Muon Decay: Measurement Of The Transverse e^+ Polarization And Its Implications On $G_{\rm F}$ (Fermi Coupling Constant) And Time Reversal Invariance

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Abstract

The two transverse polarization components $P_{\rm T_1}$ and $P_{\rm T_2}$ of the e^+ from the decay of polarized μ^+ have been measured as a function of the e^+ energy. Their energy averaged values are $\langle P_{\rm T_1}\rangle = (6.3 \pm 7.7 \pm 3.4) \times 10^{-3}$ and $\langle P_{\rm T_2}\rangle = (-3.7 \pm 7.7 \pm 3.4) \times 10^{-3}$. From the energy dependence of $P_{\rm T_1}$ and $P_{\rm T_2}$ the decay parameters η, η'' and α'/A, β'/A are derived, respectively.

Assuming only one additional coupling besides the dominant $V-A$ interaction improved limits on η, β'/A, and the scalar coupling constant g^S_{RR} are derived: $\eta = (-2.1 \pm 7.0 \pm 1.0) \times 10^{-3}$, $\beta'/A = (-1.3 \pm 3.5 \pm 0.6) \times 10^{-3}$, $Re\{g^S_{RR}\} = (-4.2 \pm 14.0 \pm 2.0) \times 10^{-3}$ and $Im\{g^S_{RR}\} = (5.2 \pm 14.0 \pm 2.4) \times 10^{-3}$.