ITQW 2017
10 – 15 Sep, Singapore
14th International Conference on Intersubband Transitions in Quantum Wells

Sands Expo and Convention Center
Singapore

CONFERENCE PROGRAM
Welcome Message

The 14th International Conference on Intersubband Transitions in Quantum Wells (ITQW 2017) will be held at the “Marina Bay Sands” in Singapore. ITQW aims to bring together leading academic scientists and researchers to exchange and share their experiences on all topics related to intersubband transition phenomena and devices. The conference will cover a wide range of topics from physics experiments to fully functional devices and applications.

ITQW is a workshop style meeting with a mixture of oral presentations and vibrant poster sessions. A tradition of ITQW is to have plenty of opportunity to mix and network outside of the lecture theatre with planned free time and social events.

Conference Chairs
Professor Qi Jie Wang, NTU, Singapore
Professor Miriam S. Vitiello, CNR, Italy
Professor Mikhail Belkin, Texas Austin, USA
Professor Carlo Sirtori, Paris Diderot, France
Introduction

Intersubband transitions have already quite a long history dated back to 1982, when a novel kind of optical transition between bound electronic levels which were present in the two-dimensional carrier gas at a semiconductor heterojunction was observed. Contrary to the interband transitions which occur in the bulk semiconductor materials, intersubband transitions happen in a superlattice structure consisting of a periodic series of thin layers with varying material composition. The energetic separation between adjacent levels is small as well as tailorable by engineering the thickness of thin layers. As a result, intersubband transitions are granted great application potentials for light emitting, detection and modulating in the broad mid-infrared and far-infrared (terahertz) frequency ranges.

For more than thirty years, impressive progresses have been made in the field of intersubband transitions. Physical understanding of intersubband transitions, including carrier transport, electron scattering mechanisms, tunneling effect, and intersubband nonlinearities etc. has been tremendously enhanced. It turns out to be solid fundamental basis for the advance of the optoelectronic devices.

So far, various photonic devices based on intersubband transitions have been developed. One of the most significant achievements is the quantum cascade laser (QCL). Facilitated by the bandstructure engineering and state-of-the-art materials growth technologies, QCLs have proven to be an efficient and compact source with outstanding power and temperature performances across the mid-infrared and terahertz spectral ranges. Another important intersubband transition-based device is quantum well infrared photodetector (QWIP), with typical feature of high speed and multicolor operation. Both QCL and QWIP have already been commercialized by a number of companies internationally, and is the core photonic component in technology underpinning a variety of applications in, for example, fields such as: biological, environmental and security sensing; process and quality control; high-speed telecommunications.

The utilizing of mature material and processing technology based on GaAs or InP contributes a lot for the development of intersubband transition-based photonic devices. In recently years, novel material systems (Si/Ge, II-VI for QC devices) and low dimensional structures (quantum dots, boxes, nanowires), have been developed to further push the progresses. In addition, it is interesting to incorporate 2D atomic layer materials (graphene, MoS₂, BP, etc) for novel functional applications. All of these make intersubband transition technology a mainstream for the new generation of sensing and telecommunication optoelectronics.

History

ITQW 2017 will be the key event in 2017 in the area of inter-subband transitions in quantum wells and inter-sublevel transitions in quantum dots. It is aimed at bringing together researchers from academia, government and industrial laboratories for scientific interaction, the showcasing of new results in the fields and debate on future trends. The conference
series has a history dating back to 1991 with the first meeting in Cargese, France, followed by meetings in Whistler, Canada (1993), Ginosar, Israel (1995), Tainan, Taiwan (1997), Bad Ischl, Austria (1999), Monterey, USA (2001), Evolene, Switzerland (2003), Cape Cod, USA (2005), Cumbria, U. K (2007), Montreal, Canada (2009), Sardinia, Italy (2011), New York, USA (2013), and Vienna, Austria (2015).
Organizing Committees

Conference Committees
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Qi Jie Wang (NTU, Singapore)
Miriam S. Vitiello (CNR, Italy)
Mikhail Belkin (Texas Austin, USA)
Carlo Sirtori (Paris Diderot, France)

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Fengqi Liu (CAS Institute of Semiconductor, China)
Harald Schneider (IIBPMR, Germany)
Jerome Faist (ETH, Switzerland)
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Co-Organizers
School of Electrical and Electronic Engineering
and Institute of Advanced Studies, NTU

Semiconductor Optoelectronics Society

The Photonics Institute, NTU Singapore

Asia Pacific Center for Theoretical Physics (APCTP)
Conference Program

**Sunday 10 September 2017**
16:00 – 18:00 Registration
18:30 – 21:00 Welcome Cocktail Reception (at Clarke)

**Monday 11 September 2017**
09:00 – 09:15 Welcome and Opening Remarks

Session 1 **Intersubband Material and Fabrications-Chair: Mikhail A. Belkin**
09:15 – 09:45 Gottfried Strasser (Technische Universität Wien) - Invited talk
QCL materials and fabrications
09:45 – 10:00 Jean-Michel Chauveau (CNRS-CRHEA)
Intersubband Transitions and Polarons in (Zn,Mg)O/ZnO Quantum Wells
10:00 – 10:15 Martin A. Kainz (Technische Universität Wien)
Compensation of asymmetries for high-performance InGaAs/InAlAs terahertz quantum cascade lasers
10:15 – 10:30 Zeineb Loghmari (Université de Montpellier)
Continuous wave operation of InAs-based quantum cascade lasers above 20 μm
10:30 – 11:00 Tea break

Session 2 **2D Material Opto-electronics-Chair: Carlo Sirtori**
11:00 – 11:45 Andrea C. Ferrari (University of Cambridge) - Plenary talk
Graphene photonics and optoelectronics
11:45 – 12:00 Long Xiao (University of Cambridge)
High Responsivity Detection of Terahertz Quantum Cascade Lasers with Graphene-Loaded Plasmonic Antenna Arrays
12:00 – 12:15 Xuechao Yu (Nanyang Technological University)
Mid-infrared photodetectors based on novel two-dimensional materials
12:15 – 14:00 Lunch

Session 3 **Mid-IR Frequency Comb and Lasers-Chair: Qijie Wang**
14:00 – 14:30 Jerome Faist (ETH Zurich) - Invited talk
Frequency comb
14:30 – 14:45 Dmitry Kazakov (Harvard University)
Harmonic frequency comb initiated by population pulsations in a quantum cascade laser
14:45 – 15:00 Pierre Jouy (ETH Zurich)
1 Watt Quantum Cascade Laser Frequency Comb emitting at λ~8.13 μm
15:00 – 15:15 Yves Bidaux (ETH Zurich)
Waveguide engineering for low dispersion mid-infrared Quantum Cascade Lasers frequency combs
15:15 – 15:30 Mikhail A. Belkin (The University of Texas at Austin)
Transfer-printing of quantum cascade lasers to silicon-based substrates

15:30 – 16:00 Tea break

Session 4 Intersubband Quantum Devices-Chair: Gottfried Strasser
16:00 – 16:15 Giacomo Scalari (ETH Zurich)
   Ultra strong THz light-matter coupling with Landau levels: transport measurements and nanocavities
16:15 – 16:30 Angela Vasanelli (Université Paris Diderot)
   Quantum model of optical properties and thermal emission of superradiant electronic excitations
16:30 – 16:45 Francesca Carosella (Université Paris Diderot)
   Band mixing in THz cascade structures
16:45 – 17:00 Martin Franckie (ETH Zürich)
   Phonon-Polariton Intersubband Gain
17:00 – 17:15 Daniele Palaferri (University Paris Diderot- Paris 7)
   Room temperature quantum well mid-infrared photodetector embedded into a patch-antennae array
17:15 – 17:30 Martin Franckie (ETH Zürich)
   Theory of 2-well GaAs/Al_{0.25}Ga_{0.75}As THz Quantum Cascade Lasers
17:30 – 17:45 Asaf Albo (Massachusetts Institute of Technology)
   Direct-phonon terahertz light-emitting intersubband lasers
17:45 – 18:30 Banquet diner near Dome flower (Majestic Bay)

Tuesday 12 September 2017
Session 5 Mid-IR Sensing and Spectroscopy-Chair: Jerome Faist
09:00 – 09:30 Boris Mizaikoff (Ulm University) - Invited talk
   mid-IR QCLs for sensing and spectroscopy
09:30 – 09:45 Filippos Kapsalis (ETH Zurich)
   Dual-wavelength DFB Quantum Cascade Lasers for Trace Gas Spectroscopy
09:45 – 10:00 Lorenz Butscher (Fraunhofer Institute for Applied Solid State Physics)
   MOEMS-based External Cavity QCLs for Real-time Spectroscopy
10:00 – 10:30 Bernhard Lendl (Technische Universität Wien) - Invited talk
   Introducing New approaches in QCL based gas sensing: Photothermal Interferometry and Heterodyne Phase Sensitive Dispersion Spectroscopy
10:30 – 11:00 Tea break

Session 6 THz detection and generation-Chair: Boris Mizaikoff
11:00 – 11:45 Junichiro Kono (Rice University) - Plenary talk
   THz detection and spectroscopy
11:45 – 12:15 Yanko Todorov (Université Paris Diderot) - Invited talk
   THz detection using metamaterial resonators and microcavities
12:15 – 12:30 Stefano Pirotta (Universite Paris Sud and CNRS)
   Ultrafast terahertz detectors based on 3D meta-atoms
12:30 – 12:45 Sukhdeep Dhillon (Laboratoire Pierre Aigrain)
  Short THz pulse generation from a dispersion compensated mode locked quantum cascade laser
12:45 – 13:00 Petar Tzenov (Technical University of Munich)
  Gain recovery dynamics and passive mode locking of THz quantum cascade lasers
13:00 – 14:30 Lunch
14:30 – 17:00 Social Events (Free)

Wednesday 13 September 2017
Session 7 THz Frequency Comb-Chair: Harald Schneider
09:00 – 09:30 Jacob Khurgin (Johns Hopkins University) - Invited talk
  Frequency comb-theory
09:30 – 09:45 Yang Yang (Massachusetts Institute of Technology)
  Full dynamic range comb formation in terahertz quantum cascade laser
09:45 – 10:00 Benedikt Schwarz (Technische Universität Wien)
  High power frequency comb based on a bi-functional QCLD
10:00 – 10:15 Hua Li (Shanghai Institute of Microsystem and Information Technology)
  Terahertz intersubband photonic devices for frequency comb operation and fast detection
10:15 – 10:45 Tea break

Session 8 THz Frequency Comb and Spectroscopy-Chair: Jacob Khurgin
10:45 – 11:30 Qing Hu (Massachusetts Institute of Technology) - Plenary talk
  THz frequency comb
11:30 – 12:00 Harald Schneider (Helmholtz-Zentrum Dresden-Rossendorf) - Invited talk
  THz-spectroscopic studies on electron dynamics in a GaAs single quantum well and an InAs single quantum dot
12:00 – 12:15 Jonas Westberg (Princeton University)
  Terahertz multiheterodyne spectroscopy of molecular samples with quantum cascade laser frequency combs
12:15 – 12:30 Alexander Valavanis (University of Leeds)
  Frequency-monitored gas spectroscopy through self-mixing interferometry in a terahertz quantum-cascade laser
12:30 – 12:45 Till Hagelschuer (German Aerospace Center)
  Real-time spectroscopy of various gas species through optical feedback in a terahertz quantum-cascade laser
12:45 – 13:00 Miriam Serena Vitiello (NEST, CNR)
  Spectral purity of terahertz quantum cascade laser sources based on intra-cavity difference frequency generation
13:00 – 14:30 Lunch
14:30 – 17:00 Excursion starts (S.E.A. Aquarium)
18:00 – 21:00 BBQ at beach
Thursday 14 September 2017
Session 9 THz Quantum Cascade Lasers-Chair: Harald Schneider
09:00 – 09:15 Ji Chen (Lehigh University)
  High brightness THz quantum-cascade lasers utilizing inexpensive custom-made lenses

09:15 – 09:30 Huan Zhu / Gangyi Xu (Shanghai Institute of Technical Physics)
  Terahertz master-oscillator power-amplifier quantum cascade laser with improved output power

09:30 – 09:45 Yongquan Zeng (Nanyang Technological University)
  Two-Dimensional Multimode Terahertz Random Lasing with Metallic Pillars

09:45 – 10:00 Simone Biasco (NEST, CNR)
  High-power, low-divergent, single-mode THz quantum cascade wire lasers operating in pulsed and continuous-wave regime

10:00 – 10:30 Tea break

Session 10 Photodetectors-Chair: Yanko Todorov
10:30 – 11:15 Philippe Bois (Thales Research & Technology) - Plenary talk
  Infrared PDs

11:15 – 11:45 Kaz Hirakawa/Zhang Ya (University of Tokyo) - Invited talk
  Novel bolometric THz detection by MEMS resonators

11:45 – 12:00 Behnam Mirzaei (Delft University of Technology)
  An 8-Beam, 4.7 THz Local Oscillator Using a Quantum Cascade Laser and a Phase Grating

12:00 – 12:15 Pedro Pereira (Pontifícia Universidade Católica do Rio de Janeiro)
  Photovoltaic asymmetric superlattice QWIP with confined states in the continuum

12:15 – 12:30 Zahra Asghari (University Paris Diderot- Paris 7)
  Room Temperature High Performances Quantum Cascade Detectors

12:30 – 14:00 Lunch

Session 11 Mid-IR Quantum Cascade Lasers-Chair: Igor Vurgaftman
14:00 – 14:30 Liu Fengqi (Institute of Semiconductors, CAS) - Invited talk
  History and recent development of QCLs in China

14:30 – 14:45 Dan Botez (University of Wisconsin-Madison)
  4.7 μm-Emitting In-Phase Resonant-Coupled, Phase-Locked Arrays of QCLs: 3.6 W Near-Diffraction-Limited Power

14:45 – 15:00 Marco Piccardo (Harvard University)
  Beat spatial hole burning

15:00 – 15:15 Frederic Demmerle (Technische Universität München)
  Surface Emission by Transversally Superimposed Gratings in Nonlinear Quantum Cascade Lasers

15:15 – 15:30 Dan Botez (University of Wisconsin-Madison)
  High Internal Efficiency Mid-IR Quantum Cascade Lasers
15:30 – 16:00 Tea break

**Session 12 Interband Cascade Lasers-Chair: Dan Botez**
16:00 – 16:30 **Igor Vurgaftman (Naval Research Laboratory) - Invited talk**
   Interband cascade lasers in the mid-IR
16:30 – 16:45 **Alireza Mottaghizadeh (University Paris Diderot- Paris 7)**
   Ultra-fast modulation of mid infrared buried heterostructure quantum cascade lasers
16:45 – 17:00 **Sukhdeep Dhillon (Laboratoire Pierre Aigrain)**
   Multi-THz Sideband Generation on an optical telecom carrier at room temperature using InP-based Quantum Cascade Lasers
17:00 – 17:15 **Martin Holzbauer (Technische Universität Wien)**
   Ring Cavity interband cascade lasers
17:15 End of day four

**Friday 15 September 2017**

**Session 13 Intersubband Devices and applications-Chair: Benjamin Williams**
09:00 – 09:30 **Claire F. Gmachl /Yasin Kaya (Princeton University) - Invited talk**
   II-VI and II-VI/III-V hybrid intersubband devices
09:30 – 09:45 **Martin Wienold (German Aerospace Center)**
   Doppler-free spectroscopy with a terahertz quantum-cascade laser
09:45 – 10:00 **Rolf Szedlak (Technische Universität Wien)**
   Commutable Monolithic QC Laser/Detector System for Remote Sensing
10:00 – 10:15 **Bernhard Lendl (Technische Universität Wien)**
   New sensing approaches employing QCLs
10:15 – 10:45 Tea break

**Session 14 Metasurfaces-Chair: Yasin Kaya**
10:45 – 11:30 **Federico Capasso (Harvard University) - Plenary talk**
   Metasurface
11:30 – 12:00 **Benjamin Williams (University of California Los Angeles) - Invited talk**
   THz metasurface
12:00 – 12:15 **Matias Katz (Technion-Israel Institute of Technology)**
   Vacuum-field Rabi Splitting at SWIR in Photocurrent of Quantum Cascade Infrared Photodetectors Coupled to Metamaterial Nano-antennas
12:15 – 12:30 **Lorenzo Bosco (ETH Zurich)**
   High power surface emitting single mode Terahertz Quantum Cascade Laser
12:30 – 12:45 **Moritz Wenclawiak (Technische Universität Wien)**
   Controlling the radiative response of plasmonic resonators in the terahertz regime
12:45 – 14:00 Lunch
14:00 – 17:00 NTU-visit
Poster Sessions

Monday 11 to Tuesday 12 September 2017 (10 am – 5 pm)

Poster Session 1

P1 Xiaoyong He (Shanghai Normal University)
Investigation of tunable manipulation terahertz waves based on graphene patterns

P2 Hiroaki Yasuda (National Institute of Information and Communications Technology)
Calculation of performance of InGaSb-based terahertz quantum cascade lasers

P3 Wenjian Wan (Shanghai Institute of Microsystem and Information Technology)
Homogeneous spectral broadening of pulsed terahertz quantum cascade lasers with radio frequency modulation

P4 Wenyi Wei (IOP CAS)
C/L-band emission of InAs QDs monolithically grown on a CMOS compatible Ge platform

P5 Sebastian Schoenhuber (Technische Universität Wien)
Frequency resolved far fields of terahertz quantum cascade lasers

P6 Jianbin Kang (Microsystem & Terahertz Research Center)
Strain dependent intersubband transition in GaN/AlGaN single quantum well on different crystal planes

P7 Sumit Saha (IIT (ISM), Dhanbad)
Optical analysis of non-polar, m-plane GaN/AlGaN quantum cascade structures

P8 Y. Zhang (University of Tokyo)
Intersublevel transitions in zero-dimensional nanomaterials probed by terahertz photocurrent spectroscopy

P9 Xiaoqiong Qi (The University of Queensland)
Dynamic modelling of coupled-cavity Terahertz Quantum Cascade lasers with optical feedback

P10 She Han (The University of Queensland)
Analysis of Granular Materials using a THz QCL operating as a Laser Feedback Interferometer

P11 Yuanyuan Li (Institute of Semiconductors, CAS)
High-power single-mode terahertz quantum cascade lasers

P12 Holger T. Grahn (Paul-Drude-Institut fuer Festkoerperelektronik)
Two-section, single-frequency terahertz quantum-cascade lasers with continuous frequency tuning by external illumination

P13 Ke Wang (Quantum Device Group, RIKEN at Sendai)
Waveguide design for GaN/AlGaN terahertz quantum cascade lasers

P14 Moritz Wenclawiak (Technische Universität Wien)
Efficient frequency conversion in THz metal-insulator-metal disk resonators loaded with semiconductor quantum wells

P15 Roland Teissier (University of Montpellier)
A comparative study of a three-well active region in double metal and single plasmon THz QCLs

P16 Yue Zhao (Institute of Semiconductors, CAS)
Phase-locked quantum cascade laser array based on a monolithically integrated Talbot cavity

P17 Feng-Jiao Wang (Institute of Semiconductors, CAS)
Normal incident long wave infrared quantum dash quantum cascade photodetector

P18 Xuefeng Jia (Institute of Semiconductors, CAS)
The design and fabrication of slotted quantum cascade lasers at 5.1μm

P19 Wolfhard Oberhausen (Technische Universität München)
Gain Coupled Distributed Feedback Mid-Infrared Quantum Cascade Lasers for THz generation

P20 Djamal Gacemi (University Paris 7 Diderot)
Parallel plates waveguide for single resonator THz spectroscopy

P21 Tsung-Tse Lin (Center for Advanced Photonics, RIKEN)
THz Quantum Cascade Lasers Toward High Output Power Near Liquid Nitrogen Temperature Operation

P22 Thomas Grange (CNRS)
Doping engineering in THz QCLs

Wednesday 13 to Thursday 14 September 2017 (10 am – 5 pm)

Poster Session 2

P23 Yulian Cao (Institute of Semiconductors, CAS)
Longer than 1.9 μm photoluminescence emission from InAs quantum structure on GaAs (001) substrate

P24 Yanhua Zhang (Institute of Semiconductors, CAS)
Pushing detection wavelength toward 1μm by type II InAs/GaAsSb superlattices

P25 Jianliang Huang (Institute of Semiconductors, CAS)
Impact of band structure of Ohmic contact layers on the response feature of p-i-n very long wavelength type II InAs/GaSb superlattice photodetector

P26 Benjamin Burnett (Northrop Grumman)
Reliable density matrix modeling of THz QCL active regions from the energy eigenbasis

P27 Kedi Wu (Nanyang Technological University)
Grayscale hologram based on mid-infrared metasurfaces

P28 Wj Fan (Nanyang Technological University)
Electronic structure and optical properties of GeSn and Ge quantum wells

P29 Xiaonan Hu (Nanyang Technological University)
Graphene-based mid-infrared Si modulator

P30 Stefan Birner (Nextnano GmbH)
User-friendly Software for the Simulation of Quantum Cascade Lasers with the NEGF Method

P31 Dao Hua Zhang (Nanyang Technological University)
InAsSb based heterojunction infrared photodetectors

P32 Yi Zheng (Nanyang Technological University)
Growth of AlGaN/GaN multiple quantum well structure on silicon by plasma assisted molecular beam epitaxy for infrared photodetector

P33 Lin Zhang (Nanyang Technological University)
Epitaxial Growth of GeSn Alloy by Chemical Vapor Deposition (CVD) Using Ge2H6 and SnCl4

P34 Ruochong Zhang (Nanyang Technological University)
Noninvasive Photoacoustic Glucose Measurement by Near-infrared Laser

P35 Mingyu Sun (Nanyang Technological University)
Electrical modulation of all dielectric metamaterial tuned by birefringent liquid crystal

P36 D. Ban (University of Waterloo)
Lasing channels switching in dual color scattering assisted THz quantum-cascade laser

P37 Xiao Zou (Nanyang Technological University)
High efficient 3μm OPCPA pumped by temporal and spatial flat-top pulse

P38 Shizhen Qu (Nanyang Technological University)
3μm OPCPA System With High Energy at 10kHz

P39 Kun Liu (Nanyang Technological University)
Stable broadband supercontinuum generation in dielectrics pumped by 1μm picosecond pulses for CEP-stable OPCPA

P40 Tao Ye (Nanyang Technological University)
Bright Monolayer Tungsten Disulfide via Exciton Chemical Modulations

P41 Bin Hu (Beijing Institute of Technology)
Active focal tuning of graphene-metal metasurface lenses

P42 Lin Liu (Nanyang Technological University)
Strong Light-matter Interaction in Monolayer WS2 Coupled with Nanoantenna Arrays
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<th>Time</th>
<th>Sunday 10th</th>
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<tr>
<td>09:00</td>
<td>Welcome and Opening Remarks</td>
<td>Session 5 Mid-IR Sensing and Spectroscopy</td>
<td>Session 7 THz Frequency Comb</td>
<td>Session 9 THz Quantum Cascade Lasers</td>
<td>Session 13 Intersubband Devices and applications</td>
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<td>Session 1 Intersubband Material and Fabrications</td>
<td>Session 6 THz detection and generation</td>
<td>Session 8 THz detection and generation</td>
<td>Session 10 Photodetectors</td>
<td>Session 14 Metasurfaces</td>
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<td>10:30</td>
<td>Session 2 2D Material OptoElectronics</td>
<td>Session 3 Mid-IR Frequency Comb and Lasers</td>
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