SPIN OBSERVABLES IN PD-SCATTERING AND TEST OF *T*-INVARIANCE

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A novel test of time-reversal invariance in proton-deuteron scattering is planned as an internal target transmission experiment at COSY [1]. The P-even T-odd observable is the polarization correlation $A_{y,xz}$ in scattering of polarized proton beam (polarization P_y) off polarized deuterium target (tensor polarization P_{xz}). This observable provides a real null test of time-reversal invariance for P-parity conserving processes [2]. In order to clarify role of the background conditions of this experiment, it is necessary to know the magnitude of several T-even P-even spin-observables in pd-scattering at energy about 100-200 MeV that is the region of the planned experiment. In the present work, we apply the Glauber-Sitenko theory of multiple scattering for calculation of the differential spin observables of elastic pd-scattering and the total pd-cross sections for polarized proton and deuteron. Actually, we use the formalism of Ref. [3] and develop it for inclusion of Coulomb effects and T-odd pN-amplitudes. Furthermore, we properly modify the formalism of Ref. [3] to provide a comparison with existing experimental data [4,5]. The results of our calculations for unpolarized differential cross section, vector A_y and tensor A_{ij} analyzing powers, spin correlation parameters C_{ij}, $C_{ij,k}$ and spin-transfer coefficients $K_j^{j'}$ in forward hemisphere are found in reasonable agreement with the data [4,5] obtained at 135 MeV and 250 MeV. We show that Coulomb effects improve agreement with the data at those energies at small angles. The total hadronic polarized cross sections σ_1, σ_2, σ_3 (as defined in Ref. [6]) are calculated using the generalized optical theorem. The energy dependence of the T-odd total cross section $A_{y,xz}$ is obtained within the double scattering mechanism for the forward pd elastic scattering amplitude. The obtained result for σ_1 put a strong restriction on the magnitude of the false vector polarization of the deuterium target ($<10^{-6}$). This restriction is caused by the requirement to reach a planned accuracy of 10^{-6} of the $A_{y,xz}$ measurement in the experiment [1].

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