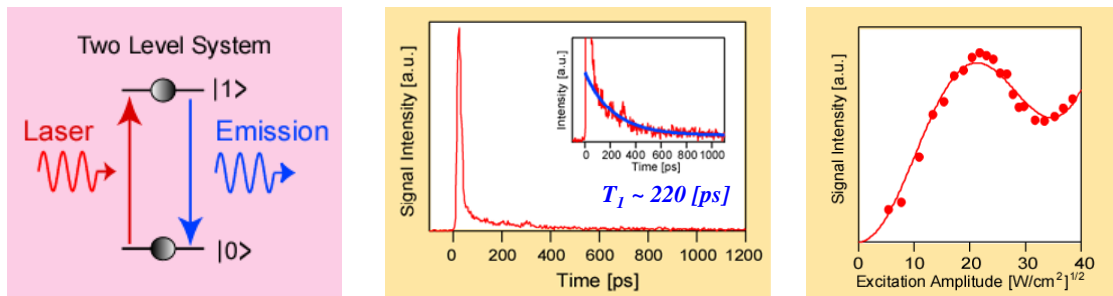


Excitonic Rabi Oscillation of GaAs Quantum Dots

By observing the Rabi oscillation by resonant excitation with pico second laser pulses, we verified the one-qubit operation (rotation gate) with the exciton level of a single GaAs quantum dot. Because we do not need a transition to the third electronic level, which was used in conventional methods, for observing the upper level population in the final state, as shown in the left panel of the figure, no extra decoherence takes place. Thus, we can fully use the genuine decoherence time of exciton, so, for example, there is a merit that we can repeat quantum operations for the maximum times. As shown in the middle panel, a spike around the time origin that is caused by reflection of an excitation laser pulse overlaps the genuine emission that decays exponentially in the temporal profile of the single dot emission. By measuring the genuine emission intensity in the tail part as a function of the excitation pulse intensity, we obtained the result shown in the right panel. Although there is a background due to incoherent processes, variation of emission intensity due to the Rabi oscillation was clearly observed.



(Left) resonant excitation of a two-level system by a laser pulse and subsequent light emission, (middle) time-resolved emission of a GaAs single quantum dot, and (right) its excitonic Rabi oscillation. The red line is a theoretical curve. Sample temperature is 4K. K. Kuroda et al., Appl. Phys. Lett. **90**, 051909 (2007).