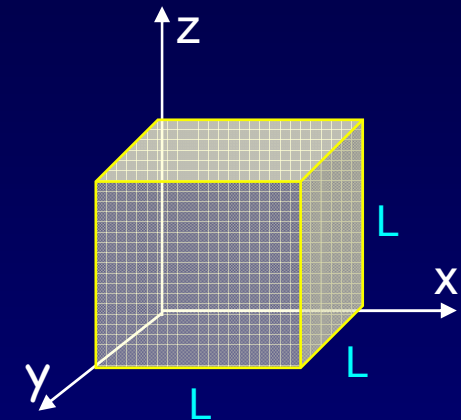


Lect. 16: Particle in a 3D Box (3)

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

$$\psi = N \sin\left(\frac{n_x \pi}{L} x\right) \sin\left(\frac{n_y \pi}{L} y\right) \sin\left(\frac{n_z \pi}{L} z\right)$$
$$E_{n_x n_y n_z} = \frac{h^2}{8mL^2} (n_x^2 + n_y^2 + n_z^2)$$

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.