Elastic Scattering of Polarized Protons off ^{204,206,208}Pb at 300 MeV

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Neutron skin thickness, the difference of root mean square radii of neutron and proton distributions, for ^{208}Pb provide a key role to dicern various effective interactions used in Skyrme Hartree-Fock (SHF) and Relativistic Mean Field (RMF) models. In order to differentiate various models, we need to extract the neutoron skin thickness with a good accuracy.

In our series of proton elastic scattering measurements at intermediate energies, we have developed a new method to extract neutron density distribution precisely in the framework of the relativistic impulse approximation (RIA) with medium modifications of NN interactions and succeeded in observing a gradual change of neutron distributions both in tin isotopes and calcium isotopes. Original RIA codes were developed by Horowitz et al. [1]

The experiment (E248) was performed at RCNP using the high resolution spectrometer Grand Raiden. We have measured cross sections and analyzing powers of proton elastic scattering off ^{204,206,208}Pb at 300MeV over an angular range of $\theta_{LAB} \leq 46.5°$. The targets were periodically changed in a few minutes by an automatic target changer system developed by our group in order to minimize the systematic ambiguity among different targets.

Preliminary experimenatal results of differential cross sections and analyzing powers are are shown in Fig.1. Dashed lines are caluculated with global potentials. Dotted lines are medium modified RIA caluculations with the RH densities. The solid line is also a medium modified RIA calculation but the target density distribution is replaced by realistic one. In this caluculation we have used the neutron density distribution reported by Ray et al.[2] and a proton density distribution unfolded from charge distribution data [3]. As shown in Fig. 1, medium modified RIA calculations fit to the cross section data as well as caluculations with global potentials and improve the fits to analayzing power data. Further analysis is in progress to extract more realistic proton density disitirbutions which include the effects from the charge distribution of neutron itself and to search neutron density distributions with those proton density distributions.

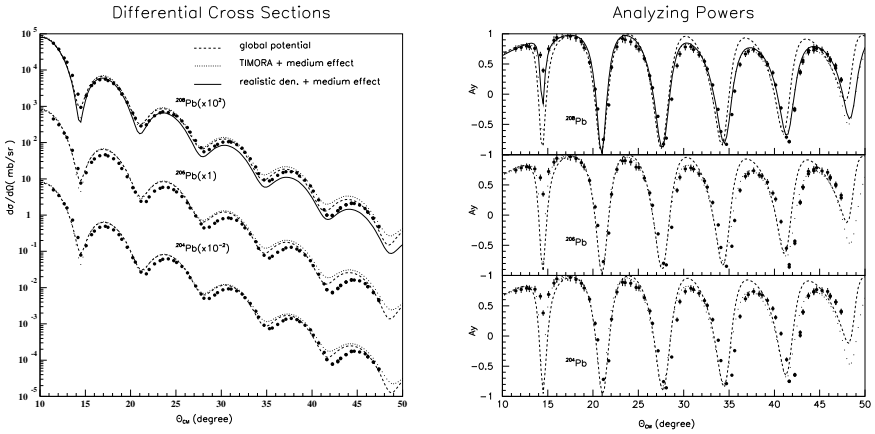

Figure 1: Cross sections and analyzing powers of proton elasitc scattering off ^{204,206,208}Pb at 300MeV.

References

[1] C. J. Horowitz et al., Computational Nuclear Physics 1, (Springer-Verlag,Berlin,1991),Chapter 7
[2] L. Ray et al., Phys. Rev. C 18, 1756 (1978)
[3] H. de Vries et al., Phys, Atomic Data and Nuclear Data Tables 36, 495 (1987).