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Study of Exotic Nuclear Structures via Total Reaction Cross Sections[1]

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Nuclear radius is one of the most basic physical quantities to study unknown exotic nuclei. A number of radii for unstable nuclei were studied through measurements of interaction cross sections ($\sigma_{\rm I}$) at high energies, using the Glauber-type calculation (Optical-Limit approximation (OLA) of Glauber theory) to investigate halo and skin structures of exotic nuclei. On the other hand, it was indicated that reaction cross sections ($\sigma_{\rm R}$) at intermediate energies (from several tens to hundreds of MeV/nucleon) were more sensitive to dilute nucleon density distribution owing to large nucleon-nucleon total cross sections ($\sigma_{\rm NN}$) compared to high-energy region. Recently, we developed a new method to deduce nucleon density distributions from the energy dependences of $\sigma_{\rm R}$, through the precise measurements of $\sigma_{\rm R}$ for various nuclei and some modifications of Glauber-type calculation. Using this method, we studied nucleon density distributions of light nuclei by measuring $\sigma_{\rm R}$ for those nuclei at HIMAC (Heavy ion Medical Accelerator in CHIBA), NIRS (National Institute of Radiological Sciences). And very recently, we deduced nuclear radii of neutron-rich Ne isotopes ($^{28-32}$Ne) which are in the island-of-inversion region by measuring $\sigma_{\rm I}$ using BigRIPS at RIBF (RI Beam Factory) to study nuclear structures of those isotopes using our method. In this workshop, results of nucleon density distributions obtained at HIMAC and results of the studies of Ne isotopes at RIBF will be introduced and discussed.

[1]Research Projects with Heavy ions at NIRS-HIMAC, and RIKEN Nishina Center