The super-allowed Fermi type charge exchange reaction for studies of isovector non-spin-flip monopole resonance

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Equation of state (EOS) of nuclear matter is of fundamental importance. Especially EOS of neutron-rich nuclei attracts a focus of experimental and theoretical studies. The isoscalar component is studied by the isoscalar incompressibility through the isoscalar monopole resonances. To expand our knowledge to asymmetric nuclear matter, additional quantities are needed. Isovector monopole resonances which are oscillation modes of the isovector density $\rho_{IV} = \rho_n - \rho_p$ are expected to be a key to approach us to the new quantities[1].

In spite of its importance, however, experimental data on isovector giant monopole resonances (IVMR) are scarce so far. This is mainly because the lack of selective probes which can excite the modes sufficiently. The RI beam induced super-allowed Fermi type charge exchange (^{10}C,^{10}B(IAS)) reaction can be a new probe to IVMR. This reaction has an advantage of selectivity to the isovector non-spin-flip transition ($\Delta T = 1, \Delta S = 0$) while contributions from isovector spin-flip transitions ($\Delta T = 1, \Delta S = 1$) can not be ruled out in other HICE reactions used so far.

Our idea to establish a probe to isovector non-spin-flip states is based on use of a super-allowed Fermi transition between isobaric analog states for the projectile. This necessarily leads to a RI beam induced charge exchange reaction since light stable nuclei with $J^\pi = 0^+$ have no analog states because of isospin $T = 0$. The analog state of the ^{10}C ground state is found at $E_x = 1.740$ MeV in ^{10}B as shown in Fig. 1. To identify the $0^+ \rightarrow 0^+$ transition in the projectile assures the non-spin-flip excitation in the target. The transition from the ^{10}C ground state to the 1.740MeV-state in ^{10}B can be experimentally discriminated by observing the emitted γ-ray of 1.022 MeV.

The experiment to study IVMR will be performed soon using the SHARAQ spectrometer at RIBF. The new idea of the experiment using this reaction will be presented.

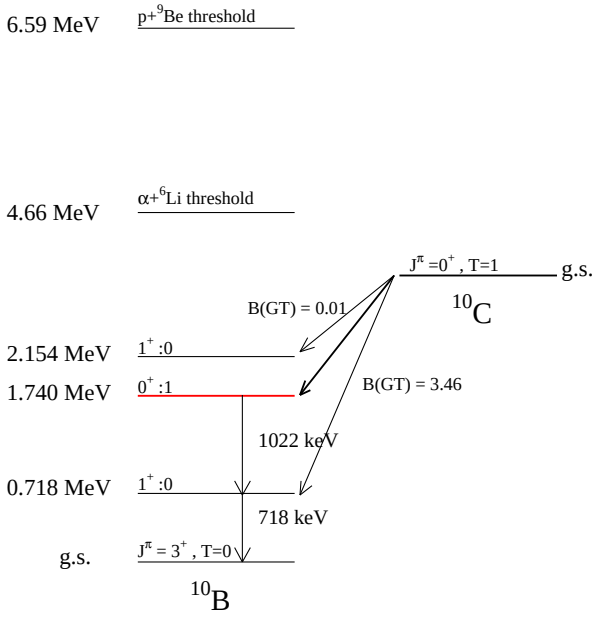

Figure 1: Energy diagram for ^{10}B.

[1] G. Colo et. al., Phys. Rev. C **67**, (2003) 044306.