Applications of THz Wave

- Terahertz modulation and switching
- Chemical, biochemical, and astrobiological detection and sensing
- Materials and security inspection
- High bandwidth, energy efficient, secure data link
- ..., many more applications

Introduction: Whys

- Why Intersubband?
  - Long wavelength generation
  - Diminished Auger processes
  - Large transition matrix elements

- Why Sb-QWs? (unique bandedge lineups)
  - Flexibility in wavelength design
  - Deep conduction band Wells allowing NIR (diode) laser pumping

Introduction: Whys

- Why optical pumping?
  - Less reliant on population inversion
  - Utilization of resonant nonlinearities
  - Lower carrier concentration and lower free carrier absorption
  - Absence of heavily doped layers for contacts and injectors
  - Potential integration if diode lasers used as pumping

Introduction: Present Approach

- CO₂ laser pumped GaAs/AlGaAs QWs emitting 15.5 mm (Paris-Sud)

- FIR Generation by Double-Resonant DFG (Lucent)
Proposed Solution:
Diode Laser Pumped QW-Intersubband Based THz Sources

Raman Enhanced Optical Gain

THz Laser Gain in InGaAs/InP/AIAsSb Quantum Wells

Diode-Laser Pumped Difference Frequency Generation (InGaAs/InP/AIAsSb QWs)
InAs/GaSb/AlSb Quantum Wells

InAs/AlSb Double QWS: DFG Scheme

InAs/AlSb Triple QWs: Laser Scheme