

Ch. 8. Quantum Mechanics in Three Dimensions

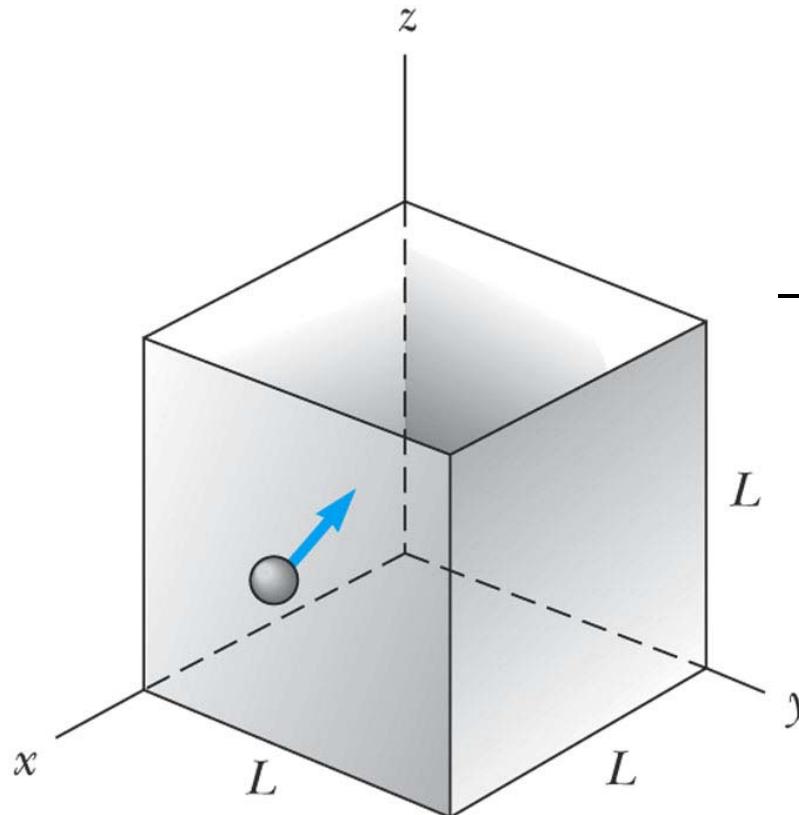
이 병 호
서울대 전기공학부
byoungho@snu.ac.kr



Seoul National University

NRL HoloTech

3-D Box



3D Schrödinger Equation

$$-\frac{\hbar^2}{2m} \nabla^2 \Psi + U(\mathbf{r})\Psi = i\hbar \frac{\partial \Psi}{\partial t}$$

© 2005 Brooks/Cole - Thomson

Fig. 8-1, p.261



Seoul National University

NRL HoloTech

3-D Box

Time-independent 3D Schrödinger Equation

$$-\frac{\hbar^2}{2m} \nabla^2 \psi(\mathbf{r}) + U(\mathbf{r})\psi(\mathbf{r}) = E\psi(\mathbf{r})$$

변수분리

$$\psi(\mathbf{r}) = \psi_1(x)\psi_2(y)\psi_3(z)$$

$$E = \frac{\pi^2 \hbar^2}{2mL^2} \left(n_1^2 + n_2^2 + n_3^2 \right),$$

$$n_1 = 1, 2, \dots$$

$$n_2 = 1, 2, \dots$$

$$n_3 = 1, 2, \dots$$



	n^2	Degeneracy
$4E_0$ —————	12	None
$\frac{11}{3}E_0$ —————	11	3
$3E_0$ —————	9	3
$2E_0$ —————	6	3
E_0 —————	3	None

© 2005 Brooks/Cole - Thomson

Fig. 8-3, p.264



Seoul National University

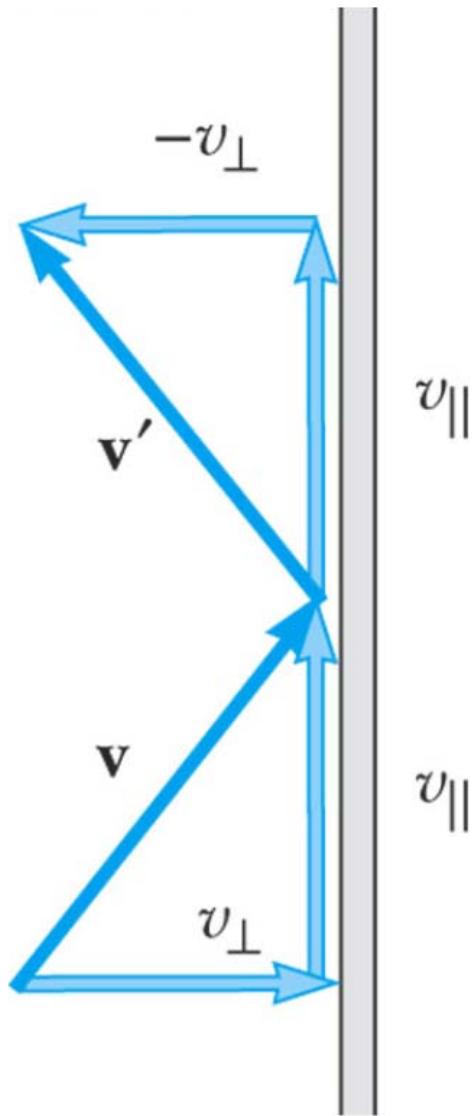
NRL HoloTech

**Table 8.1 Quantum Numbers and Degeneracies
of the Energy Levels for a Particle
Confined to a Cubic Box***

n_1	n_2	n_3	n^2	Degeneracy
1	1	1	3	None
1	1	2	6	Threefold
1	2	1	6	
2	1	1	6	
1	2	2	9	Threefold
2	1	2	9	
2	2	1	9	
1	1	3	11	Threefold
1	3	1	11	
3	1	1	11	
2	2	2	12	None

*Note: $n^2 = n_1^2 + n_2^2 + n_3^2$.





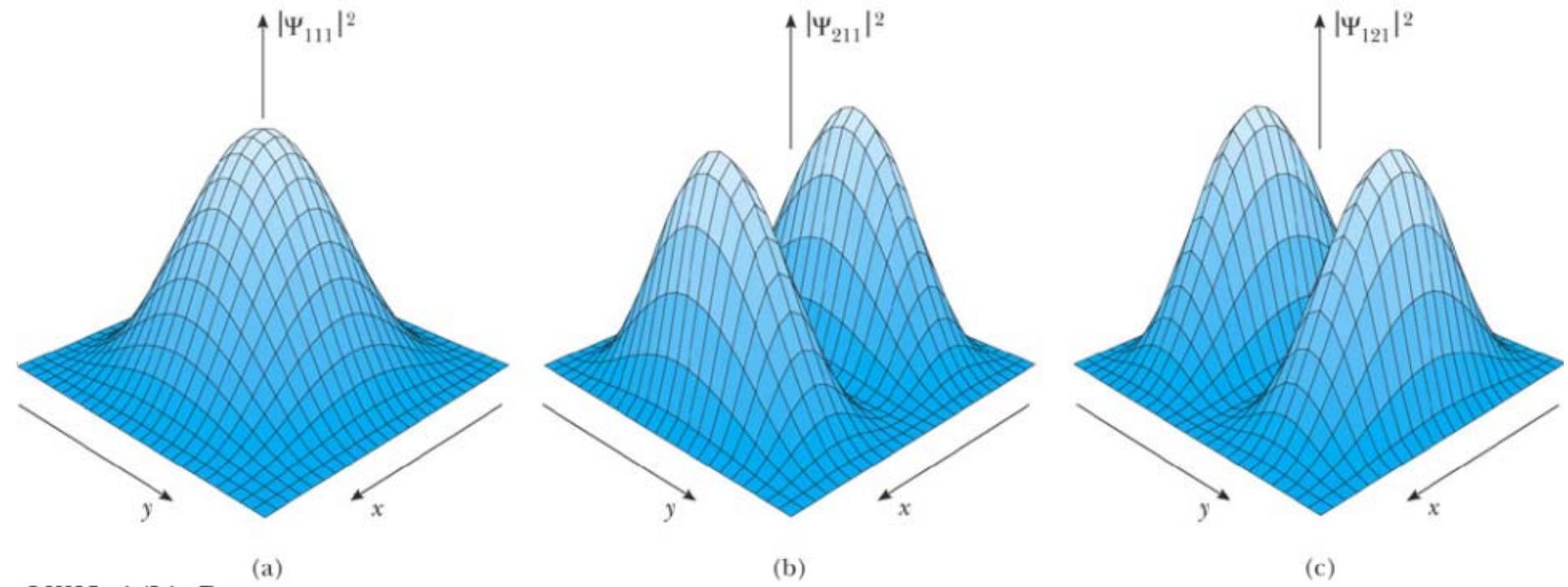
© 2005 Brooks/Cole - Thomson

Fig. 8-2, p.261



Seoul National University

NRL HoloTech



© 2005 Brooks/Cole - Thomson

Fig. 8-4, p.265



Seoul National University

NRL HoloTech