Decay Properties of ^{100}Sn and Neighbouring Nuclei

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The GT-decay of ^{100}Sn is unique in the respect that its strength is concentrated in a single 1^+ state. Since the strength of this decay mode in nuclei is not well understood, many efforts have been made to produce ^{100}Sn and to study its decay. In our experiment we could identify this isotope for the first time and observe decay data which are now completely analysed [1,2]. To produce the isotope ^{100}Sn, projectiles of ^{124}Xe were fragmented in a beryllium target. The reaction products were separated and identified in the FRS and implanted into a new type of spectroscopy detector which was designed to allow for a 4π spectroscopy of the emitted β^+, γ, and beta-delayed protons with very low background and high efficiency. In our experiment nine nuclei of ^{100}Sn could be identified unambiguously, from which we deduced a cross section of 11 pb. By a complete statistical analysis of all decays occuring within 30 seconds after the implantation of seven nuclei, the half life could be determined. Six decays could be assigned to the decay of ^{100}Sn and were used to derive the endpoint energy of the β^+-decay, the mean value of the γ-energy, and the decay branchings (Fig. 1). From these values the GT-Strength $3.0 \leq$ BGT ≤ 17.8 (Fig. 2) and the Q-Value of the decay, $Q_{EC} = 7.2^{+0.8}_{-0.5}$ could be calculated. Because of the small number of nuclei produced, the error bars are still too large to give precise information about the hindrance of the GT-decay. To get a precision of 15% for the GT-strength, about 150 decays would be necessary. We also measured the decay characteristics of four isotopes close to ^{100}Sn: the isotopes ^{102}Sn and ^{100}In and the isotopes ^{104}Sb, ^{105}Sb, which are expected to be proton emitters [3,4] (Table 1). For ^{105}Sb one proton decay event could be identified.

Isotope	half life [s]	decay energy [MeV]	branching ratio
^{100}Sn	$T_{1/2}=0.94^{+0.54}_{-0.27}$	$E_\beta=3.4^{+0.7}_{-0.3}$ $E_\gamma=2.76\pm0.43$	$\frac{\beta p}{\beta\gamma} < 20\%$
^{104}Sb	$T_{1/2}=0.44^{+0.15}_{-0.11}$		$\frac{p}{\beta\gamma} < 7\%$, $\frac{\beta p}{\beta\gamma} < 7\%$
^{105}Sb	$T_{1/2}=1.12\pm0.16$	$(E_p=0.550\pm0.030)$	$\left(\frac{p}{\beta\gamma} \approx 1\%\right)$
^{102}Sn	$T_{1/2}=4.6\pm1.4$	$E_\gamma=1.86\pm0.250$	
^{100}In	$T_{1/2}=6.3^{+1.0}_{-0.9}$		

Table 1: Results of decay measurements around ^{100}Sn.

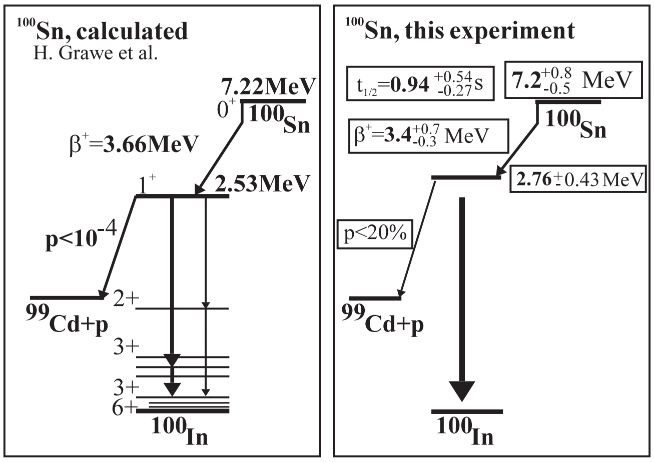

Fig. 1: Calculation of excited levels in ^{100}In which are populated by the decay of ^{100}Sn (left) in comparision with values extracted from this experiment (right).

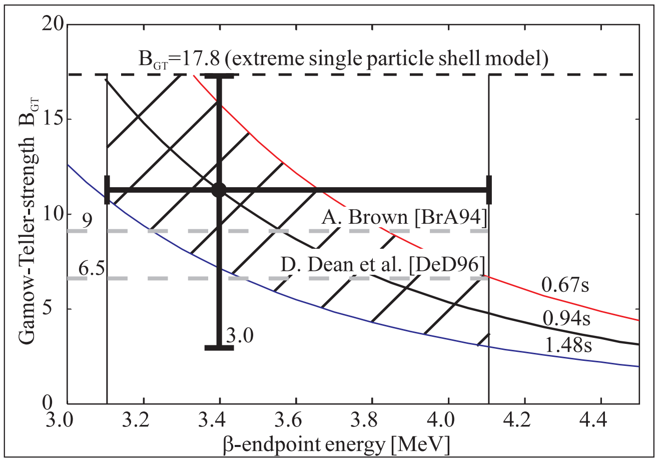

Fig. 2: GT-strength extracted from the measured endpoint energy and half life compared to calculations of Brown et al. [6] and Dean et al. [7].

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