Optical layout of time-resolved THz spectroscopy setup

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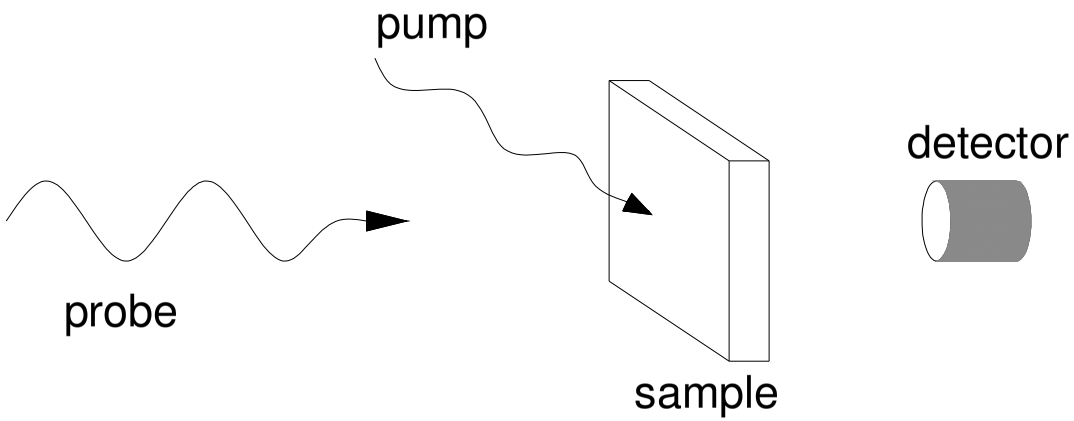
Pump-probe (time-resolved) measurements

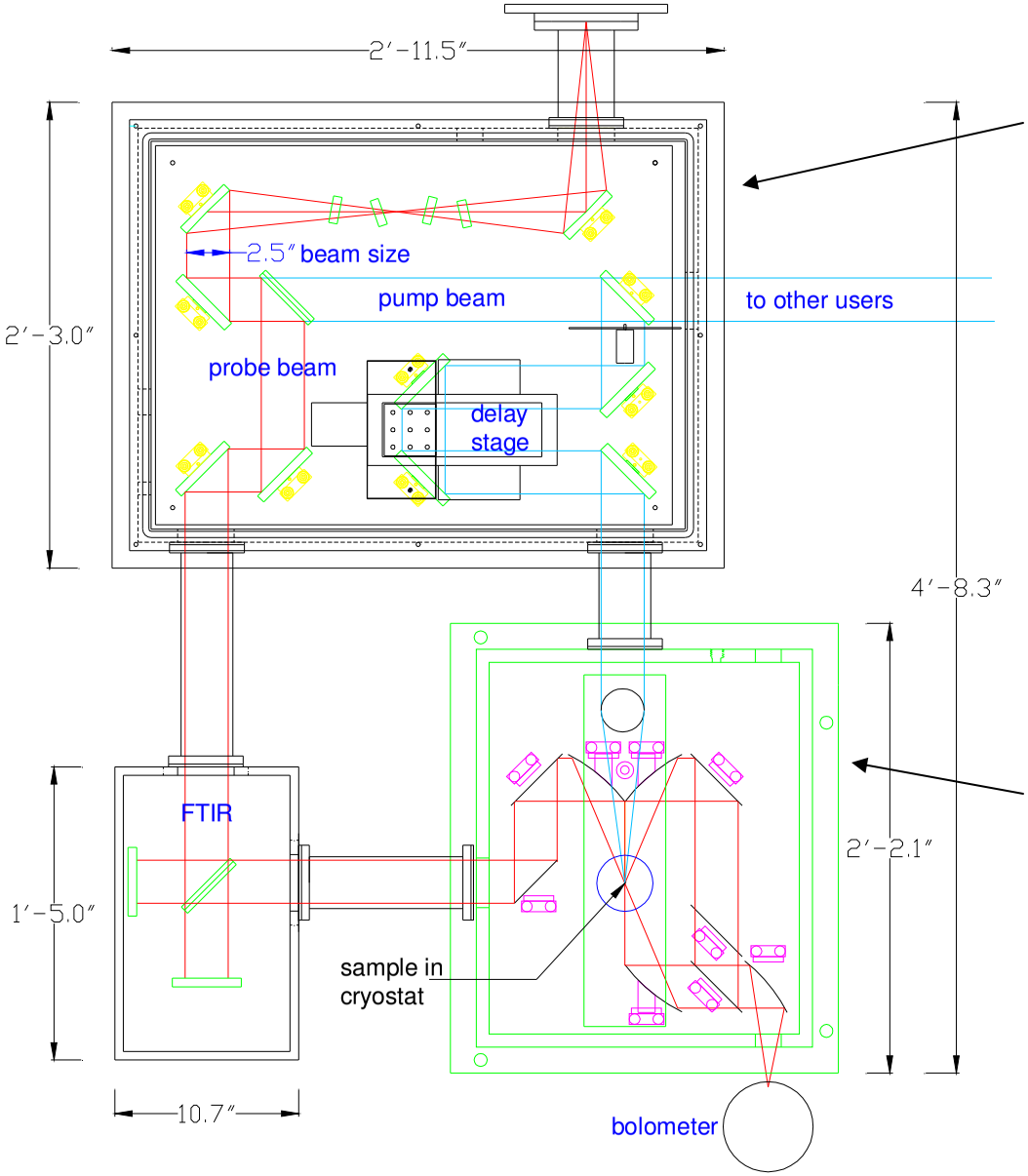


Motivation

study low-energy excitations in solids: collective modes in charge-ordered materials, spin resonances, dynamics of high-T_c superconducting materials

→ use THz light both as pump and probe

Setup for single-color pump-probe measurements



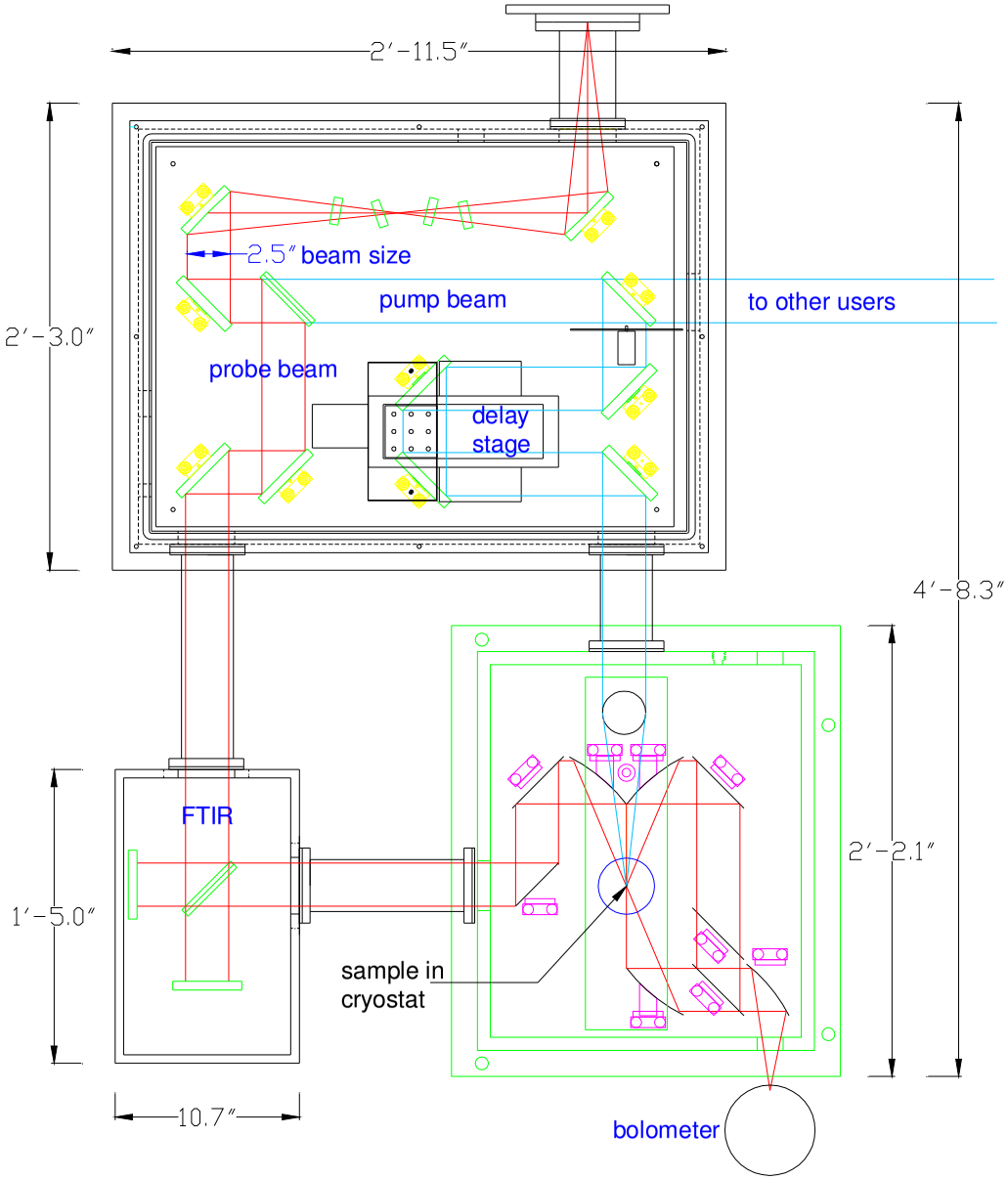
Beam-conditioning chamber:

- Collimate the beam
- Reduce beam power
- Split beam into pump and probe
- Change and modulate the probe delay
- Supply beam to other users

Sample chamber:

- focus beam on sample in cryostat
- deliver reflected or transmitted light to the detector

Setup for single-color pump-probe measurements

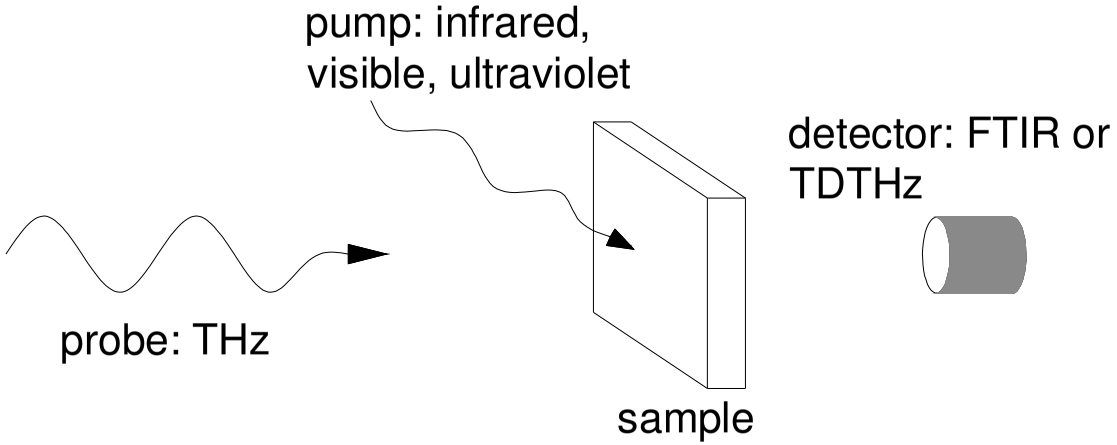


To modulate the pump signal:

1. Set pump-probe delay to Δt, take a set of scans.
2. Change pump-probe delay to $\Delta t+\delta t$, take another set of scans
3. Repeat 1 and 2 several times and take the difference between the two sets of data

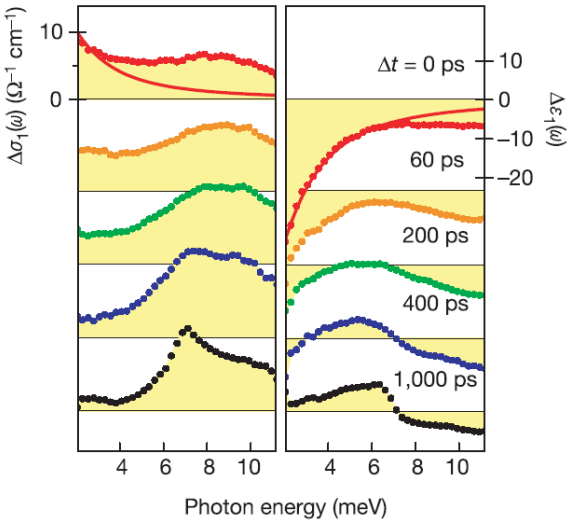
Lobo et al, Rev. Sci. Instr. **73**, 1 (2002)

Other possible experiments



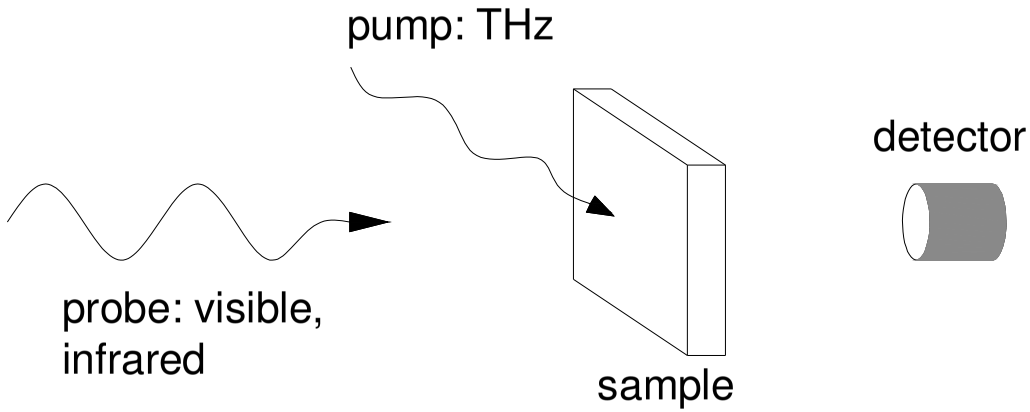
Recent examples:

- exciton dynamics
- carrier dynamics in liquids
- dynamics of superconductors



From R. A. Kaindl et al., Nature **423**, 734 (2003)

Other possible experiments



• modification of interband optical properties by intense THz fields

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• equilibrium THz spectroscopy – high-T_c superconductors, electronic states in bulk and nanoscale semiconductors, spin resonance, collective excitations