Observation of the Gamow-Teller Resonance in Beta Decay of Neutron-deficient Nuclei near ^{100}Sn

Z. Hu[1,2], L. Batist[3], B.A. Brown[2], M. Karny[4], E. Roeckl[1], and the TAS Collaboration

[1] *Gesellschaft fuer Schwerionenforschung mbH, D-64291 Darmstadt, Germany*
[2] *National Superconducting Cyclotron Laboratory, Michigan State University, MI 48824, USA*
[3] *St. Petersburg Nuclear Physics Institute, RU-188350 Gatchina, Russia*
[4] *Institute of Experimental Physics, University of Warsaw, PL-00681 Warsaw, Poland*

Neutron-deficient isotopes near the doubly magic ^{100}Sn nucleus were studied intensively during the last years, especially in terms of the problem of missing strength in Gamow-Teller(GT) β decay [1]. At GSI, we produce those nuclei by using the mass separator on-line to the heavy-ion accelerator UNILAC. As part of an ongoing research program on β decay near ^{100}Sn, we investigated ^{97}Ag and ^{98}Ag by using, as complementary spectroscopic tools, a Total-absorption Spectrometer (TAS) [2] and an array of 6 Euroball-Cluster Ge detectors (Cluster Cube) [3]. The TAS is a highly efficient NaI detector, which allows measuring the β-intensity distribution rather than the individual γ rays. The Cluster Cube represents a compromise between high resolution and high efficiency. The evaluation of TAS data depends strongly on the knowledge of the response function of the TAS for each particular cascade. The information required to obtain the response function concerns excited levels and their de-excitation patterns, which can be determined only from high-resolution experiments. Thus, the "double strategy" of combining high- and low-resolution studies provides a tool to map the GT-strength distribution to high-excitation energies in the daughter nucleus.

Based on the analysis of the Cluster Cube data [4,5], 603 γ lines (578 new) were placed in a decay scheme of ^{97}Ag, which includes 151 excited states (132 new) of ^{97}Pd, while 438 γ lines (414 new) and 173 excited states (163 new) were identified in the case of ^{98}Ag. The "peel off" method [6] was used for evaluating the TAS data. For ^{97}Ag, good agreement was achieved between TAS and Cluster Cube data, the summed GT-strengths being 3.00(40) and 2.02(40), respectively. These results are considerably higher than the value of 0.44 obtained in a previous experiment [7] using standard size Ge detectors. For ^{98}Ag, the GT strength is 2.7(4) from the TAS. However, the Cluster Cube data for ^{98}Ag still miss a considerable amount of β intensities in the high-energy region, and thus it is not appropriate to derive a GT-strength distribution directly from it.

The extreme single-particle model expects the decay of ^{97}Ag and ^{98}Ag to be dominated by the "core decay", i.e. to mainly populate, after breaking a *g9/2* pair, the 3*qp* and 4*qp* states, leading to a resonance at ^{97}Pd and ^{98}Pd excitation energies of ~4 MeV and ~5.5 MeV, respectively. This GT resonance is clearly revealed by the experiment except for the Cluster Cube data in the case of ^{98}Ag. The shell-model calculations within a so-called restricted SNB basis [8] reproduce both the centroid and the width of the GT resonance in both cases, despite a discrepancy in the summed GT-strengths. The GT-hindrance factors with respect to the TAS results amount to 4.3(6) and 4.6(6) for ^{97}Ag and ^{98}Ag, respectively, in agreement with the values expected from further configuration mixing within SNB model space. These large hindrance factors are a direct indication for the complexity of the actual nuclear wave functions compared to what one expects from the simplest single-particle shell model.

[1] K. Rykaczewski, GSI-Report GSI-95-09 (1995).
[2] M. Karny *et al*., Nucl. Instr. And Meth. in Phys. Res. B 126, 320 (1997).
[3] Z. Hu *et al*., Nucl. Instr. And Meth. in Phys. Res. A 419, 121 (1998).
[4] Z. Hu *et al*., Phys. Rev. C 60, 024315 (1999).
[5] Z. Hu *et al*., Phys. Rev. C 62, 064315 (2000).
[6] M. Karny *et al*., Nucl. Phys. A 640, 3 (1998).
[7] K. Schmidt *et al*., Nucl. Phys. A 624, 185 (1997).
[8] B. A. Brown *et al*., Phys. Rev. C 50, 2270 (1994).