Observation of low-lying dipole states in the ^{11}Li(p,n) reaction

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The SAMURAI30 experimental program aims to systematically investigate the isovector response of light nuclei near the neutron drip line.[1)] No data are available on spin-isospin collectivity for nuclei with large isospin asymmetry factors, where $(N-Z)/A > 0.25$. Gamow-Teller (GT) and spin-dipole (SDR) transitions, including their giant resonances, were studied on ^{11}Li and ^{14}Be using charge-exchange (p,n) reactions in inverse kinematics combined with the missing-mass technique.[2)] The setup of the PANDORA low-energy neutron time-of-flight counter[3)] and SAMURAI magnetic spectrometer,[4)] as well as a thick liquid hydrogen target, enables us to perform measurements with high luminosity. In our previous experiments at RIKEN RIBF on ^{132}Sn, we successfully demonstrated[5)] that we can obtain data on unstable nuclei in the giant-resonance region with similar statistics as data obtained on stable nuclei.

Preliminary results on GT giant resonance are already detailed in a previous report.[6)] More than fifteen different decay channels were identified for the ^{11}Be reaction product. A strong GT transition at 19 MeV, in agreement with previous beta-decay studies, was observed. We showed experimental evidence for the GT peak shifting below the Isobar Analog State (IAS).

In ^{11}Be,^{10}Be, and ^{9}Be related decay channels, low-lying states were also identified in the excitation energy range below 10 MeV. The angular-momentum distributions of these states show a peak at backward angles, which is characteristic of dipole transitions. Similar low-lying SD states were predicted in previous theoretical calculations on ^{11}Li by Suzuki[7)] in connection to the neutron-halo structure.

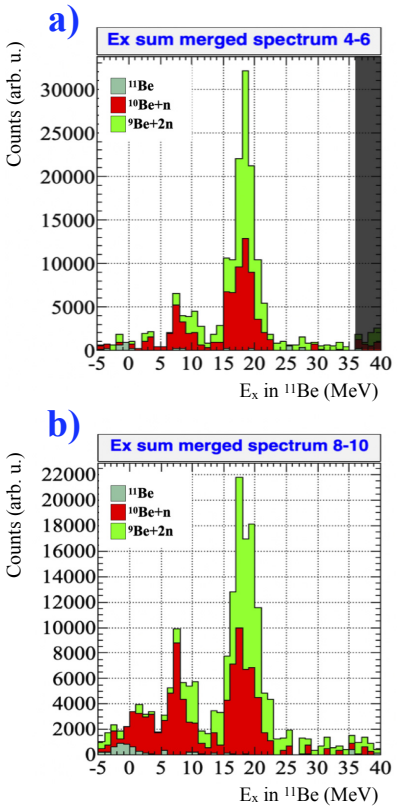

Fig. 1. Low-liying dipole states in excitation energy spectrum in the 4°–6° (a) and 8°–10° (b) center-of-mass angular bins for beryllium-related decay channels.

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