Many-body resonances in light unstable nuclei using the complex scaling method

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Complex scaling method (CSM)[1, 2] is one of the approaches to study the resonances in many-body quantum system and often used in nuclear physics and hadron physics. For nuclear physics, in proton-rich and neutron-rich nuclei, most of the states are observed as unbound states owing to the weak binding nature of valence protons/neutrons surrounding the stable core nucleus. CSM becomes a powerful tool to investigate the properties of unbound states in those nuclei.

The resonance spectroscopy in unstable nuclei has been developed using radioactive-beam experiments [3]. In addition to the energies and decay widths of resonances, information on their configurations and spatial properties is important to understand the structures of unstable nuclei. We employ CSM for the description of the many-body resonances decaying into the system of three-body and more, which are often seen in light unstable nuclei [4]. In this contribution, we present our recent results with CSM.

1. Many-body resonances in neutron-rich He isotopes and their mirror proton-rich nuclei. We treat up to five-body resonances in those nuclei. We discuss the mirror symmetry breaking in the resonances between neutron-rich and proton-rich nuclei [5].

2. We present the complex-scaled Green's function to obtain the cross sections in the reaction using unstable nuclei. Green's function is essential to evaluate the cross sections not only of resonances, but also of non-resonant continuum part individually. We show the applications to the three-body breakup reactions of neutron-rich nuclei.

References

[1] J. Aguilar, J. M. Combes, Commun. Math. Phys. **22** (1971) 269.

[2] E. Balslev, J. M. Combes, Commun. Math. Phys. **22** (1971) 280.

[3] I. Tanihata, H. Savajols, R. Kanungo, Prog. Part. Nucl. Phys. **68** (2013) 215.

[4] T. Myo, Y. Kikuchi, H.Masui, K. Katō, Prog. Part. Nucl. Phys. **79** (2014) 1.

[5] T. Myo, K. Katō, Prog. Theor. Exp. Phys. (2014) 083D01.