Gamow–Teller giant resonance in ^{132}Sn

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Among collective modes,[1)] the Gamow-Teller (GT) giant resonance is an interesting excitation mode. It is a $0\hbar\omega$ excitation characterized by the quantum-number changes in orbital angular momentum ($\Delta L = 0$), spin ($\Delta S = 1$), and isospin ($\Delta T = 1$), and it is induced by the transition operator $\sigma\tau$. In stable nuclei in medium or heavier mass regions ($A > 50$), the collectivity in this mode exhibits the GT giant resonance (GTGR), which provides information that is critically important for understanding the isovector part of the effective nucleon-nucleon interaction[2)] and the symmetry potential of the equation of state.[3)] In particular, the understanding of the short-range repulsive part of the effective interaction, *i.e.*, so-called Landau-Migdal (LM) force in the spin-isospin channel, is crucial in the prediction of the onset of the pion condensation in nuclear matters such as a neutron star.[4)] Recently, we have been rapidly expanding the domain of GTGR studies at RIBF in the nuclear chart.[5,6)] This provides a new opportunity to evaluate the strength of the LM force and the so-called LM parameter g' for an unstable nucleus.

In this study, an experiment at RIBF was performed in March 2014 to extract the GT transition strengths over a wide excitation energy range covering their giant resonances on the key doubly magic nucleus ^{132}Sn. The purpose of the experiment was to calibrate the g' parameter through observating the GTGR in ^{132}Sn. This is also an essential step toward establishing the comprehensive theoretical models for the nuclei located between ^{78}Ni and ^{208}Pb. Details of the experimental setups and analysis are already given in previous progress reports and the results have been recently published in Ref. 7). Data for the GTGR were obtained almost in the same quality as the stable-beam experiments, which opens up a new age of GR studies with RI beams in the field of experimental nuclear physics. The obtained g' parameter was 0.68 ± 0.07. In comparison to the values obtained for the stable nuclei ^{90}Zr and ^{208}Pb, it indicates that g' is kept almost constant over a region of isospin asymmetry from $(N-Z)/A = 0.11$ to 0.24 and from mass number $A = 90$ to 208. It also indicates that pion condensation occurs in the inner part of a neutron star whose mass is 1.4 times heavier than the solar mass.

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