

Inconsistency of the interactions between pseudoscalar, spinor and Rarita-Schwinger fields

Content

We perform the Dirac quantization of RS fields interacting with a spinor and the first derivative of a pseudoscalar field. We achieve the calculations for two forms of this interaction: first we review the conventional coupling of lowest derivative order, reproducing the well known inconsistencies in its anticommutator algebra. Then, we perform the analysis on the next order term popularly known as “spin 3/2 gauge invariant interaction”, which is claimed to be free of these inconsistencies. Nevertheless we find that the direct application of the Dirac formalism leads to inconsistencies in complete analogy to the previous case. This is of high relevance in the particle phenomenology field, where these interactions are used to interpret experimental data involving $\Delta(1232)$ resonances.

Summary

Our result has a great relevance in the hadron phenomenology community, since often the inconsistency issue is invoked in evaluations done with the conventional first-derivative $\pi N\Delta$ interaction, while for the second-derivative not. Recall that they are used to interpret accelerator data, estimate parameters for resonances and other critical tasks in phenomenology.

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