Contribution ID: **217** Type: **Poster report**

On the Covariant Description of the Elastic Scattering of Longitudinally Polarized Leptons by Half-Integer Spin Nuclei

Wednesday, 14 October 2020 18:50 (20 minutes)

In [1], in the framework of a general approach to the covariant description of the structure of half-integer spin nuclei, analytical expressions were found for the multipole expansion of the structure functions, entering into the differential cross section for elastic scattering of longitudinally polarized leptons
$\frac{d\sigma}{d\Omega} = \sigma_{Mott}\left\{W_1 + 2tg^2\frac{\theta}{2}W_2 - \zeta\tau\left[\frac{M}{E} + \left(1+\frac{M}{E}\right)tg^2\frac{\theta}{2}\right]W_4\right\}.$
In the effective current approximation, valid for high energies $E >> m_l$ of the scattered lepton, structure functions W_k depend upon $\tau = -q^2/4M^2$, lepton helicity ζ, and electromagnetic and weak nucleus form factors, and lepton electroweak constants.
In this work using Rarita-Schwinger formalism to describe [2] nuclei with half-integer spin $J \leq 7/2$, we construct explicit expressions for covariant electromagnetic and weak vertex functions $\Gamma^{\mu(\alpha)_j(\beta)_j}_{em,\,weak}\ (j = J - 1/2)$, as well as for the density matrix $\Lambda_{(\alpha)_j(\beta)_j}$ of an unpolarized nucleus state. Then, using multipole expansion technique in the Breit zero energy transfer system, we consider traditional multipole form factors – vector $F_{Cl}(\tau)\ (l = 0, 2,\ \dots 2J-1)$ and $F_{Ml}(\tau)\ (l = 1,\ 3,\ \dots 2J)$, as well as axial $F_{5El}(\tau)$ and $F_{5Ll}(\tau)\ (l = 1,\ 3,\ \dots 2J)$ – and get expressions for them through the covariant form factors of the vertex functions $F_E^{(n)}(\tau),\ F_M^{(n)}(\tau),\ G_1^{(n)}(\tau)$ and $g_E^{(n)}(\tau),\ g_M^{(n)}(\tau),\ g_A^{(n)}(\tau)$.
Then we obtain and discuss expressions for the right-left asymmetry A_{RL}, as well as the spin correlations of transversely polarized incident and scattered leptons. We show, that elastic scattering is helicity conserving due to smallness of the lepton mass, and right-left asymmetry contains contribution from anapole moment of the target, whereas transverse correlations arise only with simultaneous polarization of incident and scattered leptons.

1. M.Ya.Safin. Izv. Russ. Akad. Nauk, Ser. Fiz., 2020, vol. 84, no. 4, p. 527.
2. Yu.P.Bogdanov, B.K.Kerimov, M.Ya.Safin. Izv. Acad. Sci. SSSR. Ser.Fiz. 1980. vol. 44. no. 11. p. 2337; Izv. Acad. Sci. SSSR. Ser. Fiz. 1983. vol. 47. no. 1. p. 103.

Primary author: SAFIN, Minikhan

Presenter: SAFIN, Minikhan

Session Classification: Poster session 4 (part 2)

Track Classification: Section 4. Relativistic nuclear physics, elementary particle physics and high-energy physics.