APPROX eigen-SOLUTIONS to time-dep $\hat{H}(t)$ → go back to Schrödinger Equation

Recall: exact solution for NMR problem

... now: mostly approx methods where exact $\{\Psi_E(\vec{r},t)\}$ can't be found

... our focus will change from E-STATES $\Psi_E(\vec{r},t)$

to finding TRANSITION AMPLITUDES → TRANSITION PROB $\boxed{P_{if}}$ from $\underbrace{\Psi_i \to \Psi_f}_{\text{initial} \quad \text{final}}$

e-states of some t-indep version of $\hat{H}$

e.g. starting / ending $\hat{H}$ or dominant part of $\hat{H}$

Overview of methods:

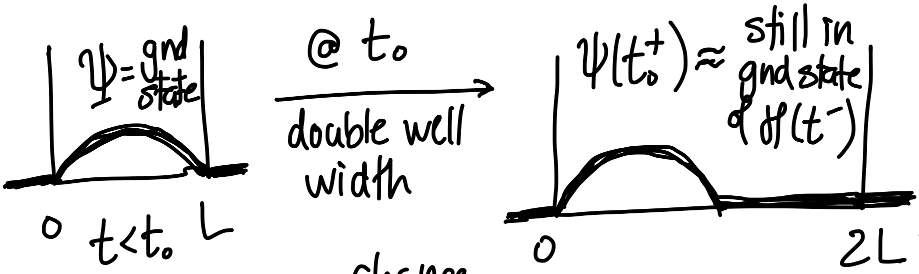
① **Sudden Approx**: $H_1 \xrightarrow[\Delta t]{} H_2$ (t-indep H_1, t-indep H_2)

where Δt of ΔH ≪ characteristic time scale T of Ψ, the state of the system

e.g. $T \simeq$ period of oscillating state

⇒ H changes so quickly @ some $t = t_0$ that

$$\Psi(t_0^+) = \Psi(t_0^-)$$ ie. Ψ momentarily unchanged!



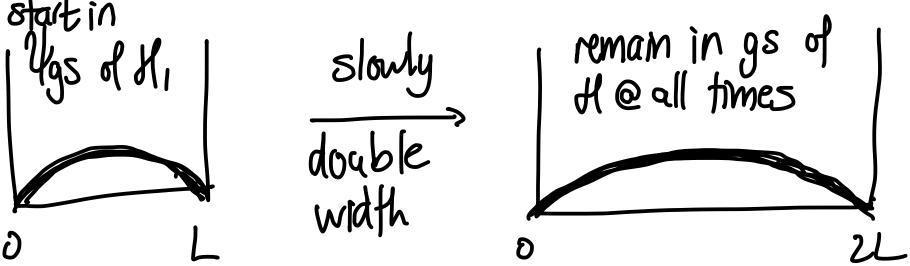
Intuition: circumstances change so quickly that particle "doesn't notice" for an instant

- Time-evolution of $\Psi(t)$ for $t > t_0$:
  project $\psi(t_0^+) = \psi(t_0^-)$ ONTO ψ_{E_n} of NEW $\mathcal{H}$; (double-sized well)
  each ψ_{E_n} gets t-dep factor $e^{-\frac{iE_n t}{\hbar}}$ as usual

2 ADIABATIC APPROX

$\underset{\text{t-indep}}{\mathcal{H}_1} \xrightarrow[\Delta t]{} \underset{\text{t-indep}}{\mathcal{H}_2}$ very slowly
i.e. $\Delta t \gg$ characteris. T

e.g. Thermo: change a system so slowly that it remains in equilibrium during the change



QM theorem (proof: Gr §10): If ψ starts in e-state $\#j$ of $\mathcal{H}_1$ then, after change $\mathcal{H}_1 \to \mathcal{H}_2$, ψ ends up in state $\#j$ of $\mathcal{H}_2$

3 TIME-DEPENDENT PERTURBATION THEORY

is its own subject $\rightarrow$ next time!