cross sections at bombarding energies of $\approx$ 100-300 MeV are accurately proportional to GT strength.[1] If true this would allow measurement of GT strength up to excitation energies substantially higher than can be measured in $\beta$-decay. However no detailed comparison of high resolution (p,n) cross sections to high excitation energy $\beta$-decay has ever been done. A recent $^{37}$Ca $\beta$-decay measurement,[2] which is the isospin mirror reaction to neutrino capture on $^{37}$Cl, found that the measured distribution of GT strength, as well as the integrated GT strength, disagreed strongly with results from a forward angle $^{37}$Cl(p,n) measurement,[3] casting doubt on the claim that forward angle (p,n) cross sections are strictly proportional to B(GT).

We have measured $^{37}$Cl(p,n) cross sections at scattering angles of 0°, 4°, and 9° and bombarding energies of 100 and 160 MeV. Our experiment improved upon the earlier measurement[3] in energy resolution (230 keV fwhm compared to 600 keV) and backgrounds associated with cosmic rays and neutron wrap around. Our preliminary result from 0° at 100 MeV bombarding energy finds large fluctuations in the ratio of B(GT) inferred from this (p,n) measurement and the $^{37}$Ca $\beta$-decay experiment at excitation energies below the IAS (see Fig. 1). The largest of these fluctuations could be explained if the level in $^{37}$K at 3.2 MeV predominantly $\gamma$-decays rather than proton decays, and hence this strength could not be seen in the $^{37}$Ca delayed-proton $\beta$-decay experiment. We will attempt to measure these branching ratios in a future experiment in Seattle.

We also find that this ratio monotonically diverges from unity at higher excitation energies. Preliminary estimates of corrections to these ratios from neutron detector ef-

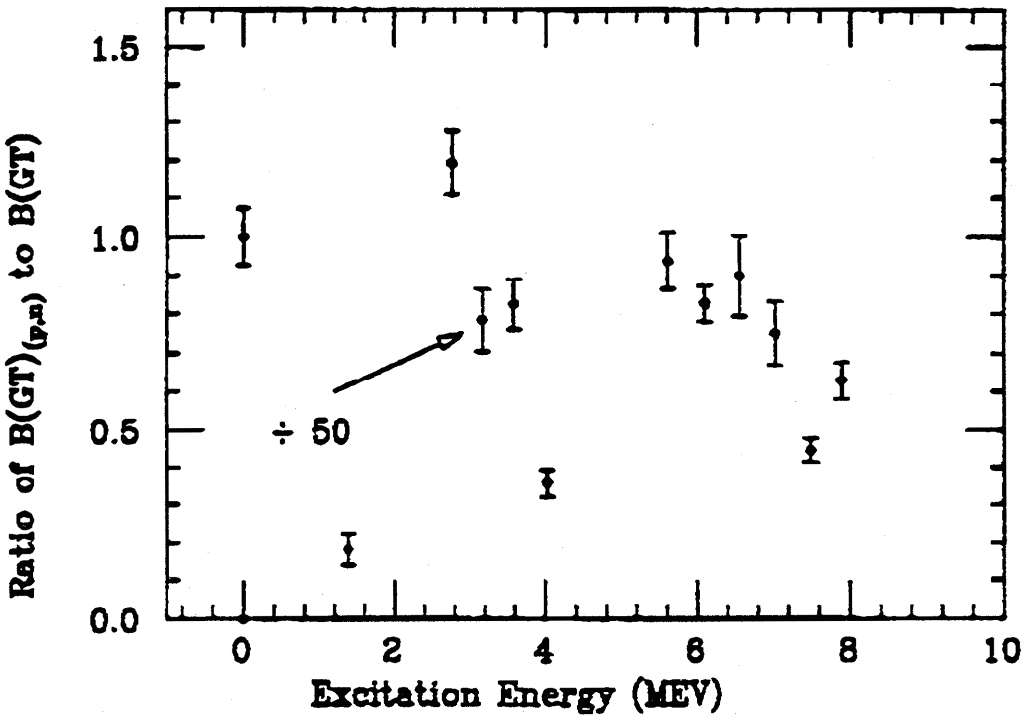


*Figure 1.* Preliminary ratio of (p,n) inferred B(GT) to $\beta$-decay B(GT). These comparisons were made by summing the (p,n) yield over the relevant energy range, assuming no background is present. No corrections to the energy dependence of the neutron detector efficiencies have been made. The point at 3.2 MeV has been divided by 50 in order to put it on this plot.

ficiencies are too small to account for this behavior at high energy. We have included estimates of the momentum-transfer corrections in these comparisons; however even at the highest energies of comparison this correction is only $\approx 7\%$. We are in the process of full Monte-Carlo calculations of the energy dependence of the neutron detector efficiencies, as well as DWIA calculations of the momentum-transfer corrections to the inferred B(GT). We are also analyzing the angular distributions to determine if some of these discrepancies arise from $\Delta L \geq 1$ contributions to the $0°$ data. In addition we have measured spin-transfer cross sections at forward angles. These cross sections should enable us to separate GT strength from Fermi strength in the region of the IAS.

We have also measured $^{23}$Na(p,n) and $^{40}$Ca(p,n) cross sections at 0°, 4° and 9° and at bombarding energies of 100 and 160 MeV, and we expect results from these measurements to be available soon.

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2. A. Garcia, E.G. Adelberger, P.V. Magnus, H.E. Swanson, O. Tengblad, and D.M. Moltz, Phys. Rev. Rev. Lett. **67**, 3654 (1991).
3. J. Rapaport *et al.*, Phys. Rev. Lett. **47**, 1518 (1981).