





③

- Rabi oscillation

- de coherence

$$P_g = \frac{1}{2} \left[ 1 + \frac{(\omega - \omega_0)^2}{\Omega^2} \right] + \frac{1}{2} \frac{\Omega^2}{\Omega^2} \cos(\Omega t)$$

$$P_e = \frac{\left( \frac{\Omega_0^2}{\Omega^2} \right) \sin^2 \left( \frac{\Omega}{2} t \right)}{1 - \frac{\Omega_0^2}{\Omega^2} \cos^2 \left( \frac{\Omega}{2} t \right)}$$

$$T = \frac{2\pi}{\Omega} \left( E_g P_g + E_e P_e \right)$$

$$\Omega = \sqrt{\Omega_0^2 + (\omega - \omega_0)^2}$$

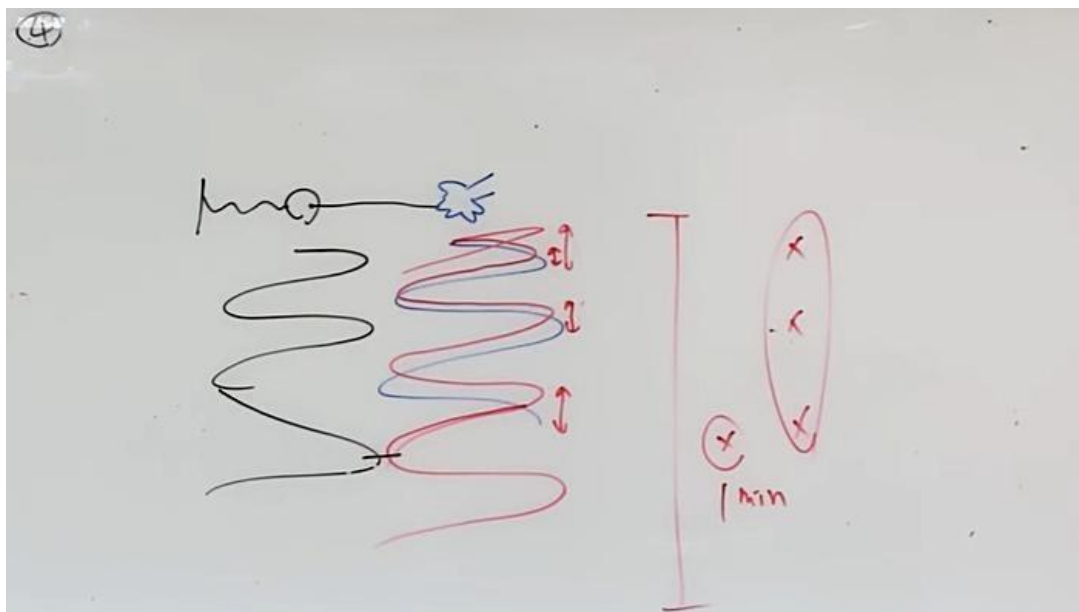
generalized Rabi frequency

Rabi frequency

detuning

$\Omega_0 \propto \langle e | \hat{H} | g \rangle$

$R_{HW}$





⑤  $P_e$

full coherence      decoherence transition      incoherent

50%

partial coherence

optical Bloch equation

$\frac{du}{dt} = -\frac{1}{T_1} u - \Delta v$

$\frac{dv}{dt} = -\frac{1}{T_2} v + \omega u + \Omega w$

$\frac{dw}{dt} = -\frac{1}{T_1} (w - w_{ss})$

$\frac{dN_e}{dt} = -\gamma N_e + \gamma N_g$

$\frac{dN_g}{dt} = -\gamma N_g + \gamma N_e$

$N_e = \frac{N_0}{2} (1 - e^{-\gamma t})$

$N_g = \frac{N_0}{2} (1 + e^{-\gamma t})$

$\frac{d(N_e - N_g)}{dt} = -\gamma (N_e - N_g)$

dynamical equilibrium

$N_e = N_g$

$N_e + N_g = N_0$

$\rightarrow N_e = N_g = \frac{N_0}{2}$

$|g\rangle$   $|e\rangle$

$N_0$

$\gamma$

$\gamma$

$\omega$

$\Omega$

$\Delta$

$(u, v, w)$

✓ - Rabi oscillation

✓ - decoherence