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PARAMETRIZACIÓN DEL VÉRTICE Y DEL PROPAGADOR EN RESONANCIAS DE SPIN 3/2 PARA EL ESTUDIO EN LA DISPERSIÓN DE PIONY NUCLEON

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The exact formulation of quantum field theories for fundamental particles with spin $\frac{3}{2}$ represents a significant challenge in theoretical physics due to the inherent complexities in describing these systems. In particular, elastic pion-nucleon scattering involves intermediate states with spin $\frac{3}{2}$,corresponding to the $\Delta(1232)$ resonance, which underscores the importance of studying these fields. In this work, we perform a systematic analysis of the description of Rarita-Schwinger fields and the different parameterizations of their propagator within an effective Lagrangian model. This model is consistently constructed to preserve the relevant symmetries, allowing for the generation of the necessary amplitudes to describe the pion-nucleon scattering process. This approach enables the accurate calculation of physical observables, such as the cross-section, which are crucial for understanding the dynamic properties of the involved hadronic resonances.

The analysis is conducted within the framework of Quantum Chromodynamics (QCD), given the relevance of pion-nucleon scattering in understanding strong interactions and the characteristics of the resulting hadrons. Special attention is given to the parameterization of the interaction vertex and the propagator of resonances with spin $\frac{3}{2}$, which are crucial aspects for ensuring the consistency and predictive capability of the model. The obtained results are compared with available experimental data, evaluating different parameterizations to identify the one that best reproduces the empirical results. This provides a robust theoretical foundation for future studies of similar hadronic processes.

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