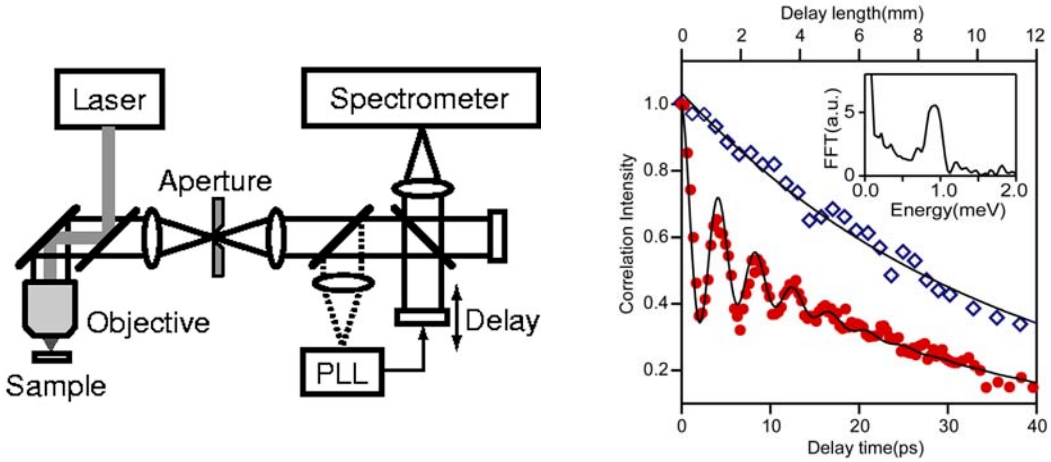
High-Resolution Micro Photoluminescence Spectroscopy

Excitonic emission of GaAs single nanostructures at low temperatures has a phase relaxation time as long as several hundred pico seconds, so accurate measurement of its spectral shape is difficult with a monochromator. Thus, as shown in the left panel of the figure, we made a Mickelson interferometer for the micro photoluminescence measurement whose optical path length is stabilized by a phase-lock loop (PLL), and achieved a high resolution (about 10 μeV) by the Fourier spectroscopy technique. The right panel of the figure shows an example of measurements by this apparatus. The blue line is an interferogram of excitonic emission for weak excitation, whereas the red line is that of a superimposed signal of exciton and exciton molecule for strong excitation. By Fourier transformation, we obtain an exciton emission peak at the origin and an additional emission peak of exciton molecules apart by 0.9 meV. Temperature dependence of the width of the emission peak measured by this apparatus at 4 to 50 K revealed that the spectral diffusion caused by the interaction with photo carriers in the barrier layer is the main origin of the spectral width in this temperature range.



(Left) Mickelson interferometer stabilized by a phase-lock loop for the micro photoluminescence measurement and (right) interferograms of emitted light of a single quantum dot for weak excitation (blue diamond) and strong excitation (red circle). The inset is the Fourier transform of the latter. K. Kuroda et al., J. Lumin. **122**, 789 (2007).