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

Jumpei Yasuda, Department of Physics, Kyushu University, Fukuoka, Japan

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

1 RIKEN Nishina Center, Wako, Japan
2 National Superconducting Cyclotron Laboratory, Michigan State University, Michigan, USA
3 Department of Physics, Tohoku University, Sendai, Japan
4 Department of Physics, Tokyo Institute of Technology, Oh-Okayama, Japan
5 Center for Nuclear Study (CNS), University of Tokyo, Wako, Japan
6 Department of Physics, University of Tokyo, Hongo, Japan
7 Department of Physics, Kyushu University, Fukuoka, Japan
8 Institute for Nuclear Research, Hungarian Academy of Sciences (MTA Atomki), Deberecen, Hungary
9 Department of Physics, Kyoto University, Kyoto, Japan
10 Department of Physics, Konan University, Kobe, Japan
11 Physics Department of the Technical University Munich, Munich, Germany
12 Department of Physics, Korea University, Seoul, Korea

The Gamow-Teller (GT) transition is one of the basic excitation modes in nuclei. In medium or heavier mass region, the collectivity in this mode exhibits the GT giant resonance (GTGR), which gives information critically important for understanding the isovector part of effective nucleon-nucleon interaction[1] and the symmetry term of the equation of state[2]. Experimentally, charge-exchange (CE) reactions at intermediate energies have been used to extract the GT transition strength. Recently, the GT transitions from unstable nuclei can be studied by the development of a new experimental technique of CE (p,n) measurements in inverse kinematics.

We performed the measurement of the ^{132}Sn(p,n) reaction at 270 MeV/u in inverse kinematics at RIBF in order to extract GT transitions from the key doubly-magic nuclei ^{132}Sn. This is an essential step for establishing comprehensive theoretical models for nuclei situated in between ^{78}Ni and ^{208}Pb.

The experiment was carried out by using the Wide-angle Inverse-kinematics Neutron Detectors for SHARAQ (WINDS)[4] and the large acceptance SAMURAI spectrometer[5]. A secondary beam of ^{132}Sn was transported to a 10 mm thick liquid hydrogen target[6], which was surrounded by the WINDS to detect recoil neutrons. From the measured neutron time-of-flight and recoil angle, the excitation energy and center-of-mass scattering angle are determined. The SAMURAI spectrometer was used for tagging (p,n) reaction events with the particle identification of the beam heavy fragments. Due to the large momentum acceptance of the SAMURAI, we can measure all the heavy fragments with different rigidities in one setting. Therefore, the excitation energy up to 30MeV, where the final state is decayed by multi-nucleon emission, can be measured. The details of experimental setup and experimental results will be presented in this talk. We also discuss the GT strength distribution on ^{132}Sn.

REFERENCES

[1] S. Fracasso and G. Colo, Phys. Rev. C 72, 064310 (2005).
[2] P. Danielewicz, Nucl. Phys. A 727, 233 (2003).
[3] M. Sasano et al., Phys. Rev. C 86, 034324 (2012).
[4] K. Yako et al., RIKEN Accel. Prog. Rep 45, 137 (2012).
[5] T. Kobayashi et al., Nucl. Instr. Meth. B317, 294 (2013).
[6] M. Kurata-Nishimura et al., RIKEN Accel. Prog. Rep 45, 122 (2012).