Study of Gamow-Teller transition from ^{132}Sn via the (p,n) reaction in inverse kinematics

J. Yasuda,[*1,*2] M. Sasano,[*1] R.G.T. Zegers,[*3] H. Baba,[*1] D. Bazin,[*3] W. Chao ,[*1] M. Dozono,[*1] N. Fukuda,[*1] N. Inabe,[*1] T. Isobe,[*1] G. Jhang,[*1,*4] D. Kameda,[*1] M. Kaneko, [*5] S. Kawase,[*6] K. Kisamori,[*1,*6] M. Kobayashi,[*6] N. Kobayashi, [*7] T. Kobayashi,[*1,*8] S. Koyama,[*1,*7] Y. Kondo,[*1,*9] A. Krasznahorkay,[*10] T. Kubo,[*1] Y. Kubota,[*1,*6] M. Kurata-Nishimura,[*1] C.S. Lee,[*1,*6] J.W. Lee, [*4] Y. Matsuda, [*11] E. Milman,[*1,*12] S. Michimasa,[*6] T. Motobayashi,[*1] D. Mucher, [*1,*13] T. Murakami, [*5] T. Nakamura,[*1,*9] N. Nakatsuka, [*1,*5] S. Ota,[*6] H. Otsu,[*1] V. Panin, [*1] W. Powell, [*1] S. Reichert, [*1,*13] S. Sakaguchi,[*1,*2] H. Sakai,[*1] M. Sako, [*1] H. Sato,[*1] Y. Shimizu,[*1] M. Shikata,[*1,*9] S. Shimoura,[*6] L. Stuhl,[*1] T. Sumikama,[*1,*8] H. Suzuki,[*1] S. Tangwancharoen, [*1] M. Takaki,[*6] H. Takeda,[*1] T. Tako,[*8] Y. Togano,[*1,*9] H. Tokieda,[*6] J. Tsubota,[*1,*9] T. Uesaka,[*1] T. Wakasa,[*2] K. Yako,[*6] K. Yoneda,[*1] and J. Zenihiro[*1]

We performed measurements on the ^{132}Sn(p,n) reaction at 220 MeV/nucleon in inverse kinematics at RIBF in order to extract Gamow-Teller (GT) transitions from the key doubly magic nucleus ^{132}Sn. This is an essential step toward establishing comprehensive theoretical models for nuclei situated between ^{78}Ni and ^{208}Pb.

The experiment was carried out by using the Wide-angle Inverse-kinematics Neutron Detectors for SHARAQ (WINDS)[1)] and the large acceptance SAMURAI spectrometer[2)]. A secondary beam of ^{132}Sn was transported onto a 10-mm thick liquid hydrogen target[3)], which was surrounded by WINDS to detect recoil neutrons. From the measured neutron time-of-flight and recoil angle, the excitation energy and center-of-mass scattering angle were determined. The SAMURAI spectrometer was used for tagging (p,n) reaction events with particle identification of the outgoing heavy residues. Owing to the large momentum acceptance of SAMURAI, we can measure all the heavy residues with different rigidities in one setting. It allows us to reconstruct the excitation energy spectrum up to high excitation energies including the GT giant resonance (GTGR).

Figure 1 shows scatter plots of neutron energy (E_n) versus laboratory scattering angle ($\theta_{\rm lab}$) for neutrons detected in WINDS, for events associated with the ^{132}Sn beam component. Scatter plots are shown separately for different heavy residues detected in the spectrometer. In Fig. 1(a), one can see a clear kinematical correlation between E_n and $\theta_{\rm lab}$, corresponding to transitions going to the ground state or low-lying excited states in ^{132}Sb. Clear kinematic loci are also visible in Figs. 1(b), 1(c), and 1(d) and shifted to higher excitation energies including the GTGR according to the decay threshold. It means that the γ, $1n$, $2n$, and $3n$ decay channels are successfully measured. The data analysis for obtaining GT distribution is in progress.

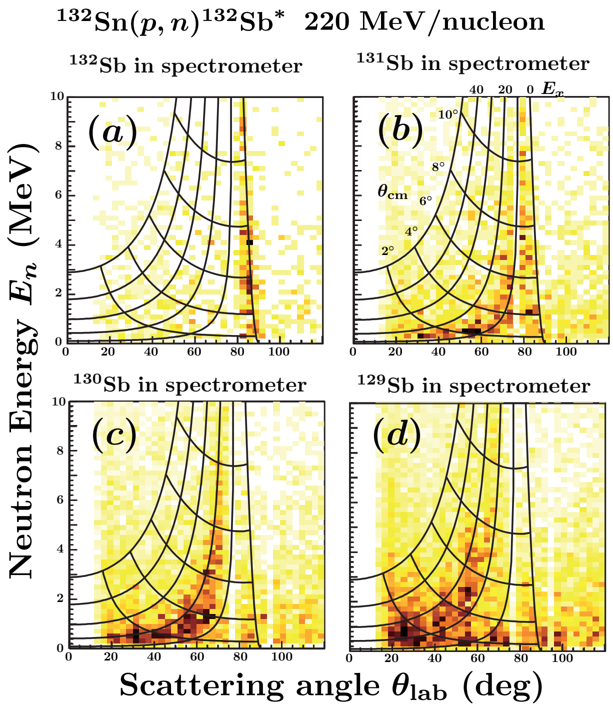

Fig. 1. Neutron spectra as a function of neutron energy (E_n) and scattering angle in the laboratory frame ($\theta_{\rm lab}$) for the ^{132}Sn beam component and for events associated with the heavy residues in the spectrometer: (a) ^{132}Sb, (b) ^{131}Sb, (c) ^{130}Sb, and (d) ^{129}Sb.

References

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*1 RIKEN Nishina Center
*2 Department of Physics, Kyushu University
*3 NSCL Michigan State University
*4 Department of Physics, Korea University
*5 Kyoto University
*6 CNS, University of Tokyo
*7 University of Tokyo
*8 Department of Physics, Tohoku University
*9 Tokyo Institute of Technology
*10 MTA, Atomki
*11 Konan University
*12 Department of Physics, Kyungpook National University
*13 Technical University Munich