

Que. Why does Schrodinger Equation have a unique form, i.e., 1st order with respect to time and 2nd order with respect to position?

Answer:

Any nth order differential equation has n different solutions. If Schrodinger equation was, hypothetically, of some order greater than 1 with respect to time, it would yield more than one possible solution. In other words, the same particle could've been described by various states at the same time, contradicting the classical certainty that we experience in everyday life. On the other hand, with respect to position it is a second order equation because knowing the position and momentum(velocity) is enough to describe the path of the particle at any position. Also, since the RHS involves the Kinetic Energy operator, represented by $p^2/2m$ and p is a linear with respect to position, it is bound to be a second order with respect to position...

1. The equation is such that it has an infinite number of solutions with different probabilities.
2. And if we consider it dimensionally, then this equation is correct. It must be 2nd order in x and 1st order in t to be dimensionally correct.
3. As opposed to classical mechanics where the equation helps to trace the trajectory, the Schrodinger differential equation helps to trace the evolution of the wave function overtime and this makes it unique as it is free from parameters of particle wave motion.