# BORN APPROXIMATION FOR POLARIZATION OF PROTONS BY $^{40}$CA NUCLEI

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The investigation of the nucleon-nucleus elastic scattering at the energies from several hundred MeV to about 1 GeV provides a valuable information both about the nucleon distributions in a target nuclei and about the nuclear reaction mechanisms.

Various theoretical approaches such a diffraction and optical models are employed in describing these processes.

In the calculations of the differential cross sections and polarization observables in the optical model approach a numerical solution of the Schrödinger equation is usually used. However, such an approach does not allows us qualitatively interpreting the scattering problem and makes us some difficulties in performing the calculations. Therefore, in order to better understanding the nature of the hadron-nucleus interaction in the region of sufficiently high energies we use the Born approximation with the spin-orbit part of the optical potential taken into account.

However, it turns out that the scattering amplitude, calculated in the 1st Born approximation with the Hermitian potential is real. As a result, in this approach the polarization of the nucleons in nuclear scattering is equal to zero. Therefore, when calculating the hadron-nucleus polarization observables at least the 2nd Born approximation should be used. This approach will be correct both for using the Hermitian or non-Hermitian complex optical potential.

On the basis of this approach analytical expressions for the amplitudes and the observables for the elastic scattering of protons by $^{40}$Ca nuclei in the 1st and 2nd Born approximation were obtained and the comparison between theoretical predictions and experimental data at the energies from 200 [1] to 800 MeV are executed. The results obtained are in a reasonable agreement with the available experimental data.

1. Yu.A. Berezhnoy, V.P. Mikhailyuk, Chinese Physics **C41** (2017) 024102.