Single-neutron states in ^{101}Sn *

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Doubly-magic nuclei are the cornerstones of the nuclear landscape. Properties of nuclei such as ^{48}Ni, ^{78}Ni, ^{100}Sn and ^{132}Sn are essential for understanding the evolution of the nuclear structure far from the line of stability. Single-particle energies are important characteristics of doubly-magic nuclei and provide stringent tests of nuclear models.

A search for γ-ray transitions in ^{101}Sn, which contains only one neutron outside the ^{100}Sn core, was carried out at the Argonne Tandem-Linac Accelerator System. ^{101}Sn nuclei were produced using the ^{46}Ti(^{58}Ni,3n)^{101}Sn reaction. Beta-delayed protons with energies and decay times consistent with previous ^{101}Sn decay studies [1] were observed at the focal plane of the Fragment Mass Analyzer. In-beam γ rays were detected in the Gammasphere Ge-detector array and were correlated with ^{101}Sn β-delayed protons using the Recoil-Decay Tagging method. The resulting γ-ray spectrum is shown in Fig. 1 (left) along with the spectrum of γ rays randomly correlated with long-lived β-particles (right). A γ-ray line at 172 keV can be seen in the ^{101}Sn spectrum, which is absent in the background spectrum. It was interpreted as the transition between the single-neutron $\nu g_{7/2}$ and $\nu d_{5/2}$ states. The measured $\nu g_{7/2}$-$\nu d_{5/2}$ energy splitting will be compared with predictions of various mean-field potentials. It will be also used to calculate multi-neutron configurations in light Sn isotopes. Prospects of using this approach to other nuclei around ^{100}Sn will be discussed..

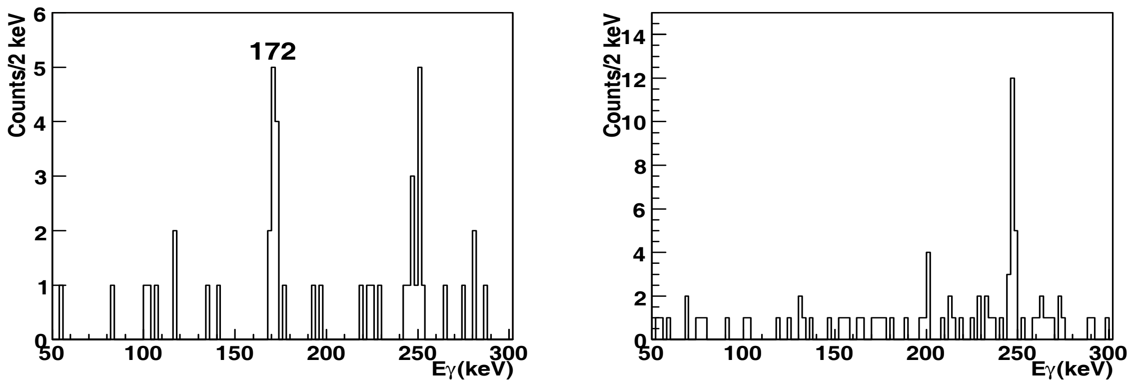

Figure 1: (left) γ rays tagged with ^{101}Sn β-delayed protons. (right) Randomly correlated γ rays.

* This work was supported by the U.S. Department of Energy, Office of Nuclear Physics under contract No. DE-AC02-06CH11357.

[1] O. Kavatsyuk *et al.*, Eur. Phys. J. **A31**, 319 (2007)