The Schrödinger Equation (SEQ)

In 1926, Erwin Schrödinger proposed an equation that described the time- and space-dependence of the wave function for matter waves (*i.e.*, electrons, protons,...)

There are two important forms for the SEQ.

First we will focus on a very important special case of the SEQ, the time-independent SEQ. Also simplify to 1-dimension: $\psi(x,y,z) \rightarrow \psi(x)$.

$$-\frac{\hbar^2}{2m}\frac{d^2\psi(x)}{dx^2} + U(x)\psi(x) = E\psi(x) \qquad \hbar = \frac{h}{2\pi}$$

This special case applies when the particle has a definite total energy (*E* in the equation). We'll consider the more general case (*E* has a probability distribution), and also 2D and 3D motion, later.

QM entities don't always have a definite energy.

Time does not appear in the equation. Therefore, $\psi(x,y,z)$ is a standing wave, because the probability density, $|\psi(x)|^2$, is not a function of time. We call $\psi(x,y,z)$ a "stationary state".

Notation: Distinguish $\Psi(x,y,z,t)$ from $\psi(x,y,z)$.