

# Quantum Mechanics

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Lets continue from the first part: we found the relations  $a_1 = 0$  ,  $b_1 = 0$  and  $c_1 = 0$ . Then,  $a_2 = \hbar\sqrt{2}$ ,  $b_2 = 0$  and  $c_2 = 0$ . Also,  $a_3 = 0$  ,  $b_3 = \hbar\sqrt{2}$  and  $c_3 = 0$ .

$$\hat{L}_+ = \hbar \begin{vmatrix} 0 & \sqrt{2} & 0 \\ 0 & 0 & \sqrt{2} \\ 0 & 0 & 0 \end{vmatrix}$$

Lets use same analogy for  $L_-$ :

$$L_- 1, 1 = 0 \quad L_+ 1, 0 = \hbar\sqrt{2} \begin{vmatrix} 1 \\ 0 \\ 0 \end{vmatrix} \quad L_+ 1, -1 = \hbar\sqrt{2} \begin{vmatrix} 0 \\ 1 \\ 0 \end{vmatrix}$$

Lets be more clear lets assume that :

$$L_- = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_2 \end{vmatrix}$$

if:

$$\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_2 \end{vmatrix} \begin{vmatrix} 1 \\ 0 \\ 0 \end{vmatrix} = \begin{vmatrix} 0 \\ 1 \\ 0 \end{vmatrix}$$

$$\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_2 \end{vmatrix} \begin{vmatrix} 0 \\ 1 \\ 0 \end{vmatrix} = i\hbar\sqrt{2} \begin{vmatrix} 0 \\ 0 \\ 1 \end{vmatrix}$$

$$\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_2 \end{vmatrix} \begin{vmatrix} 0 \\ 0 \\ 1 \end{vmatrix} = \begin{vmatrix} 0 \\ 0 \\ 0 \end{vmatrix}$$

we found the relations  $a_1 = 0$  ,  $b_1 = \sqrt{2}$  and  $c_1 = 0$ . Then,  $a_2 = 0$ ,  $b_2 = 0$  and  $c_2 = \sqrt{2}$ . Also,  $a_3 = 0$  ,  $b_3 = 0$  and  $c_3 = 0$ .

$$\hat{L}_- = \hbar \begin{vmatrix} 0 & 0 & 0 \\ \sqrt{2} & 0 & 0 \\ 0 & \sqrt{2} & 0 \end{vmatrix}$$

Using same analogy we can find that:

$$\hat{L}^2 = 2\hbar^2 \begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

Further study and solve the following exercises from the book by Zettili Study Problem 5.1 pg 310 Study Problem 5.4 pg 312