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Quantum Scattering without Magic: Part 1

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About a week ago, I wrote this log entry about quantum scattering. This log entry is a continuation of this work. Here, we are really going to get into the full awesomeness of the theory of quantum scattering. First, I'll revisit Section 5 from last time, but this time with diagrams! :D

1 Interpreting the Born-like series

Let's look at the Born-like series:

$$\text{If } \lim_{N\to\infty}(GV)^N = 0, \text{ then} \tag{1}$$

$$\psi = \sum_{N=0}^{\infty}(-iGV)^N Gf \tag{2}$$

(This equation is numbered equation 27 in Part 0.) I said that G propagates the particle and V scatters the particle. Now, I would like to expand on this interpretation, using the example of a particle in 3D space $x \in \mathbb{R}^3$ with kinetic energy $T = \frac{|p|^2}{2m}$ and potential energy $V(x)$. Recall that using the method of the inhomogeneous Schrödinger equation, initial conditions are established using a brief pulse in the forcing term , f, in around the time when the evolution begins. First, we're going to need labels for each term in this series.

$$\psi = \sum_{c=0}^{\infty}\psi_c, \text{ where} \tag{3}$$

$$\psi_c = (-iGV)^c Gf \tag{4}$$

Now, let's look at the first term:

$$\psi_0 = Gf \tag{5}$$

This is the kinetic, or free-particle solution.