

The isovector spin monopole resonance in ^{90}Nb excited via the $^{90}\text{Zr}(^3\text{He}, t)$ reaction

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The isovector giant monopole resonance (IVGMR, $\Delta T = 1$, $\Delta L = 0$, $\Delta S = 1$) and its spin-flip partner, the isovector spin monopole resonance (IVSMR, $\Delta T = 1$, $\Delta L = 0$, $\Delta S = 1$), are collective motions at high excitation energies, which are described microscopically by coherent $2\hbar\omega$ $1p - 1h$ transitions [1]. The determination of its width and energy-location provides a crucial information for testing microscopic models. The IVGMR mediates isospin mixing and isospin-symmetry breaking in nuclei [2, 3].

It has been difficult to measure the IVGMR or IVSMR experimentally because the strength of these resonances are widely spread and the peaks are overlapped on non-resonant spectra. A few experiments insisted the existence of the IVGMR [4] in $\Delta T_z = +1$ charge-exchange reactions. Additionally by using $^{208}\text{Pb}(^3\text{He}, t)$ reaction with coincidence to sequential decay protons it could have been succeeded to deduce the IVSMR in $\Delta T_z = -1$ charge-exchange at the Research Center for Nuclear Physics (RCNP) in 2001 [5].

In order to confirm the systematics and the existence of IVSMR in other nuclei, we measured IVSMR in ^{90}Nb . The remarkable point of our experiment was the coincidence measurement with ejective triton and decay proton from the resonant state, which enabled us to reduce the non-resonant spectrum at high energy region and to stand out the shape of the giant resonances. The energy of decay protons from IVSMR become enough too high to punch through the detectors, we had to prepare $\Delta E - E$ sets of which both the ΔE and E detectors were 5 mm thick. To determine the vertical component of the scattering angle at 0° , the “over-focus” mode was employed [6]. Angle calibration were performed at 3 magnetic field setting using a sieve slit.

The angular distribution of isobaric analog state (IAS) had good agreement with the distorted-wave Born approximation (DWBA) calculation by using DW81 [7]. It could be an appropriate touchstone to calculate the distribution of IVSMR.

Although the spectra contain no small amount of backgrounds and coincidence analysis requires careful calibration, it could be verified that a forward-peak component exists around 30 - 50 MeV. Now more precise analyses are still going and the structure of IVSMR would be distinguished before long.

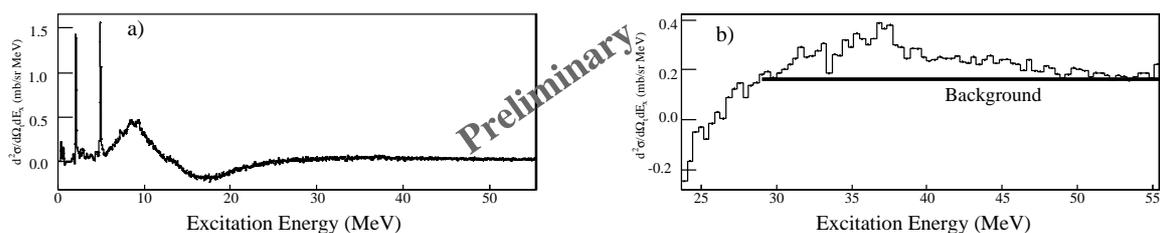


Figure 1: a) The difference spectrum between forward to backward angle measurement. b) The expanded spectrum around the IVSMR.

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