

Study of spin-isospin responses via exothermic charge exchange reaction (^8He , ^8Li)

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We performed the exothermic charge-exchange (CE) reaction of (^8He , ^8Li) at the RIKEN RIBF facility by using the BigRIPS, the High-Resolution Beamline (HRBL), and the SHARAQ spectrometer.^{1,2)} Missing mass spectra in the ^4He , $^{12}\text{C}(^8\text{He}, ^8\text{Li})$ reactions were measured at the beam energy of 190 MeV/nucleon. The spin-isospin response of a spin-dipole transition with the radioactive isotope (RI) beam induced by the CE reaction was studied.

The intensity of the secondary ^8He beam, which was produced via a projectile-fragmentation reaction of an ^{18}O beam, was about 2 Mcps at the secondary target position (SHARAQ-S0). The scattered ^8Li was momentum-analyzed with the SHARAQ spectrometer. Low-pressure multiwire drift chambers³⁾ were placed at the foci of the BigRIPS and the HRBL. Cathode readout drift chambers⁴⁾ were installed at the final focal plane (SHARAQ-S2) of the SHARAQ spectrometer. The high-resolution achromatic (HRA) transport mode²⁾ was set to obtain a momentum acceptance of 2%. The detail experimental setup is described in a previous report.⁵⁾

The secondary RI beam has momentum distribution. In order to perform high-resolution missing mass spectroscopy with the RI beam, measurement of the beam momentum (δ) of incoming and outgoing particles at the target is required. At the momentum-dispersive focal planes, δ is correlated with the beam trajectory. In the HRA mode, it is important to measure the trajectory, mainly the horizontal position (x), at the BigRIPS-F6 and the SHARAQ-S2. δ couples with the beam transfer matrix elements of x and horizontal angle (a). The matrix elements should be measured to obtain the missing mass energy in the CE

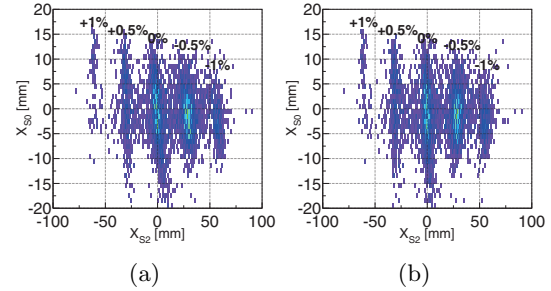


Fig. 1. Correlation of x_{S0} with x_{S2} (a) before and (b) after correction. The five loci correspond to the particles with $\delta = -1\%$, -0.5% , ..., 1% , which were tagged at the BigRIPS-F6.

reaction. The ^8Li beam was transported to the S2 for checking the matrix elements of $(x|x)$ and $(x|a)$ of the beamline and the SHARAQ spectrometer.

Figure 1(a) shows the correlations of x_{S0} with x_{S2} for the momentum correction of the ^8Li beam. The five loci correspond to the particles with $\delta = -1\%$, -0.5% , ..., 1% , which were tagged at the F6. The inclinations of the loci indicate the matrix element of $(x|x)$. The difference in the inclinations for different δ 's is due to the effect of the second-order matrix element of $(x|x\delta)$. This difference enabled us to obtain the δ at high resolution by correcting the correlation, as shown in Fig. 1(b). The matrix elements of $(x|a)$ and $(x|a\delta)$ were determined to correct the tilt of the focal plane. These higher-order matrix elements of the beamline at F6 were determined by checking the correlation with tagging the beam momentum at S2. The missing mass resolution was evaluated to be 3.2 MeV in FWHM by using the matrix elements and 4.6 MeV in FWHM before the correction. Further analysis of the missing mass and angular distribution is now in progress.

References

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