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Interaction Cross Sections and Neutron Skin Thickness of Ni Isotopes

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Since nuclear matter is composed of two Fermi particles, protons and neutrons, the equation of state of nuclear matter has a term that depends on the density difference between the two, which is called the symmetry energy. From previous studies, it is known that the first-order density dependence of the symmetry energy is closely related to the thickness of the neutron skin [1].
In this study, interaction cross sections σ_{I} and charge changing cross sections σ_{CC} for $^{58-77}$Ni on a carbon target at 260 MeV/nucleon have been measured to derive matter radii and charge radii respectively. Recently, the charge radii of Ni isotopes up to mass number 70 were measured by isotope shift method [2]. In order to derive the neutron skin thickness in the more neutron-rich region, we attempted to derive the charge radii from charge changing cross section measurements. The experiment was performed at the Radioactive Isotope Beam Factory(RIBF) at RIKEN by using the BigRIPS fragment separator.
In this presentation, we'll report the matter radii and charge radii derived from the experimental cross sections using Glauber calculations. Also, in the region where the charge radii are known, from A = 58 to 70, we' ll discuss the neutron skin thickness of Ni isotopes, which is obtained by the present data combined with known charge radii. On the other hand, in the neutron-rich region with A $\geq$ 71, we'll discuss the neutron skin thickness by combining present σ_{I} and σ_{CC} data.

References
[1] M. Centelles et al., Phys. Rev. Lett. 102 (2009) 122502.
[2] S. Malbrunot-Ettenauer et al., Phys. Rev. Lett. 128 (2022) 022502

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