Relationship Between Energy, Momentum, Wavelength

Momentum (p) to classical kinetic energy (E):

$$E = \frac{p^2}{2m}$$

Energy to wavelength (De Broglie) [1]:

$$\lambda = \frac{h}{p}$$

Spherical Harmonics

Due to a spherical shaped electrical force field, we cannot just use sine waves in 1D, but we need the 3D version, spherical harmonics [1]. We see this when we compute quantum energy levels and states for the hydrogen atom [2].

From spherical harmonics, we get three important quantum numbers. n is the principal quantum number representing energy levels. l is the quantum number representing angular momentum. m is the quantum number representing angular momentum projection (or magnetic orbital quantum number) [3].

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