Low Temperature GaAs (LT-GaAs) Experimental Results (2012.07.13-20, 30)
Preparation for pump & probe measurement

Reflectance spectra measurement: we could not observe the reflectance peak.

PL spectra measurement: PL spectra were observed between 810 and 845 nm.

Pump & probe measurement (10 K)

- We have observed 0.6-1.6 picosecond decay at 822 nm excitation wavelength. This fast decay can be attributed to non-radiative recombination induced by low temperature growth.

- Two kinds of time-resolution were used; high time resolution (1 step = 0.07 ps) for short time span (25 ps) and low time resolution (1 step = 1.67 ps) for long time span (800 ps). High time resolution is more reliable for measuring sub-picosecond decay time.

- We also measured the decay time at 826 nm excitation wavelength. The tendency of excitation power dependence measured on July 30 was different from that measured on July 20.
Sample Low Temperature GaAs

LT-GaAs-01

GaAs (1 μ m)
undoped

GaAs substrate
Reflectance spectra measurement

(Low Temperature GaAs)
Reflectance spectra (RT, 10 K)

Low Temperature GaAs

Reflectivity intensity (arb. units)

Wavelength (nm)

2012.07.13

2012.07.18

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PL spectra measurement

(Low Temperature GaAs)
**Experimental Setup**

- **PL spectra measurement** *Low Temperature GaAs*

Cryostat (10 ~ 100 K)

Sample

Ti : Sapphire laser (CW)

$\lambda = 778 \text{ nm}$

Spectrometer

Photomultiplier
PL spectra measurement
Excitation Power Dependence
(10 K) (Low Temperature GaAs)
PL spectra (10 K)
Low Temperature GaAs

Intensity (arb. units)

Wavelength (nm)

2012.07.20

10 mW
5 mW
3 mW
PL spectra (10 mW)
Low Temperature GaAs

Intensity (arb. units)

Wavelength (nm)

2012.07.20

Intensity (arb. units)

Wavelength (nm)

2012.07.20
pump & probe measurement (cross)

(Low Temperature GaAs)
To avoid the observation of coherent artifact, we used the linear orthogonal polarization (cross). Both pump and probe beams are linear polarization, but they are orthogonal.
822 nm, 70 mW-14 mW
Low Temperature GaAs

Double exponential fitting:

\[ I(t) = ae^{-\frac{t}{\tau_1}} + be^{-\frac{t}{\tau_2}} \]

Fast: 0.6 ps
Slow: 22 ps
a:b=58:42
822 nm, 50 mW-10 mW

Low Temperature GaAs

High time resolution
(1 step = 0.07 ps, time span = 25 ps)

Fast: 1.5 ps
Slow: 27 ps
a:b=61:39
In room temperature, lifetime should be faster, which can be <1ps