University of Hyderabad

School of Physics

Jan 2010 - Apr 2010 | Time : 1hr
M.Sc. II-Semester | Quantum Mechanics-I | MM : 20

Tutorial-III : Simultaneous Measurement, Uncertainty

⊘ Recall in Tutorial-III we had a physical system for which the dynamical variables X, Y, Z were represented by the 2×2 Pauli matrices $\sigma_x, \sigma_y, \sigma_z$. Answer the following questions for this system.

[1] Compute the average values of X, Y and Z in a state represented by

$$\chi = \begin{pmatrix} 1+2i \\ 1-3i \end{pmatrix}$$

[2] In each of the following cases find out if the dynamical variables can be measured simultaneously or not.

(a) X and Y

(b) Y and Z

(c) Y^2 and Z.

[3] Compute the average values of the following operators in the specified states.

(a) The average of X in the state represented by the vector

$$\begin{pmatrix} 1 \\ 2 \end{pmatrix}.$$

(b) The average value of $Y + Z$ in the state in which the variable X has a definite value -1 for X.

[4] Compute the average $\langle f|Y|f\rangle$ and the uncertainty ΔY for the variable Y if the state is given to be

$$f = \begin{pmatrix} 1+3i \\ 3-i \end{pmatrix}$$

What does the value for ΔY suggest? Give your remarks, if any.

[5] Compute the average value of $\ell X + mY + nZ$ in any one state in which $aX + bY + cZ$ has a definite value. Assume $\ell^2 + m^2 + n^2 = 1$ and $a^2 + b^2 + c^2 = 1$.

Date : Aug 16,2010