Cavity Quantum Electrodynamics (cQED)

2g = vacuum Rabi freq.
\( \kappa = \) cavity decay rate
\( \gamma = \) “transverse” decay rate
\( t = \) transit time

Strong Coupling = \( g > \kappa, \gamma, 1/t \)

Jaynes-Cummings Hamiltonian

\[ \hat{H} = \hbar \omega_r (a^\dagger a + \frac{1}{2}) + \frac{E_{el}}{2} \hat{\sigma}_x - \frac{E_J}{2} \hat{\sigma}_z - \hbar g (a^\dagger \sigma^- + \sigma^+ a) \]

Quantized Field

2-level system

Electric dipole Interaction