Contribution ID: **106** Type: **Invited Presentation**

Charge Exchange Reactions of Unstable Nuclei and the Beta-Decay Strength

Thursday, 1 June 2017 16:05 (15 minutes)

The Gamow-Teller transition (G-T) strengths are important for understanding nucleosynthesis in stars. The transition strength not only from a ground state but also from an excited state become important in some cases. Charge exchange reactions provide information of G-T strength even for transitions to excited states. However such studies had been done only at around stable nuclei. Here we show the first measurement of charge exchange (p,n) reaction on C isotopes from A=12 to 19 and demonstrate the feasibility of such experiments.

In the present experiment, production cross sections of nitrogen isotopes from high-energy (~950 MeV per nucleon) carbon isotopes on hydrogen have been measured. The fragment separator FRS at GSI was used to deliver C-isotope beams. Since the production of nitrogen is mostly due to charge-exchange (Cex) reactions below the proton separation energies, the present data reveal Gamow–Teller and/or Fermi transition strength at low excitation energies for neutron-rich carbon isotopes. The windows of a Cex reaction below the proton emission threshold and window of the beta-decay are very close with each other for neutron rich nuclei because of the small neutron separation energy.

Comparisons of transition strength obtained by two methods were made for C isotopes and consistent results were obtained for nuclei of which beta-strength are known. In light nuclei most of the transition is allowed and thus no complications due to forbidden transition is seen. The Cex cross section increases for more neutron-rich C isotopes indicating the increase of sum of the beta strength within the window.

Since the two windows are almost same for nuclei along the r-process path, studies of charge exchange reactions of r-process nuclei would provide information on the total strength of beta decay complementary with the half-life measurement in which decay strength are weighted by the decay energy of each decay channel. A simultaneous measurement of the neutrons and fragments is expected to give us more detailed information. Perspective and future experiments will be discussed in addition.

Primary author: Prof. TANIHATA, I. (School of Physics and Nuclear Energy Engineering and IRCNPC, Beihang University, Beijing 100191, China and RCNP, Osaka University, Ibaraki, Osaka 567-0047, Japan)

Co-authors: Dr ESTRADE, A. (Saint Mary's University, Halifax, NS B3H 3C3, Canada and GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr EVDOKIMOV, A. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr PROCHAZKA, A. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr SITAR, B. (Comenius University, Bratislava, Slovakia); Dr SUN, B.-H. (School of Physics and Nuclear Energy Engineering and IRCNPC, Beihang University, Beijing 100191, China); Dr NOCIFORO, C. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Prof. SCHEIDENBERGER, C. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany and Justus Liebig-Universitäte Giessen, II Physikalsches Institut,35390 Giessen , Gemany); Dr CORTINA-GIL, D. (Universidad de Santiago de Compostela, Santiago de Compostela, Spain); Dr AMEIL, F. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr FARINON, F. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Prof. GEISSEL, H. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany and Justus Liebig-Universitäte Giessen, II Physikalsches Institut,35390 Giessen , Gemany); Dr ONG, H. (RCNP, Osaka

University, Ibaraki, Osaka 567-0047, Japan); Dr WEICK, H. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr DILLMANN, I. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany and Justus Liebig-Universitäte Giessen, II Physikalsches Institut,35390 Giessen , Gemany); Dr MUKHA, I. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr ATKINSON, J. (Saint Mary's University, Halifax, NS B3H 3C3, Canada); Dr KURCEWICZ, J. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr TANAKA, J. (RCNP, Osaka University, Ibaraki, Osaka 567-0047, Japan); Dr VARGAS, J. (Universidad de Santiago de Compostela, Santiago de Compostela, Spain); Dr WINFIELD, J. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr MARTA, M. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr TAKECHI, M. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr STRMEN, P. (Comenius University, Bratislava, Slovakia); Dr JANIK, R. (Comenius University, Bratislava, Slovakia); Prof. KANUNGO, R. (Saint Mary's University, Halifax, NS B3H 3C3, Canada); Dr KNOEBEL, R. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr PIETRI, S. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany); Dr TERASHIMA, S. (School of Physics and Nuclear Energy Engineering and IRCNPC, Beihang University, Beijing 100191, China); Dr TANG, X.-D. (Institute of Modern Physics,Chinese Academy of Science, Lanzhou, 730000 China); Dr AYYAD, Y. (RCNP, Osaka University, Ibaraki, Osaka 567-0047, Japan); Dr LITVINOV, Yu. (GSI Helmholtz Center for Heavy-Ion Research, 64291 Darmstadt, Germany)

Presenter: Prof. TANIHATA, I. (School of Physics and Nuclear Energy Engineering and IRCNPC, Beihang University, Beijing 100191, China and RCNP, Osaka University, Ibaraki, Osaka 567-0047, Japan)

Session Classification: Breakout 2