Answer on Question #40362 – Physics – Quantum Mechanics

Question: does Schrödinger equation have an unique answer? Why or why not?

Answer: Schrödinger equation is a second order partial differential equation (of parabolic type):

$$i\hbar \frac{\partial \psi}{\partial t} = \widehat{H}\psi$$

Where $\widehat{H}$ is the Hamilton operator that often has form $\widehat{H} = -\frac{\hbar^2}{2m}\Delta + V(\vec{r})$. It is known from theory of partial differential equations that this equation has unique solution. However, the answer (wave function ψ) must obey some boundary conditions. One of them is square integrability:

$$\iiint dxdydz \cdot \psi^*\psi = 1$$

Another boundary conditions depend on precise problem.