

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  $\chi_{a,b,c}(x, y, z)$ ?

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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

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