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Study of quantum spin correlations of relativistic electrons

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An experiment investigating quantum spin correlations of relativistic electrons will be presented. The project aims at the first measurement of the quantum spin correlation function (and the corresponding probabilities) for a pair of relativistic particles with mass. Theoretical studies revealed unexpected properties of entangled systems in the relativistic energy range, but in all of the correlation experiments performed until now the energy of the particles was insufficient to observe relativistic effects. This measurement will be the first attempt to verify the predictions of relativistic quantum mechanics in the domain of spin correlations.

The measurement will be carried out on a pair of electrons in the final state of Møller scattering (electron pairs under study will originate from polarized electron beam scattering off atomic electrons of an unpolarized target). The measurement regards correlations of spin projections on chosen directions for the final state pair. The detector consists of two Mott polarimeters, in which the spins of both Møller electrons are measured simultaneously.

Results and conclusions from the test measurements at Mainzer Mikrotron will be discussed. For testing purposes measurements were carried out with half of the setup, which can be used as a single polarimeter, allowing to measure the polarization of the beam, as well as the mean polarization of Møller electrons.

Summary

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