ETH zürich

Quantum Optoelectronic group

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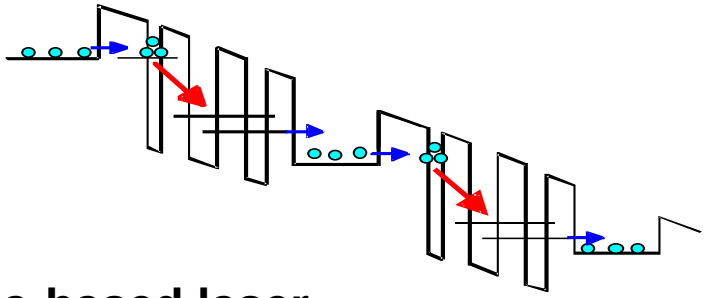
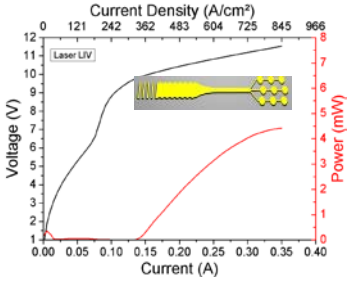
Key activities: THz QCL sources



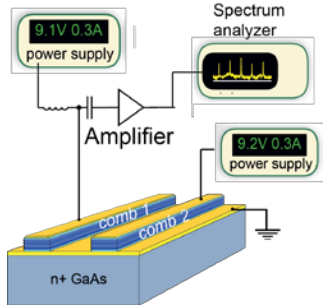
- Single mode and comb THz QCLs
  - High spectral purity, high brightness
  - Towards self-referenced comb chip sources
  - Goal: operation on a Peltier
- Key assets
  - Growth, processing, design
  - NEGF based optimization

Antenna-based laser



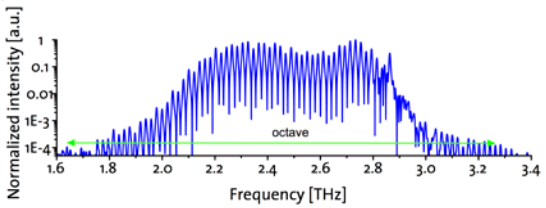
L. Bosco, et al., G.S., J.F. Appl. Phys **109**, p 201103 (2016)

On-chip dual comb



M. Rösch, et al., G.S, J.F.,
Appl. Phys. Lett vol. **108**, p. 171104, 2016.

Octave spanning gain



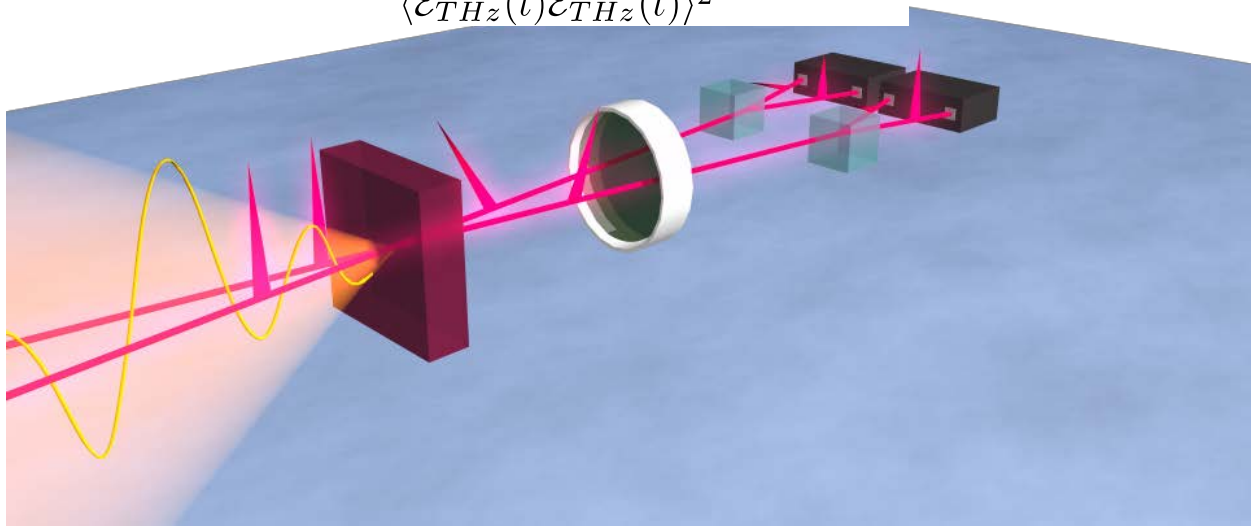
M. Rösch, G. Scalari, M. Beck, and J. Faist,
Nature Photonics, vol. 9, no. 1, pp. 42–47, 2015.

Electric field correlation measurements in the THz

Use of electro-optic sampling to perform light electric field correlation measurements

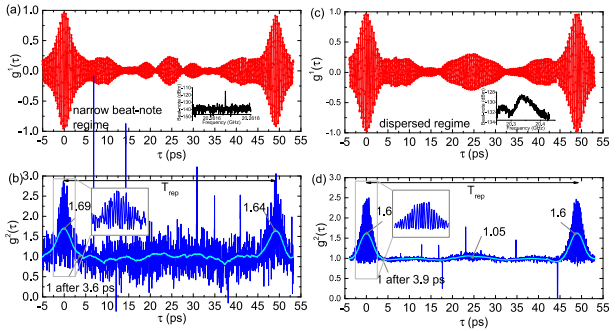
$$g^{(1)}(\tau) = \frac{\langle \mathcal{E}_{THz}(t)\mathcal{E}_{THz}(t+\tau)\rangle_t}{\sqrt{\langle \mathcal{E}_{THz}(t)^2\rangle_t \langle \mathcal{E}_{THz}(t+\tau)^2\rangle_t}}$$

$$g^{(2)}(\tau) = \frac{\langle \mathcal{E}_{THz}(t)\mathcal{E}_{THz}(t)\mathcal{E}_{THz}(t+\tau)\mathcal{E}_{THz}(t+\tau)\rangle}{\langle \mathcal{E}_{THz}(t)\mathcal{E}_{THz}(t)\rangle^2}$$



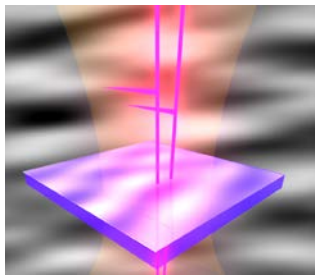
I-C Benea-Chelmus et al, *Phys. Rev. A* **93,** 043812 (2016)

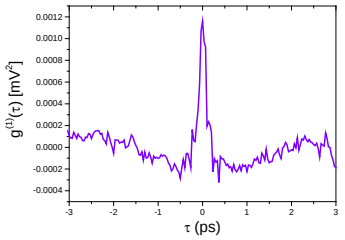
Comb QCL characterization

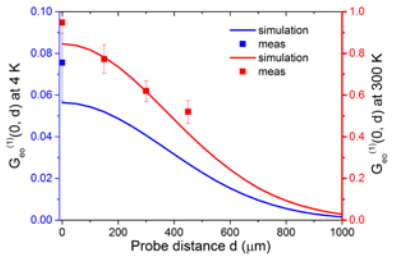


I.-C. Benea-Chelmus, et al., JF, *Phys Rev A*, vol. 96, no. 3, pp. 033821–8, Sep. 2017.

Thermal light correlations



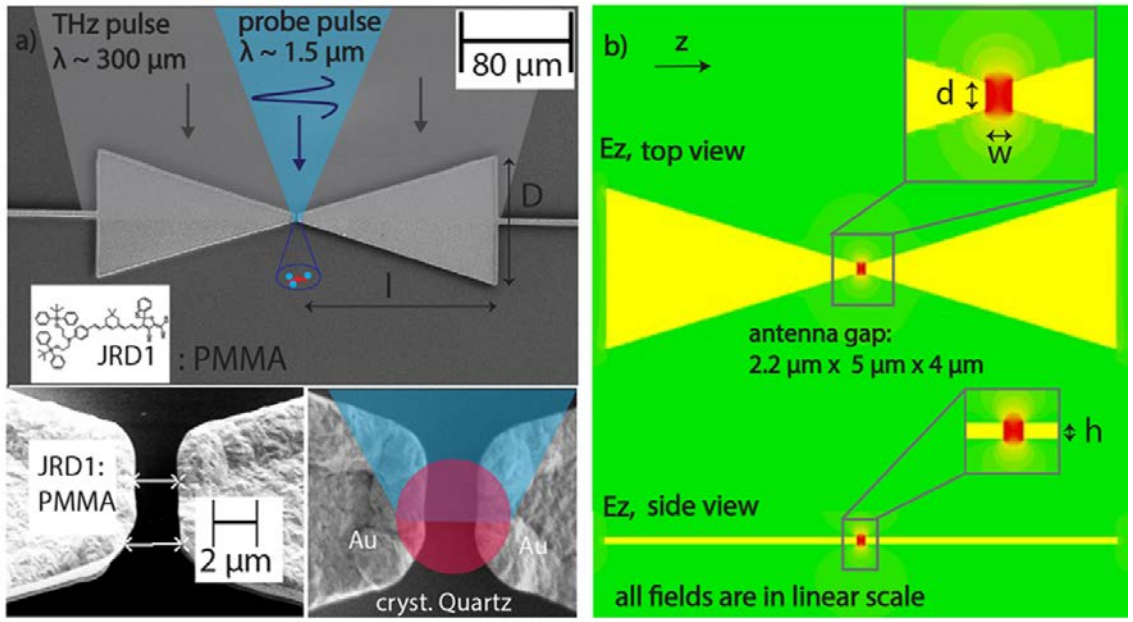


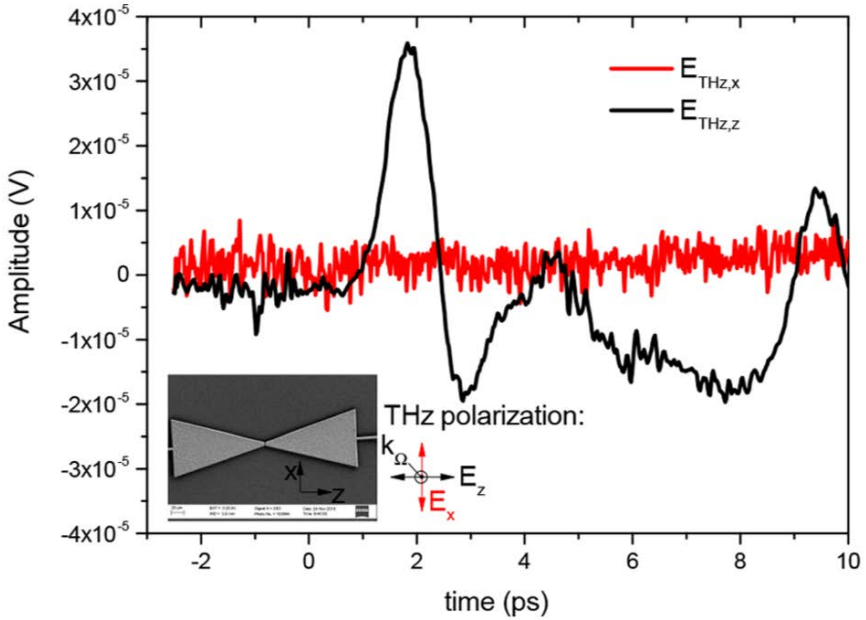


Path to quantum optics

High sensitivity THz field detectors

- Sensitivity from very high electro-optic coefficient of chromophores in an Antenna





I.-C. Benea-Chelmus, et al., J.F, *ACS Photonics*, vol. 5, no. 4, pp. 1398–1403, Apr. 2018.

Integrated, telecom- photonics based approach: Group of J. Leuthold, ETH