ON LONGITUDINALLY POLARIZED ELECTRON SCATTERING OFF POLARIZED PROTON TARGET

Safin M.Ya.
Peoples' Friendship University of Russia, Moscow, Russia
misafin@gmail.com

In the previous work [1] we have derived general expressions for the differential cross section of elastic scattering of longitudinally polarized ($\zeta = \pm 1$) electron off the polarized ($\vec{s}$) proton target. Right-left asymmetry $A_{RL}\left(\vec{s};E,q^2\right)$ was studied in the next cases of the proton spin orientation with respect to incident electron moment: $\vec{s} \parallel \vec{k}$ and $\vec{s} \perp \vec{k}$.

Here we study another type of scattering asymmetry, namely, target proton spin asymmetries: parallel $A_p^{\parallel}\left(\zeta;E,q^2\right)$ and orthogonal $A_p^{\perp}\left(\zeta;E,q^2\right)$, in dependence of incident electron helicity ζ.These asymmetries in the case of unpolarized electron scattering were investigated in [2].

$$A_p^{\parallel}\left(\zeta;E,q^2\right)=\frac{b_{ep}\left(E,q^2\right)+c_{ep}\left(E,q^2\right)\cos(\theta)+\zeta\left(b_{ep}^h\left(E,q^2\right)+c_{ep}^h\left(E,q^2\right)\cos(\theta)\right)}{a_{ep}\left(E,q^2\right)+\zeta a_{ep}^h\left(E,q^2\right)},$$

$$A_p^{\perp}\left(\zeta;E,q^2\right)=\sin(\theta)\frac{d_{ep}\left(E,\tau\right)+\zeta d_{ep}^h\left(E,\tau\right)}{a_{ep}\left(E,q^2\right)+\zeta a_{ep}^h\left(E,q^2\right)},$$

with θ being a polar angle of the scattered electron.

These formulas include various correlation functions, defined in [1]. Parity violating single spin correlation functions $a_{ep}^h\left(E,q^2\right)$, $b_{ep}\left(E,q^2\right)$ and $c_{ep}\left(E,q^2\right)$ in the absence of weak interactions can arise only due to anapole G_{1p} form factor of the proton. For the time reversal violating orthogonal asymmetry is responsible electric dipole G_{2p} form factor of the proton thru triple vector correlation functions $d_{ep}\left(E,q^2\right)$ and $d_{ep}^h\left(E,q^2\right)$.

We show, that comparative study of the right-left asymmetry $A_{RL}\left(\vec{s};E,q^2\right)$ and target proton spin asymmetries $A_p^{\parallel}\left(\zeta;E,q^2\right)$, $A_p^{\perp}\left(\zeta;E,q^2\right)$ of the angular distribution of the scattered electrons can provide further information about anapole and electric dipole proton form factors, as well as of possible deviations from the Standard Model (SM) of electroweak interactions.

1. M.Ya.Safin // Book of abstracts of LXIII Int. Conf. "NUCLEUS 2013". Moscow. Russia. October 8-12. 2013. P.166.
2. B.K.Kerimov, M.Ya.Safin // Physics of Atomic Nuclei. 2009. V.72. P.1960.