15TH INTERNATIONAL CONFERENCE ON MID-INFRARED OPTOELECTRONIC MATERIALS AND DEVICES (MIOMD)

## Online event

The Mid-Infrared Optoelectronic Materials and Devices (MIOMD) conference was established in 1996 and organised by Professor Tony Krier at Lancaster University. The conference has since become an established international conference series focusing on the latest developments in the field.

# Key dates

- Original abstract submission deadline: Thursday 10 June 2021
- Extended abstract submission deadline: Monday 21 June 2021
- Abstract acceptance notifications: Wednesday 30 June 2021
- Registration deadline: Tuesday 31 August 2021
- Conference dates: Wednesday 1 September - Friday 3 September 2021.

# About the conference

The conference is currently held approximately every two years. The **previous conference** was held in Flagstaff, Arizona in 2018.

The 15$^{th}$ MIOMD conference was scheduled to be held at the University of Surrey in September 2020. However, owing to the COVID-19 pandemic this was postponed to 2021 and will now be held as an online meeting from 1-3 September 2021.

A wide range of topics including the following will be covered:

- Infrared optoelectronic materials development, growth, and characterisation
- Infrared optoelectronic devices, components, and systems
- Infrared emitters and detectors
- Interband and intersubband materials and devices
- Novel architectures based on new materials and low-dimensional structures

## Friday 3rd September 2021

| Topic | Time/ID | Speaker | Organisation | Title |
|---|---|---|---|---|
| **Session 9:**<br><br>**Si Photonics and integration 3**<br><br>**(Pre-recorded Session)** | **I9-1** | **Mircea Guina** | **Tampere University** | **Broadband light sources at 2-3 µm region based on GaSb/SOI hybrid integration** |
| | O9-2 | Lauren Reid | University of Southampton | PIN-ch me!: A Ge-on-SOI photodiode with response up to 3.8 µm |
| | O9-3 | Colin Mitchell | University of Southampton | Development of Hybrid Integration of Quantum Cascade Lasers with Germanium Waveguides for Mid-IR |
| | O9-4 | Michele Paparella | University of Montpellier - Polytechnic University of Bari | Analysis of the optical coupling between monolithically integrated GaSb laser diodes and SiNx waveguides |
| | O9-5 | Wei Cao | University of Southampton | MIR Silicon Modulators in the 2 µm wavelength band |

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| **Session 10: Communications and sensing**<br><br>**(Pre-recorded Session)** | **I10-1** | **Natalie Wheeler** | **University of Southampton** | **Hollow core optical fibres for mid-infrared beam delivery and applications** |
| | O10-2 | Olivier Spitz | Télécom Paris | Application of chaos synchronization in injected mid-infrared quantum cascade lasers for private free-space communication |
| | O10-3 | Wioletta Trzpil | IES, Univ. Montpellier, CNRS, F-34000 Montpellier, France | Silicon micro-electromechanical resonator for enhanced photoacoustic gas detection |
| | O10-4 | Florian Pilat | Institute of Solid State Electronics, TU Wien | Spectrally-Resolved Measurement of the Linewidth Enhancement Factor |
| | O10-5 | Jordan Fordyce | Université de Montpellier | Single mode interband cascade lasers for petrochemical process monitoring |

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| **Session 11: Plasmonics and nanomaterials**<br><br>**(Pre-recorded Session)** | **I11-1** | **Sergey Morozov** | **IPM RAS** | **Mid-IR Stimulated Emission in HgCdTe QW Heterostructures with Dielectric and "Phonon" Waveguides** |
| | O11-2 | Dao Thang | Silicon Austria Labs GmbH | Resonant Metasurface Absorbers for Infrared Spectroscopic Sensing |
| | O11-3 | Mauro David | Institute of Solid State Electronics, TU Wien | LWIR dielectric-loaded surface-plasmon-polariton waveguide for optical sensing |
| | O11-4 | Loren Patricia | University of Montpellier | Perfect Absorbers based on high doped III-V semiconductor for the next generation of |

# Spectrally-Resolved Measurement of the Linewidth Enhancement Factor

**Florian Pilat[1], Nikola Opačak[1], Dmitry Kazakov[1, 2], Sandro Dal Cin[1], Georg Ramer[3], Bernhard Lendl[3], Federico Capasso[2], Gottfried Strasser[1] and Benedikt Schwarz[1, 2]**

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Semiconductor frequency comb lasers are compact, electrically pumped sources of coherent light that find application in areas such as high-precision spectroscopy for medical and chemical sensing. The linewidth enhancement factor (LEF) is well-established in the theoretical description of such lasers and plays a key role in understanding dynamic processes like laser linewidth broadening, modulation response and comb formation [1]. Therefore, the knowledge of its value is of utmost importance. As of yet the experimental investigation was limited to measurements below the lasing threshold or single-mode operation. Here we present a novel modulation technique which enables the measurement of the LEF of an arbitrary, running laser source [2]. In the case of a frequency comb we can infer the LEF over the whole laser spectrum in a single-shot measurement. This is enabled by a phase-sensitive measurement scheme called "Shifted Wave Interference Fourier Transform Spectroscopy" (SWIFTS) [3]. A sketch of the experimental setup can be seen in Fig. 1a.

The theoretical model is investigated vastly using Maxwell-Bloch simulations [4]. Then the method is demonstrated on a quantum cascade laser frequency comb. The results are shown in Fig. 1b.

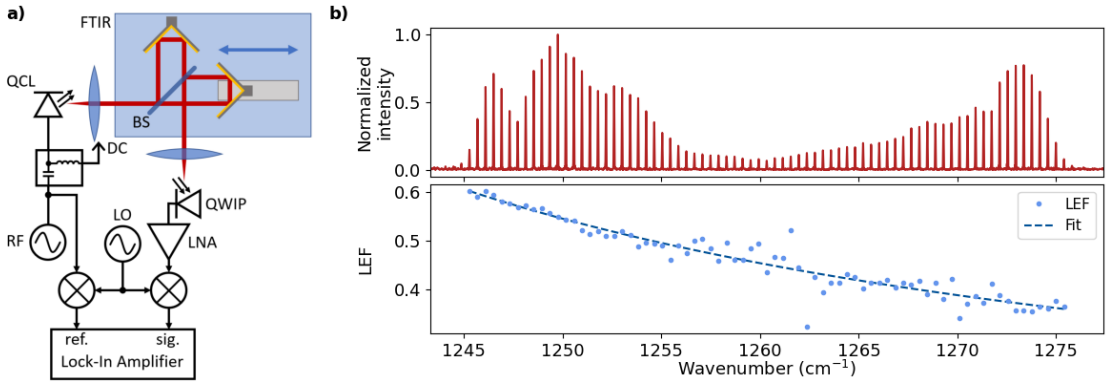


*Figure 1. a) Experimental Setup, b) Laser comb spectrum (top), Spectrally-resolved LEF with fit (bottom)*

## References

[1] M. Osinski *et al, "Linewidth broadening factor in semiconductor lasers: An overview",* IEEE J. Quant. Electron., (1987)
[2] N. Opačak *et al, "Spectrally resolved linewidth enhancement factor of a semiconductor frequency comb",* arXiv:2104.05747 [physics.optics], (2021)
[3] D. Burghoff *et al, "Terahertz laser frequencycombs,"* Nat. Photonics, (2014)
[4] N. Opačak *et al, "Theory of Frequency-Modulated Combs in Lasers with Spatial Hole Burning, Dispersion, and Kerr Nonlinearity",* Phys. Rev. Lett., (2019)