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Vector and scalar potentials in the one-dimensional Dirac equation WALTER JARONSKI, Radford University — It is well known that the Dirac equation admits no bound states for the linear potential if this potential is treated as the time component of a Lorentz vector. Bound states exist, however, if the potential is added to the equation as a Lorentz scalar, i.e., with the same status as the mass. This behavior exists even if the equation is considered with only one spatial dimension, but with simplifications resulting from the absence of spin-angular factors. In this study, we investigate the solutions of the one-dimensional Dirac equation for Lorentz vector and Lorentz scalar interactions. Simple rectangular well potentials are first considered in order to test procedures. The interesting case of the linear potential is then treated. As already stated, the linear vector potential admits no bound states. This is due to coupling to negative energy states. To study this further, the case of a triangular well is then studied. We find that bound states for a vector triangular well disappear as the width of the well increases.

Walter Jaronski
Radford University

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