

Potential calculations

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We have continued to investigate some interesting aspects of potential scattering with the Dirac equation. In the past we have pointed out the loss of resonance effects with narrow wave packets. We have also studied transition times in tunneling, and *dynamic localized states* within the Klein energy region for the barrier/well potential. Furthermore, during the past year we have drawn an analogy with planar optics, which makes our results far more amenable to experimental testing [1].

We have also calculated the first few orders of potential scattering within field theory. Although this does not allow us to derive a closed expression as with standard continuity equations it allows an easy generalization to arbitrary potentials. We have shown perfect agreement for the barrier potential results after decomposing the standard results into a perturbation series. Since the field-theoretic calculation is performed in three dimensions, it was noticed that, in general, spin flip occurs in high energy diffusion processes. This is in contrast to the one-dimensional results. A follow up calculation was performed for planar Dirac diffusion and the spin flip terms for the step and barrier potentials found. This work is being written and will be submitted for publication in the near future.

REFERENCES

1. S. De Leo and P. Rotelli, Journal of Optics A, 10 (2008) 115001