Quantum Mechanics

Quiz-I

20th October 2020 || Time 35 Mins

- You must upload your solutions by 3:45 pm.
- If (and only if) you face difficulty in uploading, mail them to subhadip.mitra@iiit.ac.in with a cc to arvind.bhaskar@research.iiit.ac.in. The subject of the mail should be "QM:Quiz <Your roll number> <Your name>".
- If you face difficulty with your connection, you must alert us before 3:30 pm by either calling me at +91-988-574-8328 or Arvind at +91-892-075-0635 or sending an SMS to any of our number.
- You don't have to write a lot, but try to put some details to show that you understand what you are writing.

1. For the general spinor $\chi = \frac{1}{5}\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ find the probability of getting $\pm\hbar/2$ if one measures S_x. Also find $\langle S_x \rangle$.

2. Argue that the eigenvalues of the operator $\hat{L}^2 - \hat{L}_x^2$ are always positive.

3. What is $[\hat{x}^2, \hat{p}^2]$?

4. Find the spectrum and the eigenfunctions of the operator $\hat{Q} = i\frac{d}{d\phi}$ where ϕ is the usual polar coordinate.

5. What is the expectation value of kinetic energy of a harmonic oscillator in the 2nd energy state?