Spin Structure Of The Charge-Exchange Process $n + p \rightarrow p + n$ At Zero Angle

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The structure of the nucleon charge-exchange process $n + p \rightarrow p + n$ is investigated basing on the isotopic invariance of the nucleon-nucleon scattering. Using the operator of permutation of the spin projections of the neutron and proton, the connection between the spin matrices, describing the amplitude of the nucleon charge-exchange process at zero angle and the amplitude of the elastic scattering of the neutron on the proton in the "backward" direction, has been considered. Due to the optical theorem, the spin-independent part of the differential cross-section of the process $n + p \rightarrow p + n$ at zero angle for unpolarized particles is expressed through the difference of total cross-sections of unpolarized proton-proton and neutron-proton scattering. Meantime, in the framework of the impulse approach, the spin-dependent part of this cross-section is proportional to the differential cross-section of the deuteron charge-exchange breakup $d + p \rightarrow (pp) + n$ at zero angle at the deuteron momentum $\mathbf{k_d} = 2\,\mathbf{k}_n$ ($\mathbf{k}_n$ is the momentum of the initial neutron). Analysis shows that, assuming the real part of the spin-independent term of the "forward" amplitude of the process $n + p \rightarrow p + n$ to be smaller or of the same order as compared with the imaginary part, the main contribution into the differential cross-section of the process $n + p \rightarrow p + n$ at zero angle is provided namely by the spin-dependent term.