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On the spin correlations of muons and tau leptons generated in the annihilation processes $e^+e^- \rightarrow \mu^+\mu^-$, $e^+e^- \rightarrow \tau^+\tau^-$

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Using the technique of helicity amplitudes, the electromagnetic process $e^+e^- \rightarrow \mu^+\mu^-$ is theoretically investigated in the onephoton approximation. The structure of the triplet states of the final $\mu^+\mu^-$ system is analyzed. It is shown that in the case of unpolarized electron and positron the final muons are also unpolarized, but their spins are strongly correlated. Explicit expressions for the components of the correlation tensor of the final $\mu^+\mu^-$ system are derived. The formula for the angular correlation at the decays of final muons μ^+ and μ^- , produced in the process $e^+e^- \rightarrow \mu^+\mu^-$ is obtained. It is demonstrated that spin correlations of muons in the process of electronpositron pair annihilation have the purely quantum character, since one of the Bell type incoherence inequalities for the correlation tensor components is always violated. The additional contribution of the weak interaction of lepton neutral currents through the virtual Z boson is considered it is established that, taking into account the weak interaction, the qualitative character of the muon spin correlations does not change. Analogous consideration can be wholly applied as well to the final tau leptons formed in the process $e^+e^- \rightarrow \tau^+\tau^-$.

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