

# Gamov-Teller Decay of Nuclei Near $^{100}\text{Sn}$

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Neutron deficient nuclei near  $^{100}\text{Sn}$  have been produced by fragmentation of a 1 A·GeV  $^{112}\text{Sn}$  beam in a beryllium target, separated in the FRS and unambiguously identified. The ions were stopped in the center of a stack of highly segmented silicon strip detectors placed at the final focal plane. This  $4\pi$  implantation detector measured the total energy of emitted  $\beta^+$ -particles with high efficiency. For measuring  $\gamma$ -radiation the implantation detector was surrounded by a 6-fold segmented NaI detector covering  $2\pi$  and a Germanium clover detector in close geometry. We determined the half-lives and the positron energies for each implanted nuclide with a maximum likelihood method taking into account three decay generations as well as background events during a fixed correlation time after the implantation. Half-life results for  $N \approx Z < 50$  nuclei were already reported [1].

During a run of 60 hours a single  $^{100}\text{Sn}$  nucleus could be identified resulting in a production cross section of  $\sigma = 1.8$  pb. The decay data of this event together with 6 events observed [2] in 1994 (with  $^{124}\text{Xe}$  fragmentation) result in a half-life of  $T_{1/2} = 1.0_{-0.26}^{+0.54}$  s and a  $\beta$  end-point energy of  $E_{\beta_0} = 3.8_{-0.3}^{+0.7}$  MeV. Due to the low statistics a meaningful comparison between the experimental Gamov-Teller strength and theoretical values is not yet possible.

With the implantation of 2800  $^{102}\text{Sn}$  nuclei we were able to study this nuclide in decay spectroscopy for the first time. Analyzing the correlated  $\beta$ -decay events with a maximum likelihood method the  $^{102}\text{Sn}$  half-life was determined as  $T_{1/2} = 3.8 \pm 0.2$  s. With the knowledge of the half-life it is possible to calculate the probability that an observed event in a decay chain can be assigned to a decay of the mother isotope. Using only decay events with a probability  $p > 0.70$  for a  $^{102}\text{Sn}$  decay, 8  $\gamma$ -transitions could be identified that follow the  $^{102}\text{Sn} \rightarrow ^{102}\text{In}$  decay (see Fig. 1). In the case of electron-capture decay it was possible to observe a 150 keV sum line from conversion electrons of the low energy transitions in the silicon detector (Fig. 1). Considering this additional information and guided by theoretical expectations [3] it is possible to construct a decay scheme which is consistent with all experimental observations: the  $\beta$ -decay feeds two  $1^+$  states at 1598 keV and 1964 keV with an intensity ratio 70:30. From these states  $\gamma$  cascades lead down to the ( $7^+$ ) ground state.

The measured  $\beta^+$  spectrum (Fig. 1) was fitted with two components to levels 366 keV apart and with the relative feeding observed in the  $\gamma$  decay. This determined the endpoint energies to these two levels and also the ground-state decay Q-value as  $Q_{\text{EC}} = 5760 \pm 90 \pm 50$  keV. The first error is that of the endpoint energy, the second is estimated to take care of the uncertainty in the low energy level scheme of  $^{102}\text{In}$ . The summed Gamov-Teller strength of the two individual transitions observed for the  $^{102}\text{Sn}$  de-

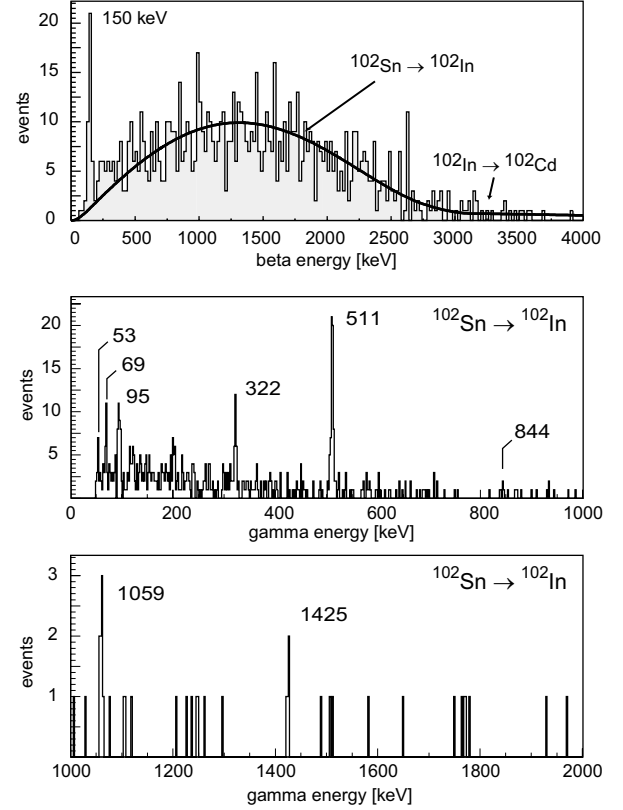


Figure 1: Measured  $\beta$  and  $\gamma$  spectra for the  $^{102}\text{Sn}$  decay. Only decay events which can be assigned to a decay of  $^{102}\text{Sn}$  with a probability  $p > 0.7$  are shown. In the  $\beta$  spectrum also a line from conversion electrons shows up.

cay is  $B_{\text{GT}} = 4.0 \pm 0.6$ . This value is among the largest observed in the nuclear chart. The reference strength value, expected for the  $\pi g_{9/2} \rightarrow \nu g_{7/2}$  decay of  $^{102}\text{Sn}$  on the basis of the extreme single-particle shell model, is  $B_{\text{GT}}^{\text{ref}} = 17.8$ , thus leading to a hindrance factor  $h = B_{\text{GT}}^{\text{ref}}/B_{\text{GT}} = 4.5$ .

Using the same experimental techniques it was possible to measure the Q-value of  $^{98}\text{Cd}$  with high precision ( $Q_{\text{EC}} = 5430 \pm 40$  keV). Together with the already known decay data [4] the summed Gamov-Teller strength for the four observed transitions results in  $B_{\text{GT}} = 2.9 \pm 0.2$ . This result is in agreement with the published value of  $B_{\text{GT}} = 3.5_{-0.7}^{+0.8}$  [4].

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## References

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