

General Physics Notes (0914026):

In some of the previous notes, we had the relations of the energy to the wavenumber in a Schrödinger system, or a system that behaves according to a wave relation. Particles are waves and at the smallest scale, their behavior is very much wavelike. Kelvin Helmholtz and Raleigh Jeans instabilities are characteristic of fluid or wavelike behavior. We can get into this turbulent fluid dynamics with the Navier Stokes equations (which have been solved recently). I think A.I. is working in that with the PINN and universal approximation theorem.

$$E_k = \frac{\hbar^2 k^2}{2\mu} \quad (1)$$

$$G(r, r', E) = \left(\frac{1}{2\pi}\right)^3 \frac{2\mu}{\hbar^2} \int_0^\infty k^2 \partial k \int_0^{2\pi} \partial \phi \int_0^\pi \frac{\sin \theta \cdot \zeta(s, \theta, t) \partial \theta e^{i \cdot k s \cos \theta}}{K^2 - k^2} \quad (2)$$

These are some pretty nasty integrals and on top of it we add the zeta turbulence or the zeta calculus. I'll spare you the integration and just give you the results. You can look at my handwritten notes if you are interested.

$$\int \partial^3 \vec{r}' \langle \vec{k} | \vec{r}' \rangle \langle \vec{r}' | W | \vec{k}; + \rangle =$$

$$\left(\frac{1}{2\pi}\right)^{\frac{3}{2}} e^{i \vec{k} \cdot \vec{r}} \left(-\frac{\mu}{2\pi \hbar^2}\right) \frac{2\pi^{\frac{3}{2}} e^{i \vec{k} \cdot \vec{r}}}{r} \frac{\Gamma(s, \theta, t) + \Gamma(s + s_\pi, \theta, t)}{1 + \Gamma(s, \theta, t)} \langle \vec{k} | W | \vec{k}; + \rangle$$

We have the gamma function arising from the integration of the zeta function. It is not the best way, probably you want to write out the terms explicitly and truncate the series. I had to break up the equation on multiple lines because it is so difficult. For the 1-D problem, we have a nice relation.

$$\left[E + \frac{\hbar^2 \partial^2}{2\mu \partial r^2} - V(r) + \frac{\hbar^2 l(l+1)}{2\mu r^2} \right] G = \delta(r - r') \quad (3)$$

ANGULAR PARTS FACTOR OUT, WE ARE LEFT WITH THE RADIAL GREEN'S FUNCTION. Looking back, we recall what the asymmetric radial components of the spherical harmonic conjugated partition was like.

$$G(r, r', E) = r r' \langle r, \theta | lm | G(E) | lm \rangle \otimes | r' \rangle \quad (4)$$

This is it for now. Partial wave series when we expand G in eigenfunctions of spherical harmonics and substitute into differential equation to find the angular parts. Again, the angular dependence factors out giving us a result with no kinks. Of course, this is the 1-D problem and there are things with the fractional dimensions that will come into play.