

First Charge-Exchange Measurements with SHARAQ*

K. Miki¹, H. Sakai^{1,2} and NP0811-SHARAQ72 Collaboration

¹ Department of Physics, University of Tokyo, Hongo 7-3-1, Bunkyo, Tokyo 113-0033, Japan.

² RIKEN Nishina Center, RIKEN, Hirosawa 2-1, Wako, Saitama 351-0198, Japan.

Spin-isospin responses are one of the most important fundamental collective mode in nuclei. The exothermic Heavy-Ion Charge-Exchange (HICE) reaction employing radioactive projectiles having a large positive reaction Q-value allows us to access the so far unexplored $\omega > q$ region (time-like region) in spin-isospin responses. Note that the HICE reactions with conventional stable beams can access only the $\omega < q$ region (space-like region). Here ω and q are the excitation energy and momentum transfer, respectively. In order to realize the study of spin-isospin responses in $\omega > q$, we have constructed the high resolution magnetic spectrometer SHARAQ under the ICHOR project¹ (Isospin-spin responses in CHarge-exchange exOthermic Reactions) and installed the SHARAQ in the experimental hall of the Radio-Isotope Beam Facility (RIBF) in RIKEN Nishina Center, taking an advantage of strong RI beam intensities of RIBF. The photograph of SHARAQ taken in spring of 2008 is shown below.

Among various kinds of spin-isospin responses, the isovector spin monopole resonance (IVSMR) attracts significant interest. Since the IVSMR is a breathing mode with spin and isospin flips, it can be related to the nuclear matter compressibility with spin and isospin degrees of freedom. Despite of the importance of the IVSMR, only few experiments are reported on IVSMR for the β^- channel and none for the β^+ channel. In order to establish the IVSMR(β^+), we carried out the measurement on the $(t, {}^3\text{He})$ reactions at 300 MeV/u. The triton beam of 300MeV/u was produced by the fragmentation of the ${}^4\text{He}$ beam of 320MeV/u, and was bombarded on the secondary targets with an intensity of 1×10^7 pps. Produced ${}^3\text{He}$ particles were momentum-analyzed by the SHARAQ spectrometer. This is the first physics measurement utilizing SHARAQ. The double differential cross section spectra for the ${}^{208}\text{Pb}, {}^{90}\text{Zr}(t, {}^3\text{He})$ reactions are obtained for $0 < \text{Ex} < 70$ MeV excitation energy and $0^\circ < \theta_{lab} < 3^\circ$ scattering angles. In this talk, the SHARAQ construction and the obtained signatures of the IVSMR(β^+) will be presented.

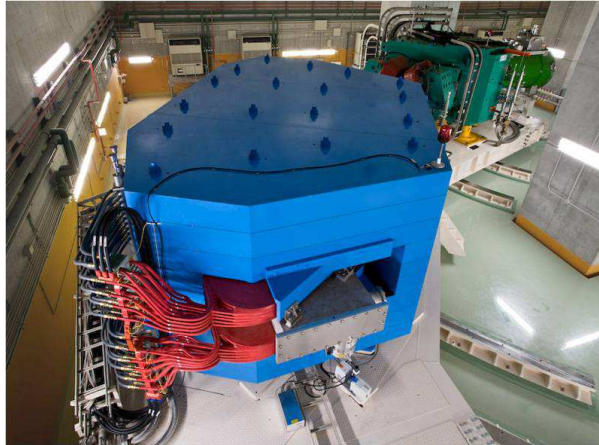


Figure 1: *The high resolution magnetic spectrometer as of spring 2008.*

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¹Spokesperson : H. Sakai.