



Fraunhofer Institute for Applied  
Solid State Physics IAF

# 45<sup>th</sup> Freiburg Infrared Colloquium Final Program

---

**May 16–17, 2023**

# Program

---

## Tuesday, May 16, 2023

---

08:00	Registration
09:00	Welcome
09:15	HgCdTe Detectors
10:45	Coffee Break
11:15	Type-II Superlattice Detectors
13:00	Lunch (Canteen of Badenova AG)
14:00	Poster Session & Coffee Break (Main Building)
15:30	IR-Lasers on Si & Quantum Cascade Laser Applications
19:00	Conference Dinner at Peterhof Cellar (University of Freiburg)

---

## Wednesday, May 17, 2023

---

09:15	SWIR Detection
10:45	Coffee Break
11:15	Advanced IR-Lasers
13:00	Lunch (Canteen of Badenova AG)
14:00	Advanced Detector Topics
15:30	Coffee Break
16:00	Photonic Integration & Applications
17:30	Closing

---

# Tuesday, May 16, 2023

---

08:00 – 09:00      **Registration**

09:00 – 09:15      **Welcome**

## HgCdTe Detectors

### Session Chair: Volker Daumer

- 09:15 – 09:45      **1.1 Invited Paper: IR Detector Development at Leonardo, UK**  
*C. Maxey, J. Wilson, L. Hipwood, S. Bains, I. Baker, J. Price, A. Greenen  
Leonardo, Southampton, United Kingdom*
- 09:45 – 10:05      **1.2 Small, Large and HOT: MCT-based Small Pitch, Large Format Megapixel MWIR Infrared Detectors for Higher Operating Temperatures at AIM**  
*M. Ullrich, H. Bitterlich, R. Breiter, H. Figgemeier, D. Eich, A. Epping, S. Hanna, K.-M. Mahlein  
AIM Infrarot-Module GmbH, Heilbronn, Germany*
- 10:05 – 10:25      **1.3 A Novel Dual Color Missile Warning Sensor**  
*M. Münzberg<sup>1</sup>, J. Fritze<sup>1</sup>, J. Albrecht<sup>2</sup>, M. Beer<sup>3</sup>, H. Lutz<sup>3</sup>  
<sup>1</sup> Hensoldt Optronics GmbH, Oberkochen, Germany  
<sup>2</sup> Hensoldt Sensors GmbH, Taufkirchen, Germany  
<sup>3</sup> AIM Infrarot Module GmbH, Heilbronn, Germany*
- 10:25 – 10:45      **1.4 Overview of Photoluminescence Decay Measurements on II-VI and III-V Materials at CEA LETI**  
*C. Cervera, O. Gravrand, M. Soria, J. Rothman  
Univ. Grenoble Alpes, CEA, Leti, Grenoble, France*
- 10:45 – 11:15      **Coffee Break**

# Type-II Superlattice Detectors

## Session Chair: Martin Walther

- 11:15 – 11:45**      **2.1 Invited Paper: T2SL-based MWIR HOT Imagers**  
L. Höglund, M. Delmas, D. Ramos, R. Ivanov, L. Žurauskaitė, D. Evans, D. Rihtnesberg, L. Bendrot, S. Smuk, A. Smuk, S. Becanovic, S. Almqvist, P. Tinghag, S. Fattala, E. Trybom, E. Costard  
*IRnova, Kista, Sweden*
- 11:45 – 12:05**      **2.2 Applications of T2SL Detectors in Earth and Planetary Science Applications**  
S. Gunapala<sup>1</sup>, D. Ting<sup>1</sup>, A. Soibel<sup>1</sup>, A. Khoshakhlagh<sup>1</sup>, S. Rafol<sup>1</sup>, S. Keo<sup>1</sup>, B. Pepper<sup>1</sup>, A. Fisher<sup>1</sup>, C. Hill<sup>1</sup>, W. Johnson<sup>1</sup>, O. Kalashnikova<sup>1</sup>, M. Garay<sup>1</sup>, A. Davies<sup>1</sup>, M. Ogut<sup>1</sup>, A. Sood<sup>2</sup>, J. Zeller<sup>2</sup>, C. David<sup>3</sup>, S. Babu<sup>4</sup>, P. Ghuman<sup>4</sup>  
<sup>1</sup> *Jet Propulsion Laboratory, California Institute of Technology Pasadena, United States of America*  
<sup>2</sup> *Magnolia Optical Technologies, Inc, Albany, United States of America*  
<sup>3</sup> *Anduril Industries, Inc., Irvine, United States of America*  
<sup>4</sup> *NASA Earth Science Technology Office Greenbelt, United States of America*
- 12:05 – 12:25**      **2.3 Electro-Optical Characterization of Midwave Infrared Ga-free InAs/InAsSb Type-2 Superlattice (T2SL) Barrier Photodetector**  
A. Ramiandrasoa<sup>1</sup>, V. Arounassalame<sup>1</sup>, M. Tornay<sup>2</sup>, M. Bouschet<sup>2</sup>, J.P. Perez<sup>2</sup>, P. Christol<sup>2</sup>, N. Péré-Laperne<sup>3</sup>, I. Ribet<sup>1</sup>  
<sup>1</sup> *ONERA - The French Aerospace Lab, Palaiseau, France*  
<sup>2</sup> *IES, Univ. Montpellier, Montpellier, France*  
<sup>3</sup> *Lynred, Veurey-Voroize, France*
- 12:25 – 12:45**      **2.4 Antimony-based Detector Technology from eSWIR to LWIR**  
R. Müller, V. Daumer, J. Niemasz, M. Wobrock, A. Wörl, Q. Yang, R. Rehm  
*Fraunhofer Institute for Applied Solid State Physics IAF, Freiburg, Germany*
- 13:00 – 14:00**      **Lunch (Canteen of Badenova AG)**

# 14:00 – 15:30 Poster Session & Coffee Break

## Poster Session & Coffee Break (Main Building)

- 3.1 Emerging Opportunities for SWIR Sensing and Imaging**  
N.D. Akhavan, G.A. Umana-Membreno, R. Gu, J. Antoszewski, L. Faraone  
*The University of Western Australia, Crawley, Australia*
- 3.2 Review of Quantum Efficiency Enhancement Techniques for LWIR and VLWIR Type-II Superlattice Detectors**  
L. Bendrot<sup>1,2</sup>, M. Delmas<sup>1</sup>, L. Höglund<sup>1</sup>, D. Ramos<sup>1</sup>, R. Ivanov<sup>1</sup>, E. Costard<sup>1</sup>, H. Pettersson<sup>2,3</sup>  
<sup>1</sup> *IRnova, Kista, Sweden*  
<sup>2</sup> *Solid State Physics and Nanolund, Lund University, Lund, Sweden*  
<sup>3</sup> *School of Information Technology, Halmstad University, Halmstad, Sweden*
- 3.3 Direct Band Gap GeSn Photodiodes Operating in the MWIR Spectral Region**  
C. Cardoux<sup>1</sup>, L. Casiez<sup>1</sup>, M. Frauenrath<sup>1</sup>, N. Pauc<sup>2</sup>, V. Calvo<sup>2</sup>, J.M. Hartmann<sup>1</sup>, N. Coudurier<sup>1</sup>, P. Rodriguez<sup>1</sup>, P. Grosse<sup>1</sup>, O. Gravrand<sup>1</sup>, A. Chelnokov<sup>1</sup>, V. Reboud<sup>1</sup>  
<sup>1</sup> *Univ. Grenoble Alpes, CEA, LETI, Grenoble, France*  
<sup>2</sup> *Univ. Grenoble Alpes, CEA, Grenoble INP, IRIG, PHELIQS, Grenoble, France*
- 3.4 Pyroelectric Detectors for Earth Explorer 9 - FORUM: Design and Characterization**  
A. Hacker<sup>1</sup>, A. Neuzner<sup>1</sup>, L. Perez-Prieto<sup>1</sup>, R. Mistry<sup>2</sup>, M. Zahir<sup>3</sup>  
<sup>1</sup> *Airbus Defence and Space, Taufkirchen, Germany*  
<sup>2</sup> *Leonardo, Southampton, United Kingdom*  
<sup>3</sup> *ESA, ESTEC, Noordwijk, The Netherlands*
- 3.5 Discussion on Diffusion Current Suppression in HgCdTe MWIR P on N Photodiodes**  
T. Legoff, N. Baier, C. Lobre, F. Rochette, W. Rabaud, O. Gravrand  
*CEA LETI, Grenoble, France*
- 3.6 Modeling InAs/GaSb Type-II Superlattices for Mid-Wavelength Infrared Photodetectors with the nextnano++ Software**  
H. S. Maczko  
*nextnano GmbH, Munich, Germany*
- 3.7 Optical Concentration Effect in fully Delineated Mid-Wave Infrared T2SL SWaP HD Detectors Arrays.**  
D. Ramos<sup>1,2</sup>, M. Delmas<sup>1</sup>, L. Höglund<sup>1</sup>, R. Ivanov<sup>1</sup>, L. Žurauskaitė<sup>1</sup>, D. Evans<sup>1</sup>, D. Rihntesberg<sup>1</sup>, L. Bendrot<sup>1</sup>, S. Smuk<sup>1</sup>, A. Smuk<sup>1</sup>, S. Becanovic<sup>1</sup>, S. Almqvist<sup>1</sup>, P. Tinghag<sup>1</sup>, S. Fattala<sup>1</sup>, E. Trybom<sup>1</sup>, E. Costard<sup>1</sup>  
<sup>1</sup> *IRnova Kista, Sweden*  
<sup>2</sup> *School of Electrical Engineering and Computer Science KTH Royal Institute of Technology, Kista, Sweden*
- 3.8 On the Way to a Single-Photon Camera for SWIR Active Imaging**  
F. Rutz, A. Wörl, A. Bächle, J. Niemasz, R. Rehm  
*Fraunhofer Institute for Applied Solid State Physics IAF, Freiburg, Germany*
- 3.9 Photo-modulated Lateral & Vertical Electronic Transport in InAs/GaSb Type-II Superlattices**  
G. A. Umana-Membreno<sup>1</sup>, R. Müller<sup>2</sup>, J. Niemasz<sup>2</sup>, N. D. Akhavan<sup>1</sup>, J. Antoszewski<sup>1</sup>, V. Daumer<sup>2</sup>, R. Rehm<sup>2</sup>, L. Faraone<sup>1</sup>  
<sup>1</sup> *Dept. Electrical, Electronic & Computer Eng., The Univ. of Western Australia, Perth, Australia*  
<sup>2</sup> *Fraunhofer Institute for Applied Solid State Physics IAF, Freiburg, Germany*

- 3.10 Use of EBIC for MTF Measurement of HOT MCT Focal Plane Planar Array with Very Small Pixel Pitches**  
S. Bustillos Vasco<sup>1</sup>, N. Baier<sup>1</sup>, C. Lobre<sup>1</sup>, F. Rochette<sup>1</sup>, W. Rabaud<sup>1</sup>, G. Lasfarges<sup>1</sup>, O. Gravrand<sup>1</sup>, C. Martin<sup>2</sup>, L. Rubaldo<sup>2</sup>  
<sup>1</sup> CEA LETI, Grenoble, France  
<sup>2</sup> LYNRED, Veurey-Voroize, France
- 3.11 Convolutional Neural Networks for TOD Classification as Tool for Automated Lab-based Imager Assessment**  
D. Wegner, S. Kessler  
Fraunhofer IOSB, Ettlingen, Germany
- 3.12 Recognition and Parameterization of Surface-Leakage-Conductivity Channels in Narrow Bandgap Materials by the Use of Mobility Spectrum Analysis**  
J. Wróbel<sup>1</sup>, S. Zlotnik<sup>1</sup>, J. Boguski<sup>1</sup>, M. Kojdecki<sup>2</sup>, J. Wróbel<sup>1,3</sup>  
<sup>1</sup> Institute of Applied Physics, Military University of Technology, Warsaw, Poland  
<sup>2</sup> Faculty of Cybernetics, Military University of Technology, Warsaw, Poland  
<sup>3</sup> Institute of Physics, Polish Academy of Sciences, Warsaw, Poland
- 
- 3.13 High-Resolution Upconversion-Based Mid-Infrared Spectroscopy Platform**  
S. M. M. Friis, L. Høgstedt  
NLIR ApS, Farum, Denmark
- 3.14 Coherent Beam Combining of Quantum Cascade Lasers in a Master Oscillator – Power Amplifier Setup**  
S. Hugger, C. Schilling, S. Giudicatti, M. Rattunde  
Fraunhofer Institute for Applied Solid State Physics IAF, Freiburg, Germany
- 3.15 ATEX Compliant, FPGA Based Three-Channel Quantum Cascade Laser Sensor for Sulfur Species Detection in Petrochemical Process Streams**  
H. Moser<sup>1,2</sup>, W. Pölz<sup>3</sup>, J. P. Waclawek<sup>1,2</sup>, B. Lendl<sup>2</sup>  
<sup>1</sup> Competence Center CHASE GmbH, Vienna, Austria  
<sup>2</sup> TU Wien - Vienna University of Technology, Vienna, Austria  
<sup>3</sup> OMV R&M GmbH, Schwechat, Austria
- 3.16 IMPASS – Intermodulated Photoacoustic Stark Spectroscopy for Background-free Ammonia Detection**  
A. Polak, J. Feehan, D. Stothard  
Fraunhofer Centre for Applied Photonics, Glasgow, United Kingdom
- 3.17 Mid-Infrared Waveguides and Passive Photonic Devices on an InP Platform**  
K. Zhang, R. Mayer, G. Boehm, M.A. Belkin  
Walter-Schottky Institut, Technische Universität München, Garching, Germany

# IR-Lasers on Si & Quantum Cascade Laser Applications

## Session Chair: Marko Härtelt

- 15:30 – 16:00**      **4.1 Invited Paper: Mid-IR Lasers Epitaxially Integrated onto Si**  
*E. Tournié*, A. Remis, M. Paparella, A. Gilbert, L. Monge-Bartolomé, M. Rio-Calvo,  
 D. A. Diaz Thomas, Z. Loghmari, L. Cerutti, A.N. Baranov, R. Teissier, J.-B. Rodriguez  
*IES, University of Montpellier, France*
- 16:00 – 16:20**      **4.2 Solitons in Quantum Cascade Laser based Kerr Combs**  
 R. N. Opačak<sup>1,2</sup>, D. Kazakov<sup>2</sup>, L. Columbo<sup>3</sup>, S. Dal Cin<sup>1</sup>, M. Beiser<sup>1</sup>, F. Pilat<sup>1</sup>, M. Brambilla<sup>4</sup>, F. Prati<sup>5</sup>,  
 M. Piccardo<sup>2,6</sup>, F. Capasso<sup>2</sup>, **B. Schwarz**<sup>1,2</sup>  
<sup>1</sup> *Institute of Solid State Electronics, TU Wien, Vienna, Austria*  
<sup>2</sup> *John A. Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, United States of America*  
<sup>3</sup> *Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Torino, Italy*  
<sup>4</sup> *Dipartimento di Fisica Interateneo and CNR-IFN, Università e Politecnico di Bari, Bari, Italy*  
<sup>5</sup> *Dipartimento di Scienza e Alta Tecnologia, Università dell'Insubria, Como, Italy*  
<sup>6</sup> *Center for Nano Science and Technology, Fondazione Istituto Italiano di Tecnologia, Milano, Italy*
- 16:20 – 16:40**      **4.3 Novel Infrared Techniques for Medical Applications**  
 W. Mäntele<sup>1,2</sup>  
<sup>1</sup> *Institut für Biophysik, Goethe-Universität Frankfurt, Germany*  
<sup>2</sup> *DiaMonTech AG, Berlin, Germany*
- 16:40 – 17:00**      **4.4 Recent Advances and New Applications of QCL-IR Microspectroscopy**  
 M. Godejohann  
*MG Optical Solutions GmbH, Utting/Ammersee, Germany*
- 19:00**                      **Conference Dinner at Peterhof Cellar (University of Freiburg)**  
 For detailed information please go to [www.infrared-colloquium.de](http://www.infrared-colloquium.de)

# Wednesday, May 17, 2023

---

## SWIR Detection

### Session Chair: Frank Rutz

- 09:15 – 09:45**      **5.1 Invited Paper: InGaAs/InP and Ge-on-Si Single-Photon Avalanche Diodes for SWIR Applications**  
A. Tosi  
*Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Milano, Italy*
- 09:45 – 10:05**      **5.2 Low Noise InGaAs/InP based Photodetector Development**  
A. W. Walker, C. Storey, C. Flueraru, O. Pitts  
*National Research Council of Canada, Ottawa, Canada*
- 10:05 – 10:25**      **5.3 MERLIN (MEthane Remote sensing Lidar mission) Etalon Effect in 1.645  $\mu\text{m}$  InGaAs APD Photodiode**  
M. Kritzler, C. Wührer, C. Kühl, N. Strasser, M. Haiml, D. Viehmann  
*Airbus Defence and Space GmbH, Taufkirchen, Germany*
- 10:25 – 10:45**      **5.4 Upconversion of Single Photons for Environmental Sensing**  
R. Smith<sup>1</sup>, B. Ndagano<sup>1</sup>, A. Weld<sup>2</sup>, X. Ai<sup>2</sup>, A. Cardoso<sup>3</sup>, J. G. Rarity<sup>3</sup>, A. Astill<sup>4</sup>, L. Wright<sup>4</sup>, K. Pandiyan<sup>4</sup>,  
C. B. E. Gawith<sup>4</sup>, L. J. Mcknight<sup>1</sup>  
<sup>1</sup> *Fraunhofer Centre For Applied Photonics, Glasgow, United Kingdom*  
<sup>2</sup> *QLM Technology Limited, Unit DX, Bristol, United Kingdom*  
<sup>3</sup> *Quantum Engineering Technology Laboratory, Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom*  
<sup>4</sup> *Covesion Ltd, Unit F3 Adanac North, Southampton, United Kingdom*
- 10:45 – 11:15**      **Coffee Break**



# Advanced IR-Lasers

## Session Chair: Marcel Rattunde

- 11:15 – 11:45**      **6.1 Invited Paper: Interband Cascade Lasers and Detectors**  
 A. Bader, B. Petrovic, A. Schade, R. Weih, F. Hartmann, S. Höfling  
*Julius-Maximilians-Universität Würzburg, Physikalisches Institut, Germany*
- 11:45 – 12:05**      **6.2 GaSb based pulsed High-Power Laser Diodes in the Near Mid-Infrared**  
 J. Gilly<sup>1</sup>, D. Rapp<sup>1</sup>, J. Schaffner<sup>2</sup>, M.T. Kelemen<sup>1</sup>  
<sup>1</sup> *Coherent, Freiburg, Germany*  
<sup>2</sup> *Coherent, Mainz, Germany*
- 12:05 – 12:25**      **6.3 Narrow linewidth 2  $\mu\text{m}$  GaSb-based VECSEL for quantum-frequency-converter pumping**  
S. Adler, P. Holl, E. Diwo-Emmer, A. Bächle, M. Rattunde  
*Fraunhofer Institute for Applied Solid State Physics IAF, Freiburg, Germany*
- 12:25 – 12:45**      **6.4 Comparison of Diode-Pumped Dy:KPC and Dy:PGS Lasers Operating above 4.4  $\mu\text{m}$**   
P. Schlosser, V. Savitski  
*Fraunhofer Centre for Applied Photonics, Fraunhofer UK Research Ltd., Glasgow, United Kingdom*
- 13:00 – 14:00**      **Lunch (Canteen of Badenova AG)**

# Advanced Detector Topics

## Session Chair: Andreas Wörl

- 14:00 – 14:30**      **7.1 Invited Paper: Radiation Effects on Solid-State Image Sensors: From Silicon to Infrared Detectors**  
 V. Goiffon  
*ISAE-SUPAERO, Université de Toulouse, France*
- 14:30 – 14:50**      **7.2 Near Infrared Image Sensor Based on Organic Photodetector Monolithically Integrated on CMOS Read-Out**  
A. B. Siddik<sup>1,2</sup>, E. Georgitzikis<sup>1</sup>, P. E. Malinowski<sup>1</sup>, J. Kang<sup>1,4</sup>, J. H. Kim<sup>1</sup>, Y. Hermans<sup>1</sup>, V. Pejovic<sup>1,2</sup>,  
 I. Lieberman<sup>1</sup>, A. Kadashchuk<sup>1,3</sup>, J. Genoe<sup>1,2</sup>, T. Conard<sup>1</sup>, P. Heremans<sup>1,2</sup>, D. Cheyns<sup>1</sup>  
<sup>1</sup> *IMEC, Leuven, Belgium*  
<sup>2</sup> *ESAT, KU Leuven, Leuven, Belgium*  
<sup>3</sup> *National Academy of Sciences of Ukraine, Kyiv, Ukraine*  
<sup>4</sup> *Ulsan National Institute of Science and Technology, Ulsan, South Korea*

- 14:50 – 15:10**      **7.3 MEMS Optical Filters for Multi-Spectral Thermal Imaging and Spectroscopy**  
G. Gill, H. Mao, D. Silva, [L. Faraone](#)  
*Department of Electrical, Electronic and Computer Engineering, The University of Western Australia, Perth, Australia*
- 15:10 – 15:30**      **7.4 HOT Longwave InAs/InAsSb Superlattice Cascade Photodiodes**  
[Ł. Kubiszyn](#), K. Michalczewski, B. Seredyński, A. Krawczyk, K. Dąbrowski, M. Wankiewicz, K. Nowakowski-Szkudlarek, J. Jureńczyk, W. Gawron, J. Piotrowski  
*VIGO Photonics S.A., Ożarów Mazowiecki, Poland*
- 15:30 – 16:00**      **Coffee Break**

## Photonic Integration & Applications

### Session Chair: Robert Keil

- 16:00 – 16:30**      **8.1 Invited Paper: III-V on Silicon QC-Laser Integration and Photonic Integrated Circuits: Towards Ultimate Miniaturization of Mid-IR Sensors**  
[B. Ben Bakir](#), M. Volpert, T. Bria, K. Jourde, S. Barnola, C. Constancias, P. Labeye, P. Barritault, S. Messaoudène, O. Lartigue, V. Reboud, M. Doron, B. Bourlon, S. Nicoletti  
*Univ. Grenoble Alpes, CEA, LETI, Optics and Photonics Department, Grenoble, France*
- 16:30 – 16:50**      **8.2 Multiplexing of Distinct Quantum Cascade Laser Active Regions for Multi-species Gas Sensing using Photonic Integration on InP**  
[D. Burghart](#), K. Zhang, A. Koeninger, G. Boehm, M.A. Belkin  
*Walter-Schottky Institut, Technische Universität München, Garching, Germany*
- 16:50 – 17:10**      **8.3 Balanced-Detection ICAPS for Highly Compact Trace Gas Detection**  
[J. P. Waclawek](#)<sup>1,2</sup>, H. Moser<sup>1,2</sup>, B. Lendl<sup>2</sup>  
<sup>1</sup> Competence Center CHASE GmbH, Vienna, Austria  
<sup>2</sup> TU Wien – Vienna University of Technology, Vienna, Austria
- 17:10 – 17:30**      **8.4 Stand-off Explosive Sensing and Hyperspectral Imaging with a Scanning Dual-Comb IR Spectrometer**  
J. Hayden<sup>1</sup>, J. Feehan<sup>2</sup>, R. Spesyvtsev<sup>2</sup>, M. Stankiewicz<sup>1</sup>, R. Terazzi<sup>1</sup>, M. Geiser<sup>1</sup>, A. Hugi<sup>1</sup>, [V. Savitski](#)<sup>2</sup>  
<sup>1</sup> IRsweep AG, Switzerland  
<sup>2</sup> Fraunhofer Centre for Applied Photonics, Fraunhofer U.K. Research Ltd., Glasgow, United Kingdom
- 17:30 – 17:45**      **Closing**