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Search for T-Invariance Violation in the Proton-Deuteron Scattering

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Time-reversal invariance will be tested in proton-deuteron scattering via an internal target transmission experiment at COSY[1].The polarization asymmetry Ay,xz will be measured using a polarized proton beam (polarization Py) and polarized deuterium target (tensor polarization Pxz). For P-parity conserving interactions this observable provides a real null test of time-reversal invariance which is not affected by the final state interaction [2]. In order to control background conditions of this experiment one has to know the magnitude of several T-even, P-even spin-observables in pd scattering at energy of the planned experiment 100-200 MeV. In the present work the differential spin observables of the elastic pd scattering and total pd cross sections for polarized proton and deuteron are calculated within the Glauber theory. We use the formalism of Ref. [4] and develop it for inclusion of T-odd pN amplitudes. Furthermore, we properly modify the formalism of Ref. [4] to make a comparison with existing experimental data. The results of our calculations for unpolarized differential cross section, vector Ay and tensor Aij analyzing powers, spin correlation parameters Cij, Cij,k and spin-transfer coefficients Kji'at 135 MeV and 250 MeV are in a reasonable agreement with the data [5,6] in forward hemisphere. We found that Coulomb interaction does not lead to divergences for the Ay,xz observable. The total hadronic polarized cross sections sigma1, sigma2, sigma3 (as defined in Ref. [3]) are calculated using the generalized optical theorem similarly to Ref. [7]. The obtained result for sigma1 put a strong restriction on the magnitude of the false vector polarization of the deuteron (Py <10-6) caused by the planned accuracy of the T-odd effect measurement of about 10-6 [1]. Energy dependence of the Ay,xz observable is calculated for several types of T-odd NN-interactions. This dependence differs from that found in Ref. [8] where only a breakup mechanism was accounted.

1.COSY Proposal N 215,"Test of Time reversal invariance in proton-deuteron

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