TOTAL-ABSORPTION GAMMA SPECTROSCOPY OF THE ^{94}Ag, ^{94}Pd AND ^{94}Rh BETA DECAY

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Previous β–decay studies of N ≥ 50 nuclei around ^{100}Sn, performed by using a total absorption γ–ray spectrometer (TAS), have revealed strong resonant feeding of high–lying daughter states [1]. This property is due to the ($\pi g_{9/2}^{-1}$, $\nu g_{7/2}$) excitation, with a transformed nucleon scattering across the magic gap at Z,N=50. For the nuclei with N<50, the $\pi g_{9/2} \rightarrow \nu g_{9/2}$ transformation within the same shell is unblocked and, correspondingly, the bare Gamow–Teller (GT) strength should have a double–humped energy dependence. Therefore, one expects the β decay to populate two groups of excited states, separated by an energy corresponding to the magic N=50 gap. To gain evidence for this feature, the β^+/EC decays of $^{94}Ag_{47}$, $^{94}Pd_{48}$ and $^{94}Rh_{49}$ were investigated by means of the TAS. The case of ^{94}Ag is particularly interesting since a (7^+) and a (21^+) isomer were identified [2,3] in this nucleus, which are referred to as ^{94m1}Ag and ^{94m2}Ag in the following. Prior to this work, very little was known on the β–decay of ^{94}Pd, as only the half–life of 9.0(0.5) s and a few β–delayed γ rays were measured [4], without a decay scheme being established.

Fusion evaporation reactions induced by a 4.8 MeV/u ^{40}Ca beam from the UNILAC of GSI Darmstadt on a ^{58}Ni target were used to produce ^{94}Ag and ^{94}Pd nuclei. The recoils were stopped in the graphite catcher of a FEBIAD ion source. In order to obtain good conditions for the measurement of the ^{94}Ag decay, the yield of ^{94}Pd was suppressed by a factor of about 30 by trapping it in cold pockets. The reaction products were separated by using the GSI on-line mass separator. The ^{94}Rh activity was produced as a daughter from the decay of ^{94}Pd. The TAS consists of a large NaI crystal and auxiliary detectors for selecting β^+ and EC events and identifying β–delayed protons (βp).

The experimental TAS spectra confirm the double–humped character of the β–strength distribution of ^{94m1}Ag and ^{94m2}Ag. The integrated value of the GT strength (B_{GT}) for the decays of ^{94m1}Ag, ^{94}Pd and ^{94}Rh were determined to be 4.0, 1.2 and 0.9, respectively. For the ^{94}Ag decay, the strong β–feeding of high–lying ^{94}Pd states is also confirmed by the βp data, as can be seen from Fig. 1. For the B_{GT} distribution of the ^{94}Pd decay, displayed in Fig. 2, the second maximum was found at a noticeably lower energy, the corresponding B_{GT} value being smaller than anticipated on the basis of the ^{94m1}Ag and ^{94}Rh data. Nevertheless, the value of B_{GT} is sufficiently large to indicate an admixture of $g_{7/2}$–neutron configurations.

The wide B_{GT} peak at a ^{94}Pd excitation-energy around 14 MeV (see Fig. 1) is assigned to the βp decay of ^{94m2}Ag. A pulse-shape analysis was used to select TAS spectra related to the γ branching, yielding agreement with the spin-parity value of (21^+) assigned to this isomer earlier [3].

A decay scheme of ^{94}Pd has been suggested for the first time. A new low-lying isomer in ^{94}Rh with a half–life of 0.48(5) μs and a spin-parity value of 2^+ has been established. On the basis of the new data about the β^+/EC feeding of low-lying ^{94}Ru levels, the previous spin-parity assignment of 3^+ for the ground state of ^{94}Rh has to be changed to 4^+.

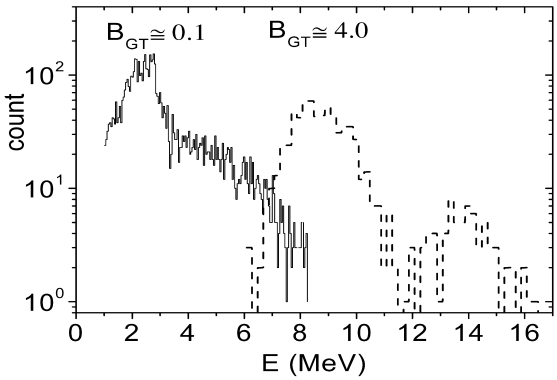

Fig. 1. Energy spectrum of β–delayed protons (dashed-line histogram) and TAS–energy spectrum (solid line) measured for the β decays of ^{94m1}Ag and ^{94m2}Ag. The former spectrum was obtained by summing the TAS and proton energies and shifting it by the ^{94}Pd proton separation energy.

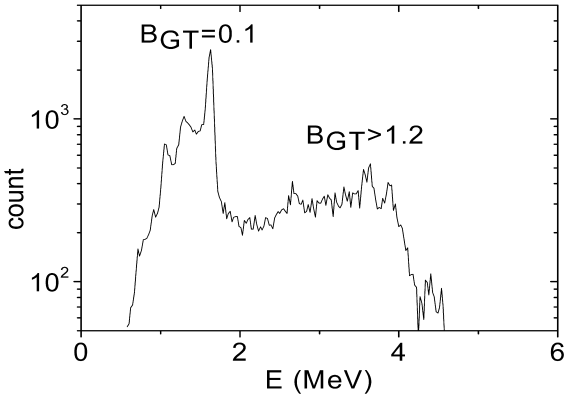

Fig. 2. TAS energy spectrum for the β^+ decay of ^{94}Pd

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