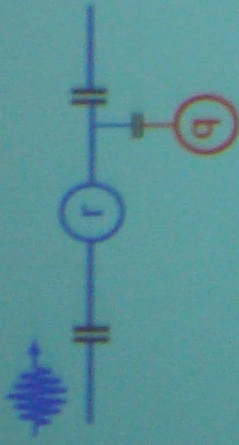
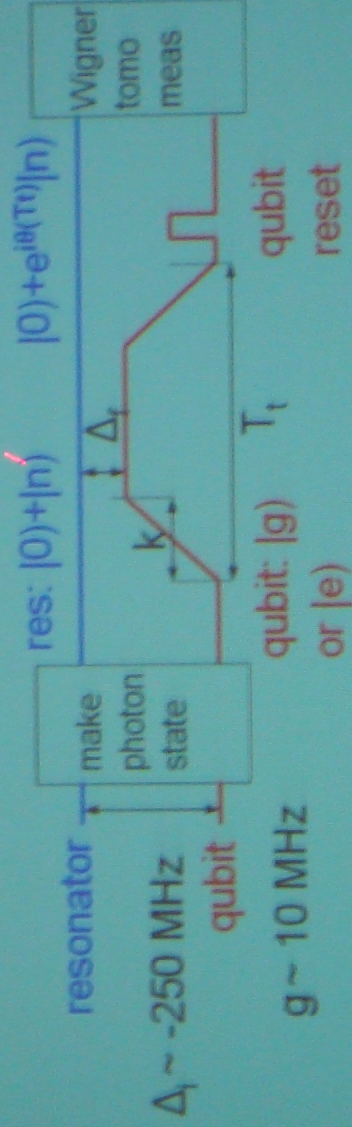


Nonlinear circuit QED : dynamic process



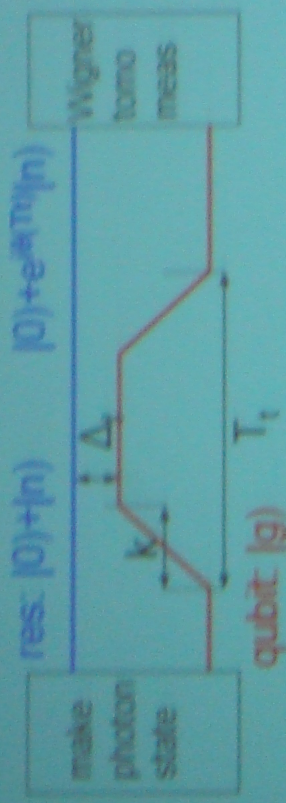
- fix detuning Δ : when photons enter the resonator, coupling is suddenly turned on
- $(g/\Delta)^2$ probability to demolish qubit state

- put photons in, adiabatically tune Δ :

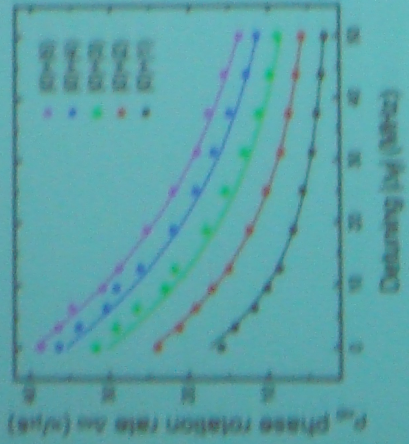


- adiabatic procedure: no energy exchange in final state
- accumulated phase shift: $\Delta E(t) = E_{|n, \sigma_z\rangle}(t) - E_{|0, \sigma_z\rangle}(t)$
 $\theta(T_t) = -\frac{1}{\hbar} \int_0^{T_t} [\Delta E(t) - \Delta E(0)] dt$

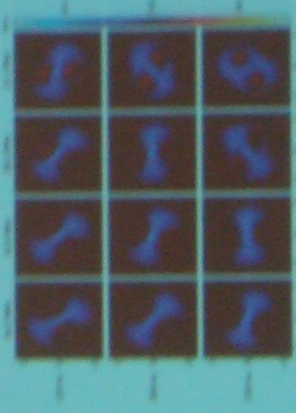
Conclusions



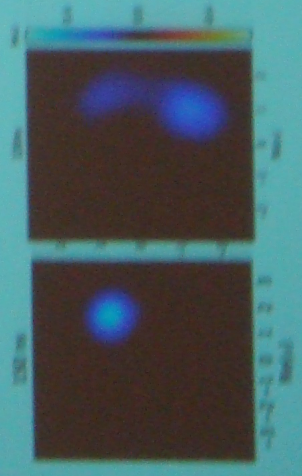
- dynamic adiabatic procedure to measure the phase shift



- measure phase and freq. shift in a broad regime extend to strongly nonlinear regime



- dispersive regime linear to nonlinear crossover



- coherent state phase shift induced by |g> or |e>