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**Datum:** 22.08.2017 11:08  
**An:** Christine Brendt <christine.brendt@tuwien.ac.at>

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**To:**Schwarz, Benedikt, Technische Univ. Wien <[benedikt.schwarz@tuwien.ac.at](mailto:benedikt.schwarz@tuwien.ac.at)>

Dear Benedikt Schwarz,

You are marked as the presenter for "**Continuous-wave operation of MOVPE grown bi-functional quantum cascade laser/detectors,**" scheduled to be presented 1 February 2017. We're looking forward to your talk!

**Symposium:** SPIE OPTO  
**Symposium Dates:** 28 January - 2 February 2017  
**Symposium Location:** San Francisco, California United States  
**Conference 10111:** Quantum Sensing and Nano Electronics and Photonics XIV  
<http://spie.org/PWO/conferencedetails/quantum-sensing-nanoelectronics-photonics>

**PRESENTATION DETAILS:**

**Presentation Title:** Continuous-wave operation of MOVPE grown bi-functional quantum cascade laser/detectors [10111-85] (Oral )  
**Presentation Date/Time:** 1 February 2017 4:30 PM (time is subject to minor timing shifts. Check webpage linked above shortly before your presentation, or the sign in front of the room.)  
**Duration:** 15 minutes (includes Q&A)  
**Presentation Guidelines:** (preloading presentations to laptops in room, AV info, etc.)  
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# Continuous-wave operation of MOVPE grown bi-functional quantum cascade laser/detectors (Conference Presentation)

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From: [Proceedings Volume 10111, Quantum Sensing and Nano Electronics and Photonics XIV](#) ([/conference-proceedings-of-spie/10111.toc](#))

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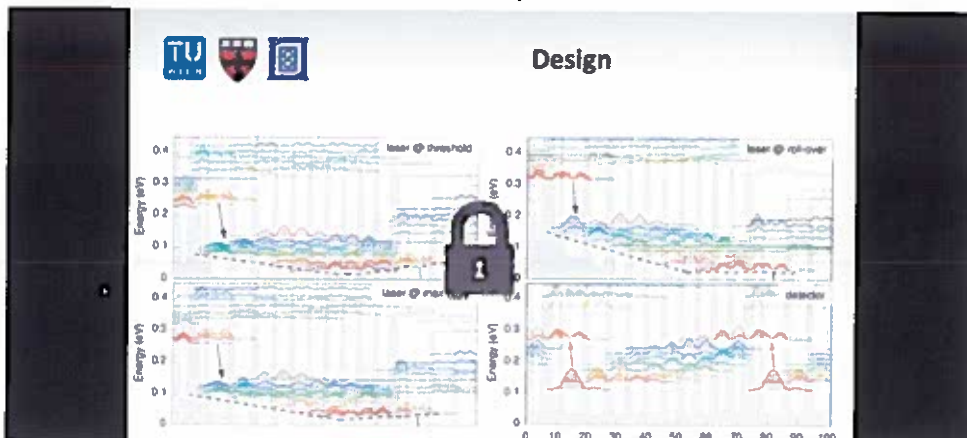
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## Abstract

Bi-functional active regions, capable of light generation and detection at the same wavelength, allow a straightforward implementation of the mid-infrared quantum cascade technology for integrated photonics. Different parts of the chip can be used for laser and for photodetectors. Potential applications are on-chip integrated sensors or lasers with integrated power monitoring capabilities. In the first bi-functional designs, wavelength matching was achieved using thicker barriers and reduced energy splittings between the extraction levels, but with the drawback of a reduced laser performance. The following introduction of the horizontal-vertical extraction scheme was a significant step towards high performance laser operation. In this work, we combine our design experience with optimized, laterally overgrown waveguides and refined bandstructure modelling. The device was designed for emission at 8  $\mu\text{m}$  to show that wavelength matching can also be achieved at longer wavelengths, where it becomes increasingly difficult due to the smaller ratio between photon energy and LO-phonon energy. Graded interfaces were used in the bandstructure design to consider the behaviour of the MOVPE growth. In pulsed mode a threshold current density of 1.3  $\text{kA}/\text{cm}^2$  and a total wallplug efficiency of over 10% was achieved. In continuous-wave operation, the device emits 80mW output power in an episcide-up configuration. A much higher performance can be expected after episcide-down mounting on AlN substrates. In detector operation the device has a responsivity at the emission wavelength of about 20  $\text{mA}/\text{W}$ .

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