Fraunhofer IAF

Fraunhofer Institute for Applied Solid State Physics IAF

45th Freiburg Infrared Colloquium Preliminary Program

May 16–17, 2023

www.infrared-colloquium.de

Program Overview

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 (at IAF main building)
15:30	IR-Lasers on Si and Quantum Cascade Laser Applications
19:00	Conference Dinner at Peterhofkeller (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 and Applications
17:30	Closing

Tuesday, May 16, 2023

08:00 – 09:00 **Registration**

09:00 – 09:15 **Welcome**

HgCdTe Detectors

Session Chair: TBD

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[1], J. Fritze[1], J. Albrecht[2], M. Beer[3], H. Lutz[3]
[1] Hensoldt Optronics GmbH, Oberkochen, Germany
[2] Hensoldt Sensors GmbH, Taufkirchen, Germany
[3] 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: TBD

11:15 – 11:45 **2.1** **Invited Paper: T2SL-based MWIR HOT Imagers**
L. Höglund and 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[1], D. Ting[1], A. Soibel[1], A. Khoshakhlagh[1], S. Rafol[1], S. Keo[1], B. Pepper[1], A. Fisher[1], C. Hill[1], W. Johnson[1], O. Kalashnikova[1], M. Garay[1], A. Davies[1], M. Ogut[1], A. Sood[2], J. Zeller[2], C. David[3], S. Babu[4], P. Ghuman[4]
[1] Jet Propulsion Laboratory, California Institute of Technology Pasadena, United States of America
[2] Magnolia Optical Technologies, Inc, Albany, United States of America
[3] Anduril Industries, Inc., Irvine, United States of America
[4] NASA Earth Science Technology Office Greenbelt, Maryland, 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[1], V. Arounassalame[1], M. Tornay[2], M. Bouschet[2], J.P. Perez[2], P. Christol[2], N. Péré-Laperne[3], I. Ribet[1]
[1] ONERA - The French Aerospace Lab, Palaiseau, France
[2] IES, Univ. Montpellier, Montpellier, France
[3] 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 at IAF 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[1,2], M. Delmas[1], L. Höglund[1], D. Ramos[1], R. Ivanov[1], E. Costard[1], H. Pettersson[2,3]
[1] IRnova, Kista, Sweden
[2] Solid State Physics and Nanolund, Lund University, Lund, Sweden
[3] School of Information Technology, Halmstad University, Halmstad, Sweden

3.3 **Direct Band Gap GeSn Photodiodes Operating in the MWIR Spectral Region**
C. Cardoux[1], L. Casiez[1], M. Frauenrath[1], N. Pauc[2], V. Calvo[2], J.M. Hartmann[1], N. Coudurier[1], P. Rodriguez[1], P. Grosse[1], O. Gravrand[1], A. Chelnokov[1], V. Reboud[1]
[1] Univ. Grenoble Alpes, CEA, LETI, Grenoble, France
[2] Univ. Grenoble Alpes, CEA, Grenoble INP, IRIG, PHELIQS, Grenoble, France

3.4 **Pyroelectric Detectors for Earth Explorer 9 - FORUM: Design and Characterization**
A. Hacker[1], A. Neuzner[1], L. Perez-Prieto[1], R. Mistry[2], M. Zahir[3]
[1] Airbus Defence and Space, Taufkirchen, Germany
[2] Leonardo, Southampton, United Kingdom
[3] 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[1,2], M. Delmas[1], L. Höglund[1], R. Ivanov[1], L. Žurauskaitė[1], D. Evans[1], D. Rihtnesberg[1], L. Bendrot[1], S. Smuk[1], A. Smuk[1], S. Becanovic[1], S. Almqvist[1], P. Tinghag[1], S. Fattala[1], E. Trybom[1], E. Costard[1]
[1] IRnova AB Kista, Sweden
[2] 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[1], R. Müller[2], J. Niemasz[2], N, D. Akhavan[1], J. Antoszewski[1], V. Daumer[2], R. Rehm[2], L. Faraone[1]
[1] Dept. Electrical, Electronic & Computer Eng., The Univ. of Western Australia, Perth, Australia
[2] 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[1], N. Baier[1], C. Lobre[1], F. Rochette[1], W. Rabaud[1], G. Lasfarges[1], O. Gravrand[1], C. Martin[2], L. Rubaldo[2]
[1] *CEA LETI, Grenoble, France*
[2] *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[1], S. Złotnik[1], J. Boguski[1], M. Kojdecki[2], J. Wróbel[1,3]
[1] *Institute of Applied Physics, Military University of Technology, Warsaw, Poland*
[2] *Faculty of Cybernetics, Military University of Technology, Warsaw, Poland*
[3] *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[1,2], W. Pölz[3], J. P. Waclawek[1,2], B. Lendl[1]
[1] *TU Wien - Vienna University of Technology, Vienna, Austria*
[2] *Competence Center CHASE GmbH, Vienna, Austria*
[3] *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 **Balanced-Detection ICAPS for Highly Compact Trace Gas Detection**

J. P. Waclawek[1,2], H. Moser[1,2], B. Lendl[1]
[1] *TU Wien – Vienna University of Technology, Vienna, Austria*
[2] *Competence Center CHASE GmbH, Vienna, Austria*

3.18 **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 and Quantum Cascade Laser Applications

Session Chair: TBD

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, and J.-B. Rodriguez
University of Montpellier, France

16:00 – 16:20 **4.2** **Solitons in Quantum Cascade Laser based Kerr Combs**
R. N. Opačak[1,2], D. Kazakov[2], L. Columbo[3], S. Dal Cin[1], M. Beiser[1], F. Pilat[1], M. Brambilla[4], F. Prati[5], M. Piccardo[2,6], F. Capasso[2] , B. Schwarz[1,2]
[1] Institute of Solid State Electronics, TU Wien, Vienna, Austria
[2] John A. Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, United Kingdom
[3] Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Torino, Italy
[4] Dipartimento di Fisica Interateneo and CNR-IFN, Universitá e Politecnico di Bari, Bari, Italy
[5] Dipartimento di Scienza e Alta Tecnologia, Universitá dell'Insubria, Como, Italy
[6] 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
Institut für Biophysik, Goethe-Universität Frankfurt, Germany and 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 Peterhofkeller (University of Freiburg)**
For detailed information please go to www.infrared-colloquium.de

Wednesday, May 17, 2023

SWIR Detection

Session Chair: TBD

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 µm 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[1], B. Ndagano[1], A. Weld[2], X. Ai[2], A. Cardoso[3], J. G. Rarity[3], A. Astill[4], L. Wright[4], K. Pandiyan[4], C. B. E. Gawith[4], L. J. Mcknight[1]
[1] Fraunhofer Centre For Applied Photonics, Glasgow, United Kingdom
[2] QLM Technology Limited, Unit DX, United Kingdom
[3] Quantum Engineering Technology Laboratory, Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom
[4] Covesion Ltd, Unit F3 Adanac North, Southampton, United Kingdom

10:45 – 11:15 **Coffee Break**

Advanced IR-Lasers

Session Chair: TBD

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, Germany

11:45 – 12:05 **6.2** **GaSb based pulsed High-Power Laser Diodes in the Near Mid-Infrared**
J. Gilly[1], D. Rapp[1], J. Schaffner[2], M. T. Kelemen[1]
[1] Coherent, Freiburg, Germany
[2] Coherent, Mainz, Germany

12:05 – 12:25 **6.3** **Single-Frequency 2 µm GaSb-based Semiconductor Disk Laser 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 µm**
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: TBD

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[1,2], E. Georgitzikis[1], P. E. Malinowski[1], J. Kang[1,4], J. H. Kim[1], Y. Hermans[1], V. Pejovic[1,2], I. Lieberman[1], A. Kadashchuk[1,3], J. Genoe[1,2], T. Conard[1], P. Heremans[1,2], D. Cheyns[1]
[1] IMEC, Leuven, Belgium
[2] ESAT, KU Leuven, Leuven, Belgium
[3] National Academy of Sciences of Ukraine, Kyiv, Ukraine
[4] 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 and Applications

Session Chair: TBD

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, 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 Non-invasive Diagnostics by Infrared Spectroscopy of Breath**
K. S. Maiti[1,2]
[1] Max-Planck-Institut für Quantenoptik, Garching, Germany
[2] Lehrstuhl für Experimental Physik, Ludwig-Maximilians-Universität München, Garching, Germany

17:10 – 17:30 **8.4 Stand-off Explosive Sensing and Hyperspectral Imaging with a Scanning Dual-Comb IR Spectrometer**
J. Hayden[1], J. Feehan[2], R. Spesyvtsev[2], M. Stankiewicz[1], R. Terazzi[1], M. Geiser[1], A. Hugi[1], V. Savitski[2]
[1] IRsweep AG, Switzerland
[2] Fraunhofer Centre for Applied Photonics, Fraunhofer U.K. Research Ltd., Glasgow, United Kingdom

17:30 – 17:45 **Closing**