High-resolution study of $^{37}\text{Cl}\rightarrow^{37}\text{Ar}$ Gamow-Teller transition via $^{37}\text{Cl}(^{3}\text{He},t)^{37}\text{Ar}$ reaction

Yoshihiro Shinbara

*Graduate School of Science and Technology, Niigata University*

Y. Fujita$^{1}$, T. Adachi$^{2}$, G. Berg$^{3}$, B.A. Brown$^{4}$, H. Fujimura$^{5}$, H. Fujita$^{6}$, K. Fujita$^{7}$, K. Hara$^{8}$, K.Y. Hara$^{9}$, K. Hatanaka$^{6}$, J. Kamiya$^{6}$, K. Katori$^{9}$, T. Kawabata$^{10}$, K. Nakanishi$^{11}$, G. Martinez-Pinedo$^{12}$, N. Sakamoto$^{6}$, Y. Sakemi$^{5}$, Y. Shimizu$^{11}$, T. Tameshige$^{13}$, M. Uchida$^{14}$, M. Yoshifuku$^{1}$, M. Yosoi$^{6}$, R. Zegers$^{4}$

$^{1}$*Department of Physics, Osaka University*
$^{2}$*KVI*
$^{3}$*Department of Physics, Notre Dame University*
$^{4}$*NSCL, Michigan State University*
$^{5}$*CYRIC, Tohoku University*
$^{6}$*RCNP, Osaka University*
$^{7}$*Department of Physics, Kyusyu University*
$^{8}$*JAEA*
$^{9}$*RIKEN*
$^{10}$*Department of Physics, Kyoto University*
$^{11}$*CNS, Tokyo University*
$^{12}$*GSI*
$^{13}$*HIMAC*
$^{14}$*Department of Physics, Tokyo Institute of Technology*

The Gamow-Teller (GT) transition strengths from the ground state of $^{37}$Cl to the excited states in $^{37}$Al are important because $^{37}$Cl is used as a neutrino detector through $^{37}$Cl($\nu,e$)$^{37}$Ar reaction. Up to now the neutrino cross section has been calculated based on the data from $^{37}$Ca beta-decay measurements, in which the isospin symmetry between $^{37}$Cl$\rightarrow^{37}$Ar and $^{37}$Ca$\rightarrow^{37}$K is assumed. However, the energy spectrum of the $^{37}$Cl(p,n)$^{37}$Ar experiment showed differences from the $^{37}$Ca beta-decay data.

Recently, we performed a (p,n)-type $^{37}$Cl($^{3}$He,t)$^{37}$Ar experiment at E=140MeV/nucleon, in which a high resolution of 30keV has been achieved. The GT strength distribution was obtained up to the excitation energy (Ex) of 14.2MeV. The obtained distribution was compared with that of the $^{37}$Ca beta-decay up to Ex=8.6MeV. The overall shape of the distributions were similar, but the details were not necessary the same. In order to understand those differences, the experimental data was compared with the shell model (SM) calculation using the USD interaction. The SM calculation suggests that a large L=2 component in the charge-exchange reaction can make those differences at lower energies. On the other hand, the differences seen at higher energies are due to the breaking of the mirror symmetry. Additionally, a neutrino cross section for the $^{8}$B solar neutrino source will be shown based on our data.