

Electromagnetic and Scalar Pion form factor in the Kroll-Lee-Zumino model

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Abstract

The renormalizable Abelian quantum field theory model of Kroll, Lee, and Zumino is used at the one loop level to compute vertex corrections to the tree-level, Vector Meson Dominance (VMD) electromagnetic pion form factor. These corrections, together with the one-loop vacuum polarization contribution, imply a resulting electromagnetic pion form factor in excellent agreement with data in the whole range of accessible momentum transfers in the space-like region. The time-like form factor, which reproduces the Gounaris-Sakurai formula at and near the rho-meson peak, is unaffected by the vertex correction at order $O(g^2)$. The KLZ model is also used to compute the scalar radius of the pion at the one loop level, finding $\langle r_{\pi^2}^S \rangle = 0.40 \text{ fm}^2$. This value implies for the low energy constant of chiral perturbation theory $\Gamma^4 = 3.4$.