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# Resolution of the Klein Paradox for Spin-½ Particles

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*The problem of a relativistic spin-½ particle scattering from a step potential is solved within the theoretical framework of relativistic dynamics. This treatment avoids the Klein paradox. An experiment for testing the theory is suggested.*

## 1. INTRODUCTION

The Klein paradox[1] is the as yet experimentally untested prediction that a relativistic particle incident on a step potential of sufficient strength will be reflected by the barrier with a reflection coefficient that exceeds unity. The prediction that more particles will be reflected than were incident does not arise when the problem of spinless particles scattering from a step potential is solved within the framework of the four-space formulation (FSF).[2] The difference between the predictions of the FSF[2] and the conventional approach[1] implies that scattering from a step potential could be used to experimentally test the FSF.

This experiment has not been performed because the weakest potential for spinless particles must exceed 280 MeV (for pions). If the same predictions hold for spin-½ particles as for spin-0 particles, then the strength of the step potential will drop significantly (to about 1 MeV for electrons) and become more accessible experimentally.

Attempts to resolve the Klein paradox for spin-½ particles have been hampered by the lack of a spin-½ formalism consistent with the FSF. This difficulty was recently removed when the spin-½ formalism of Horwitz, Piron, and Reuse[3,4],[2] (their "relativistic dynamics") appeared. The purpose

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[2] A classical discussion of the FSF and "relativistic dynamics" concepts was given independently by Pearle.[5] Pearle's difficulty with rest mass conservation is cleared up by Fanchi.[6]