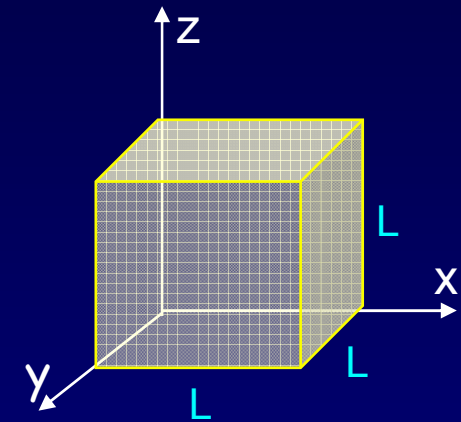# Particle in a 3D Box (3)

The energy eigenstates and energy values in a 3D cubical box are:

$$\psi = N \sin\left(\frac{n_x \pi}{L} x\right) \sin\left(\frac{n_y \pi}{L} y\right) \sin\left(\frac{n_z \pi}{L} z\right)$$

$$E_{n_x n_y n_z} = \frac{h^2}{8mL^2}\left(n_x^2 + n_y^2 + n_z^2\right)$$

where n_x, n_y, and n_z can each have values 1,2,3,….

This problem illustrates two important points:

- Three quantum numbers (n_x,n_y,n_z) are needed to identify the state of this three-dimensional system.
  That is true for every 3D system.

- More than one state can have the same energy: "Degeneracy".
  Degeneracy reflects an underlying symmetry in the problem.
  3 equivalent directions, because it's a cube, not a rectangle.