Spatial Eq$^{\underline{n}}$

$$-\frac{\hbar^2}{2M}\frac{1}{u(x)}\frac{d^2u}{dx^2} + V(x) = E \qquad \times \; u(x)$$

$$\boxed{-\frac{\hbar^2}{2M}\frac{d^2u}{dx^2} + V(x)u(x) = E\,u(x)}$$

Time-independent Schrödinger Eq$^{\underline{n}}$ (TISE)

- In general: still tricky to solve
  - In particular: TISE depends upon forces $V(x)$
  - 2nd order ODE
  - Depends upon parameter E

Separable Solutions to SE

Separable solutions have the form $\boxed{\psi(x,t) = Ae^{-iEt/\hbar}\, u(x)}$

where $u(x)$ satisfies TISE (w/ same E)

Stationary states

We call separable solutions to SE stationary states

Q: What is prob. density $P(x,t)$ for a stationary state?

$$P(x,t) = |\psi(x,t)|^2 = \psi^*(x,t)\psi(x,t)$$

[assume E is real]

$$= A^* \cancel{e^{+iEt/\hbar}}\, u^*(x)\, A\cancel{e^{-iEt/\hbar}}\, u(x)$$

$$= |A|^2\, |u(x)|^2$$

$\rightarrow$ this is independent of time!

$P(x,t)$ is independent of time i.e. stationary for stationary states.

SEE LATER

For stationary states all physical properties are independent of time.

e.g. position
momentum
energy
...

Note: wavefunction itself is NOT independent of time!

$$\psi(x,t) = Ae^{-iEt/\hbar}u(x)$$

Subtle