SO FAR:

- state described by wavefn. $\psi(x,t)$
- time evolution of wavefn determined by Schrödinger eqn:

$$i\hbar \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m}\frac{\partial^2 \psi}{\partial x^2} + U(x)\psi$$

↖ potl. energy of electron at x.

- states w. definite energy E have wavefns:

$$\psi(x,t) = \psi_E(x)\, e^{-i\frac{E}{\hbar}t}$$

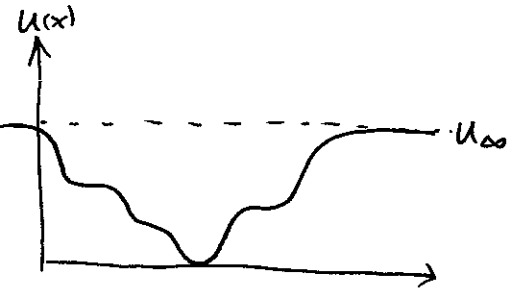
where

$$-\frac{\hbar^2}{2m}\frac{\partial^2 \psi_E(x)}{\partial x^2} + U(x)\psi_E(x) = E\,\psi_E(x)$$

TIME INDEP. SCHR. EQN.

QM general recipe:

step 1: determine potential energy fn $U(x)$ to specify problem



step 2: use the time indep. S.E. to find energy eigenstates

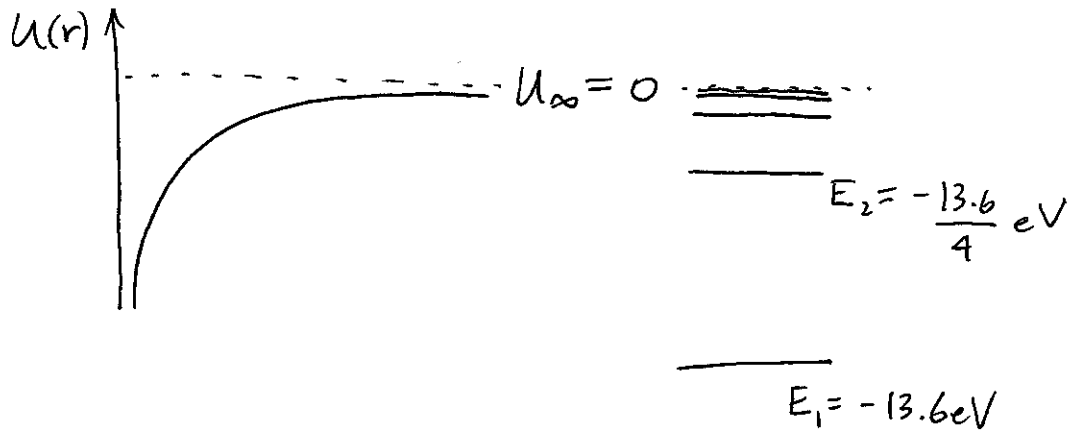
★ normalizible solns with $E < U_\infty$ exist only for specific energies ★

→ these are the wavefns for BOUND STATES.

★ bound state energies determine most observable properties of system ★

e.g. H atom

Bound state energies $E_n = \frac{-13.6\,eV}{n^2}$



* Discrete freqs. in atomic spectra explained by transitions $E_a \to E_b$ photon emitted w. energy $hf = E_a - E_b$

orbital sim

CLICKER

* There is a state of minimum energy *

$\Rightarrow$ Atoms are stable.

* Energy eigenstates are STATIONARY: $|\psi(x,t)|^2$ indep of time $\therefore$ no acceleration $\therefore$ no radiation.

SQ. WELL SIM $\to$ CLICKER.

General state: superposition of energy eigenstates

$\Rightarrow |\psi(x,t)|^2$ not indep. of time, but time dependence follows from time dep. of eigenstates

$$\psi(x,0) = \sum c_n \psi_{E_n}(x) \quad \Rightarrow \quad \psi(x,t) = \sum c_n \psi_{E_n}(x)\, e^{-\frac{iE_n}{\hbar}t}$$

simulation