Unit for the development of terahertz sensing and imaging systems

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Members of the unit

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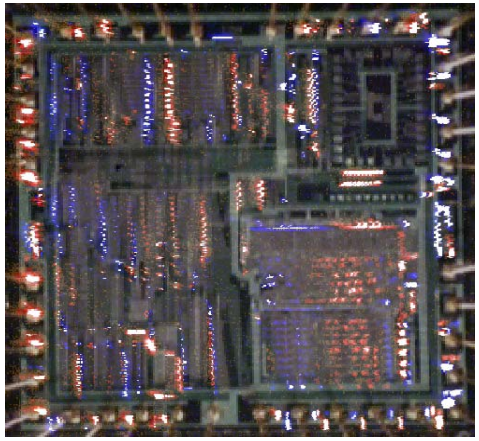
Iwao Hosako

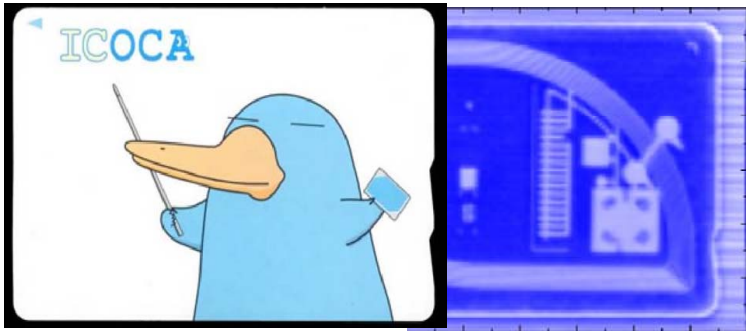
Application for THz sensing and imaging

－Technology for a secure and safe society－

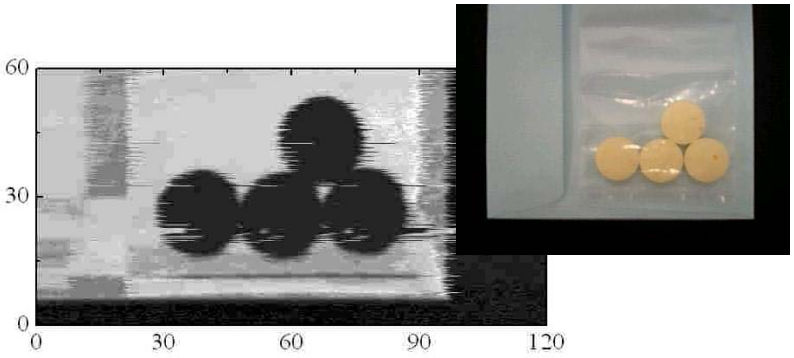
Microprocessor analysis



IC card

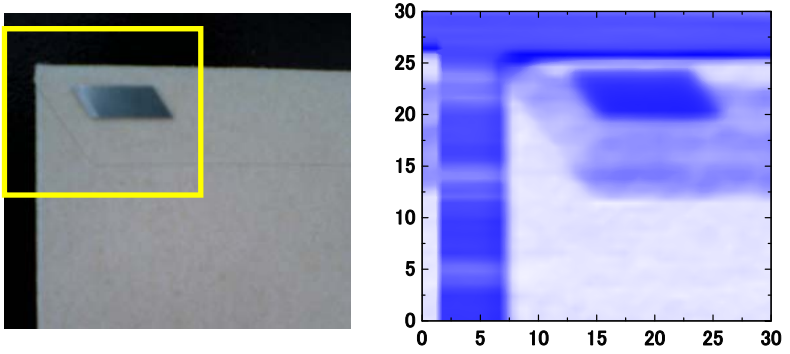


Drug inspection



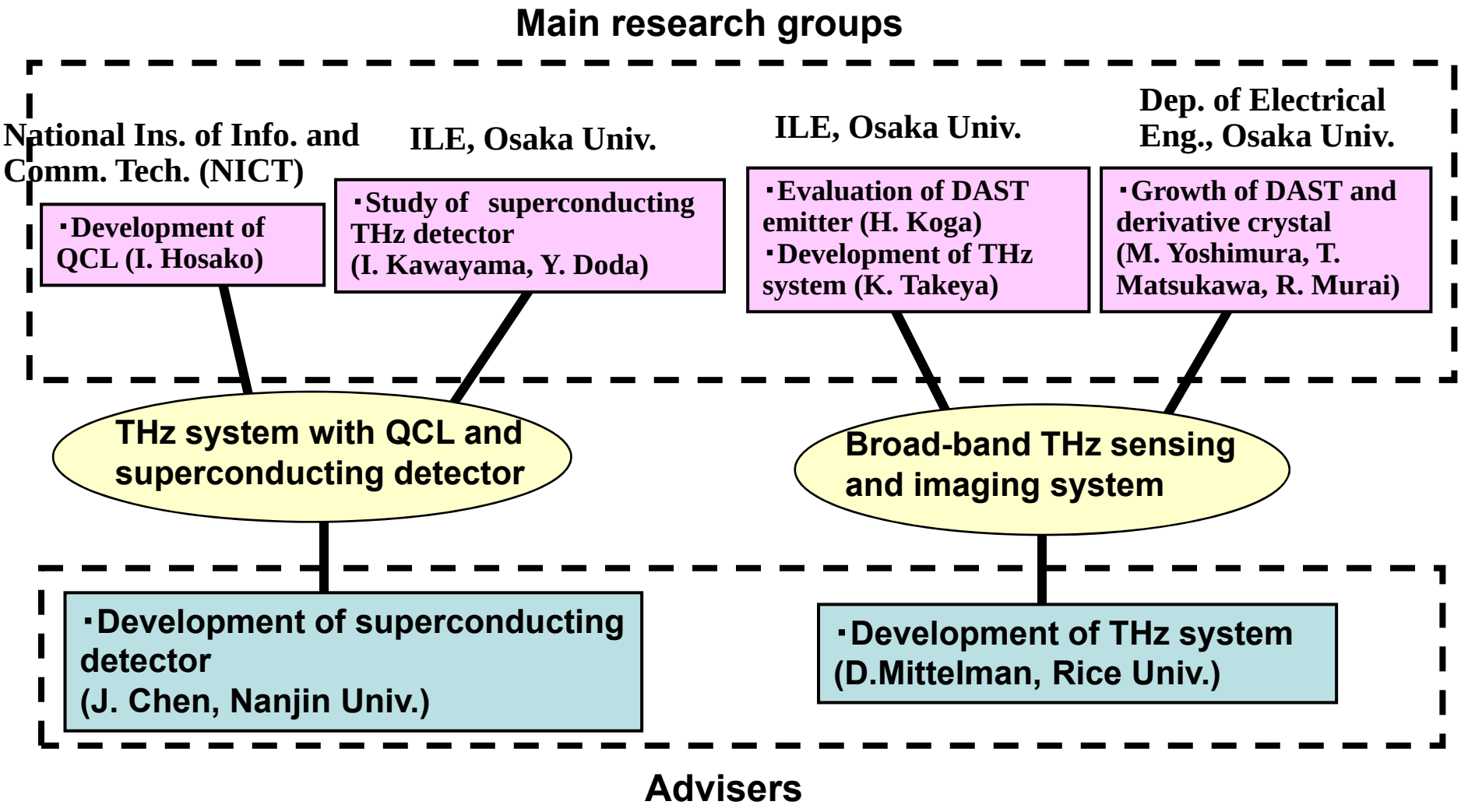
Tablets in a envelope

Security check



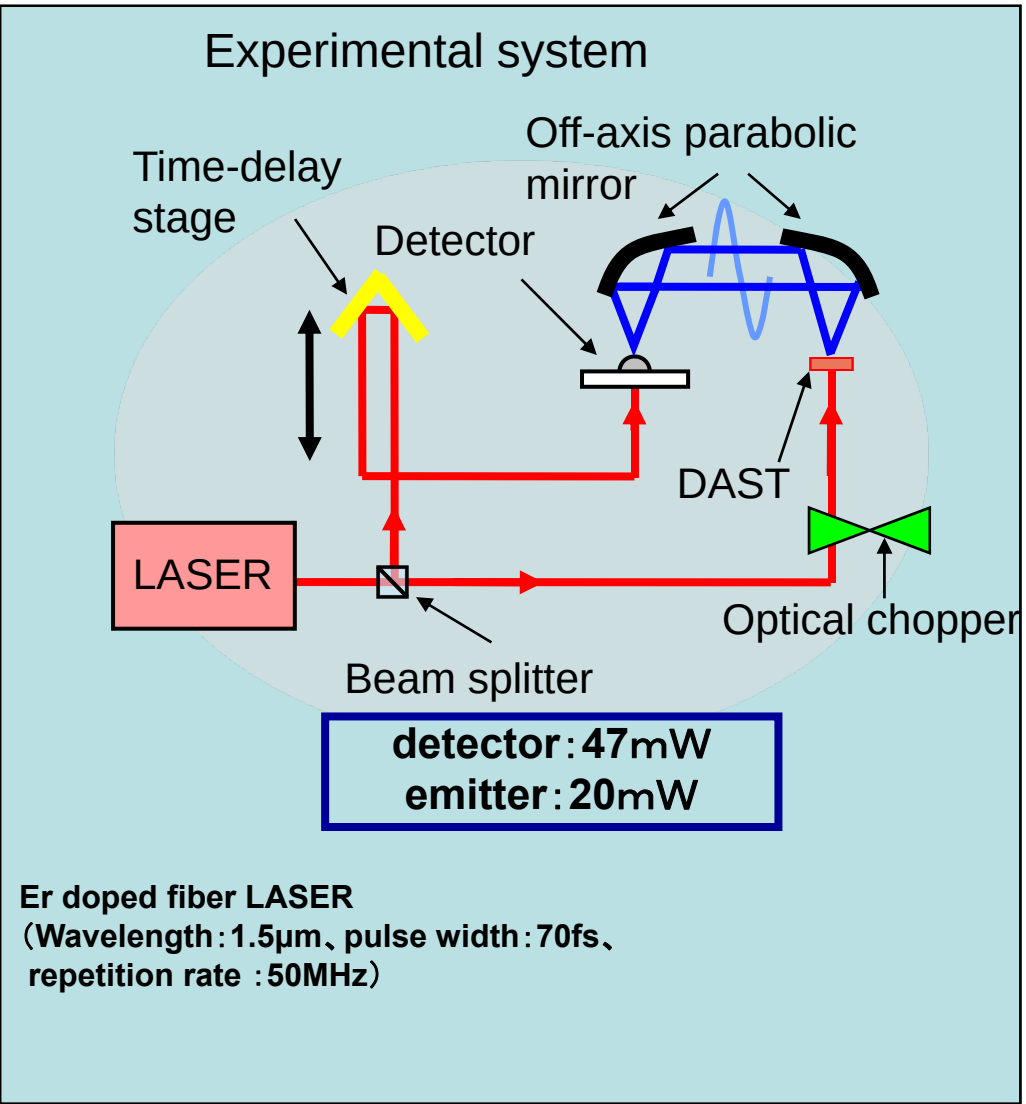
Cutter knife in a envelope

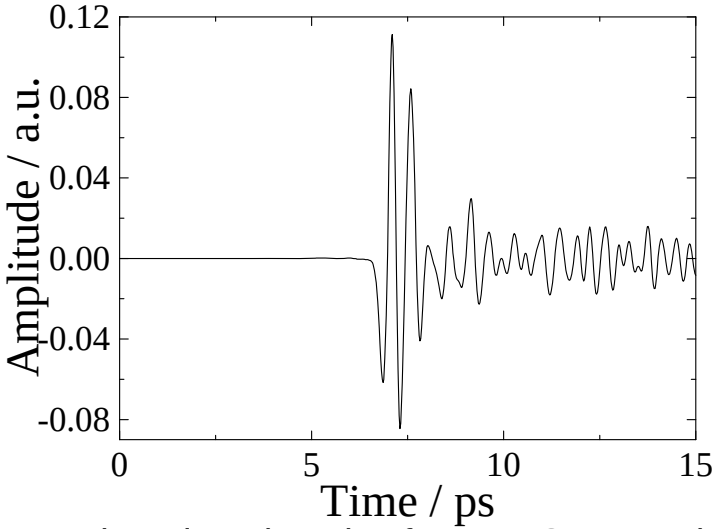
Organization chart of the THz research unit



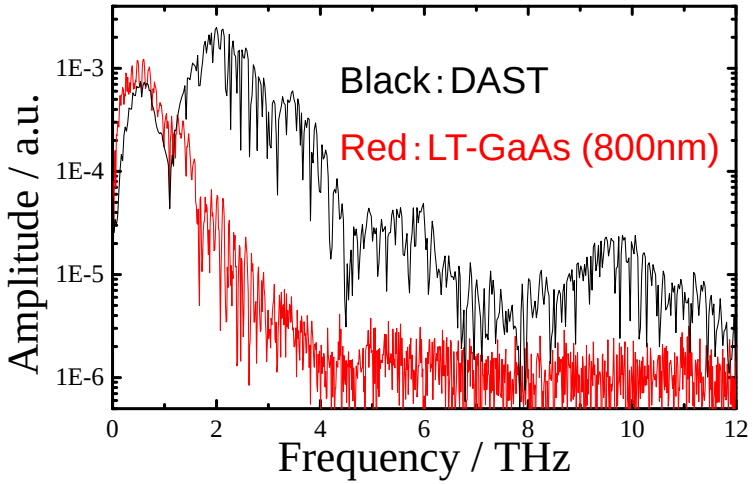
Broad-Band THz Spectroscopy

Observation and application of THz waves at high frequency region (over 4 THz) using DAST crystal (4-dimethylamino-N-methyl-4 stilbazolium tosylate).



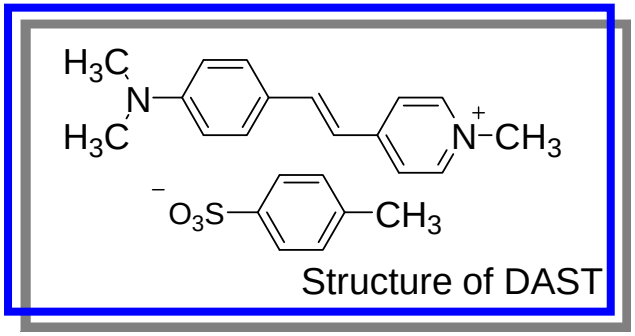


Time domain pulse from DAST crystal



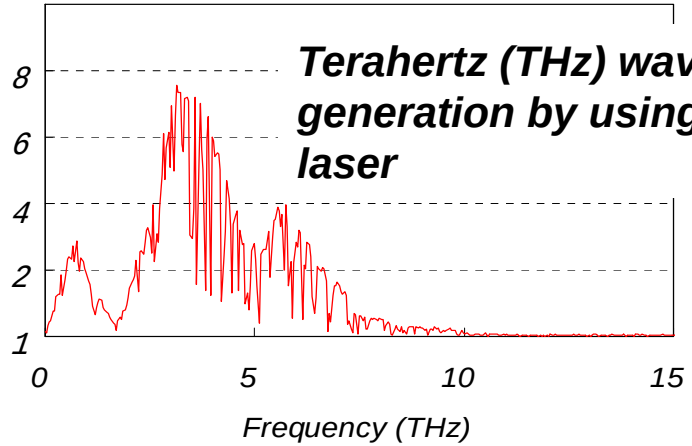
Amplitude spectra from DAST (Black) and LT-GaAs (Red)

Growth of DAST derivatives for THz emitter



Structure of DAST


DAST single crystal
(3.0 × 2.5 × 0.362 mm^3)



DAST crystals is expected as a candidate for broadband THz-wave source.

However,

(1)Absorption around 1.1 THz ・・・ it is important to apply the imaging, and so on

(2) Recently the crystal growth of DAST derivatives and the properties of THz-wave generation have been reported.

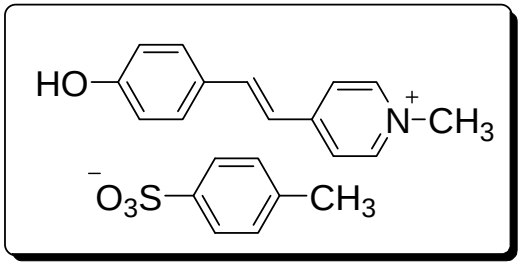
We attempt to develop new DAST derivatives for THz-wave generation.

- ***No absorption around 1.1 THz***
- ***Generation of high-power and broadband THz wave***

Approach

1.New DAST derivatives

Ex.



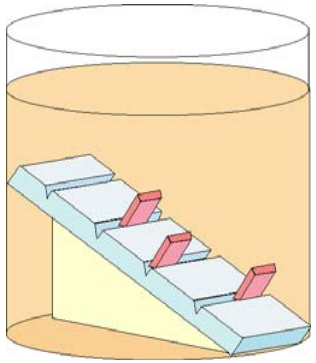
MC-*p*TS

Okada lab. (Yamagata Univ.)

Umezawa lab. (FNCT)

2.Crystal growth

Mori lab.



Slope Nucleation Method (SNM)

Fig. 1 single crystal of MC-*p*TS

3.THz wave generation

Tonouchi lab.

THz-wave application

Development of a New Technique for the Crystal growth

Research of the Mechanism of Femtosecond Laser-induced Nucleation

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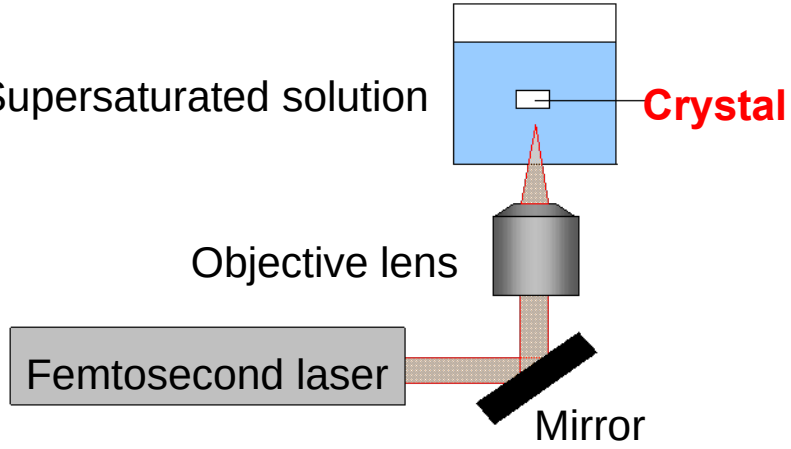
Laser Irradiated Growth Technique

We irradiate supersaturated solution with femtosecond laser, and induce nucleation actively.



Successful examples

organic molecules
- urea
- anthracene
- DAST

biomacromolecule
- water-soluble protein lysozyme
- membrane protein AcrB

We can grow crystals at low supersaturation → high quality crystals

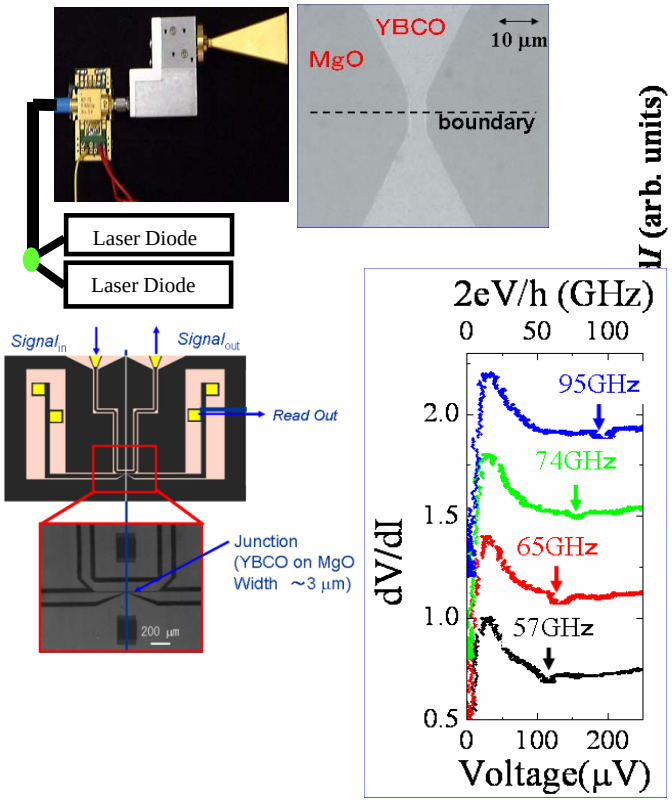
The optimum laser irradiation condition is not determined
Some samples did not crystallize by laser irradiation

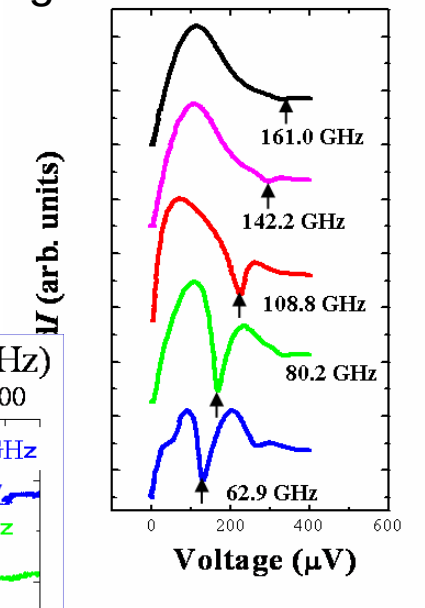
➡ **Clarify the mechanism of Laser Irradiated Growth Technique and optimize laser irradiation condition**

Superconducting THz detector

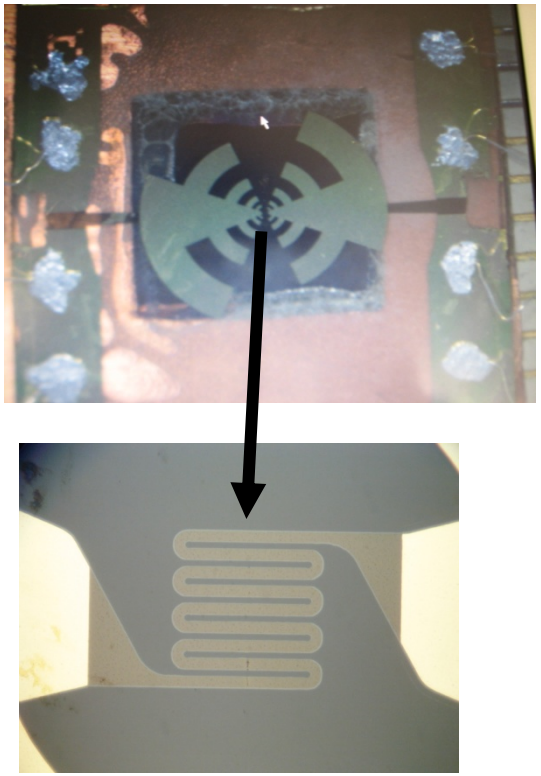
Previous Researches

- Detection of Photomixing Signals -





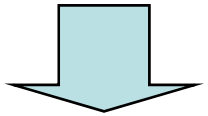
Log-periodic Antenna
with Josephson Array



Introduce Quantum Cascade Laser (QCL) that should be powerful THz source for high speed imaging systems

Plans

- Broad-band THz-TDS with DAST
- Growth of DAST derivatives as the candidates of new THz emitters
- Superconducting THz detectors
- Imaging system with QCL



New THz sensing and imaging systems

(Broad-band, High sensitivity, High speed etc.)