Quantum Mechanics – Solutions

42 continued (end)

so after time t the state becomes

$$|\psi(t)\rangle = e^{-\frac{iHt}{\hbar}}|\psi\rangle = e^{-\frac{i2t}{\hbar}}\frac{2i}{\sqrt{5}}\left(\frac{-2i|1\rangle+|3\rangle}{\sqrt{5}}\right)$$

$$- e^{\frac{i3t}{\hbar}}\frac{i}{\sqrt{5}}\left(\frac{i|1\rangle+2|3\rangle}{\sqrt{5}}\right). =$$

$$= |1\rangle\left(\frac{4}{5}e^{-\frac{2it}{\hbar}} + \frac{1}{5}e^{\frac{3it}{\hbar}}\right) + |3\rangle\left(\frac{2i}{5}e^{-\frac{2it}{\hbar}} - \frac{2i}{5}e^{\frac{3it}{\hbar}}\right).$$

So from this equation the measurements of B will give 1 and 3 with probabilities

$$\left|\frac{4}{5}e^{-\frac{2it}{\hbar}} + \frac{1}{5}e^{\frac{3it}{\hbar}}\right|^2 \text{ and } \left|\frac{2i}{5}\left(e^{-\frac{2it}{\hbar}} - e^{\frac{3it}{\hbar}}\right)\right|^2$$

i.e. $\frac{16+1+8\cos\frac{5t}{\hbar}}{25} = \frac{17+8\cos\frac{5t}{\hbar}}{25}$ and $\frac{8}{25}\left(1-\cos\frac{5t}{\hbar}\right)$

respectively.

Hence we will find the value 1 after $\frac{5t}{\hbar} = 2\pi$.

$$\langle B\rangle = \frac{\left(17+8\cos\frac{5t}{\hbar}\right)+3\cdot 8\left(1-\cos\frac{5t}{\hbar}\right)}{25}.$$

The max probability of finding 3 is $\frac{16}{25}$

So never certainty!

If original observation gave 2 as the n eigenstate of H all subsequent measurements will also give 2!