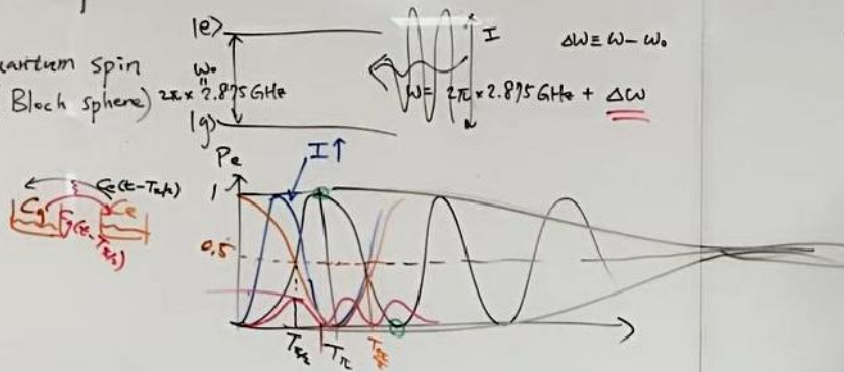




Lecture6 Ramsey interferometry

- Ramsey Interferometry

- classical and quantum spin (Bloch sphere)



(2)

$$C_g(t) = e^{-i\Delta t/2} \left[\cos\left(\frac{\Omega t}{2}\right) + \frac{i\Delta}{\Omega} \sin\left(\frac{\Omega t}{2}\right) \right] C_g(0) + \frac{i\Omega_R}{\Omega} e^{-i\phi} \sin\left(\frac{\Omega t}{2}\right) C_e(0)$$

$$C_e(t) = e^{i\Delta t/2} \left[\frac{i\Omega_R}{\Omega} e^{i\phi} \sin\left(\frac{\Omega t}{2}\right) C_g(0) + \left(\cos\left(\frac{\Omega t}{2}\right) - \frac{i\Delta}{\Omega} \sin\left(\frac{\Omega t}{2}\right) \right) C_e(0) \right]$$

$$\Delta \equiv \omega - \omega_0$$

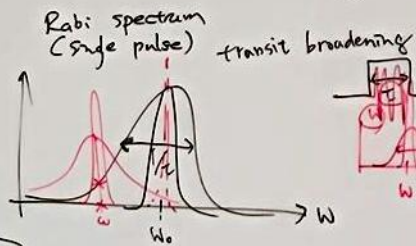
$$\Omega_R = \frac{|V_{me}|}{\hbar}$$

$$\Omega = \sqrt{\Omega_R^2 + \Delta^2}$$

ϕ = microwave initial phase

$$H_{int} \propto e^{-i\omega t + i\phi}$$

τ = pulse duration





(4)

$$C_g(t) = e^{-i\Delta t/2} \left[\cos\left(\frac{\Omega T}{2}\right) + \frac{i\Delta}{\Omega} \sin\left(\frac{\Omega T}{2}\right) \right] C_g(0) + \frac{i\sqrt{\Omega}}{\Omega} e^{i\phi} \sin\left(\frac{\Omega T}{2}\right) C_e(0)$$

$$C_e(t) = e^{i\Delta t/2} \left[\frac{i\sqrt{\Omega}}{\Omega} e^{i\phi} \sin\left(\frac{\Omega T}{2}\right) C_g(0) + \left(\cos\left(\frac{\Omega T}{2}\right) - \frac{i\Delta}{\Omega} \sin\left(\frac{\Omega T}{2}\right) \right) C_e(0) \right]$$

emission ($|e\rangle \rightarrow |g\rangle$)

absorption

$\Delta(\omega \mp T)$

$|g\rangle \xrightarrow{\frac{1}{\sqrt{2}}} \frac{1}{\sqrt{2}}(|g\rangle + |e\rangle)$

$|g\rangle \xrightarrow{\frac{1}{\sqrt{2}}} \frac{1}{\sqrt{2}}(|g\rangle - |e\rangle)$

$|e\rangle \xrightarrow{\frac{1}{\sqrt{2}}} \frac{1}{\sqrt{2}}(|g\rangle + |e\rangle)$

$|e\rangle \xrightarrow{\frac{1}{\sqrt{2}}} \frac{1}{\sqrt{2}}(|g\rangle - |e\rangle)$

$P_e = \frac{1}{4} (1 + 1 - e^{i\Delta(t+T)} - e^{-i\Delta(t+T)}) = \frac{1}{2} (1 - \cos(\Delta(t+T))) = \sin^2\left(\frac{\Delta(t+T)}{2}\right)$

✓ - Ramsey interferometry

- classical and quantum spin (Bloch sphere)