Decay Properties of N≃Z Nuclei: Progress Report from the GSI ISOL-Facility

E. Roeckl
GSI Darmstadt, Planckstr. 1, D-64291 Darmstadt, Germany
e-mail: e.roeckl@gsi.de

Proton-rich nuclei, situated at or near the N=Z line between the double shell closures ^{56}Ni and ^{100}Sn, have been produced by fusion-evaporation reactions, separated by using the Isotope Separator On-line (ISOL) of GSI Darmstadt, and investigated by means of decay spectroscopy. Particular recent highlights concern the β and γ decay of the 12^+ yrast isomer in ^{52}Fe [1], and the β-delayed γ rays or protons studied for ^{56}Cu [2, 3], ^{57}Zn [4], ^{60}Ga [5], ^{61}Ga [6], the odd-odd N=Z nuclei ^{62}Ga, ^{70}Br [7], ^{94}Ag [8], and the *rp*-process waiting-point nucleus ^{93}Pd [9]. By combining high-resolution and total-absorption γ-ray measurements, a resonance-like distribution of the Gamow-Teller strength was found for the β decays ^{96}Ag [10], ^{97}Ag [11], ^{98}Ag [12] and $^{100-107}$In [13]. Moreover, a triple α chain was observed, which starts at ^{114}Ba and ends at ^{102}Sn [14].

These experiments have yielded either the first observation of the respective decay or considerable improvements over previous work with respect to source intensity and/or purity, detection efficiency, energy resolution and/or counting statistics. Examples for the important role of the development of ISOL ion sources and detector techniques will be given. The nuclear structure aspects of the new experimental data will be discussed, including in particular the first measurement of B(E4) values in ^{52}Fe, the new information on hitherto-unobserved β-decay branches to excited states in the core nucleus ^{56}Ni (4^+,5^+) and in the single-proton nucleus ^{57}Cu ($5/2^-$,$7/2^-$,$9/2^-$), the experimental evidence for the occurrence of long-lived (high-spin) isomers in the N=Z odd-odd nuclei ^{62}Ga, ^{70}Br and ^{94}Ag, which are of interest, e .g., for future high-precision measurements of superallowed $0^+\rightarrow0^+$ transitions, the shell-model interpretation of the Gamow-Teller resonance near ^{100}Sn, and the new α-decay data beyond ^{100}Sn. This discussion will take points of astrophysical relevance into account.

[1] A. Gadea et al., in Proc. PINGST 2000 Workshop, Lund Univ. Rep., 2000, p. 118
[2] M. Ramdhane et al., Phys. Lett. B 342, 222 (1998)
[3] Unpublished results from GSI Experiment U170; R. Borcea, priv. comm.
[4] Unpublished results from GSI Experiment U170; A. Jokinen, priv. comm.
[5] Unpublished results from GSI Experiment U173; Z. Janas, C. Mazzocchi, priv. comm.
[6] M. Oinonen et al., Eur. Phys. J. A 5, 151 (1999)
[7] J. Doering al., in Proc. PINGST 2000 Workshop, Lund Univ. Rep., 2000, p. 131
[8] Unpublished results from GSI Experiment U174; M. La Commara, priv. comm.
[9] K. Schmidt et al., Eur. Phys. J. A 8, 303 (2000)
[10] Unpublished results from GSI Experiment U176; L. Batist, priv. comm.
[11] Z. Hu et al., Phys. Rev. C 60, 024315 (1999)
[12] Z. Hu et al., Phys. Rev. C 62, 064315 (2000)
[13] M. Karny et al., Nucl. Phys. A, in print.
[14] Unpublished results from GSI Experiment U180; Z. Janas, C. Mazzocchi, priv. comm.