

5-6. Suppose A , B , and C are the three cartesian coordinates of momentum p_x , p_y , p_z . What is the form of the function $\chi_{a,b,c}(x, y, z)$?

From equation (5.6)

$$\phi(\mathbf{p}) = \int_{\mathbb{R}^3} \exp\left(-\frac{i\mathbf{p} \cdot \mathbf{x}}{\hbar}\right) f(\mathbf{x}) dx dy dz \quad (1)$$

where $\phi(\mathbf{p})$ is the amplitude for the state $\mathbf{p} = (p_x, p_y, p_z)$.

From equation (5.36)

$$F_{a,b,c} = \int_{\mathbb{R}^3} \chi_{a,b,c}^*(\mathbf{x}) f(\mathbf{x}) dx dy dz \quad (2)$$

where $F_{a,b,c}$ is (for this problem) the amplitude for the state $p_x = a$, $p_y = b$, and $p_z = c$.

Noting that (1) and (2) are identical for the state $\mathbf{p} = (a, b, c)$ we have

$$\chi_{a,b,c}^*(\mathbf{x}) = \exp\left(-\frac{i(a, b, c) \cdot \mathbf{x}}{\hbar}\right)$$

and

$$\chi_{a,b,c}(\mathbf{x}) = \exp\left(\frac{i(a, b, c) \cdot \mathbf{x}}{\hbar}\right)$$