2022 II-VI WORKSHOP on the PHYSICS and CHEMISTRY of II-VI MATERIALS
PROGRAM

Monday, October 24, 2022
Gasparilla Ballroom
(5:00 – 7:00 pm)

Workshop Registration Check-In (5:00 – 7:00 PM)

Welcome by II-VI 2022 Workshop Co-Chairs (5:45 pm)
Enrico Bellotti, Boston University
Eric Piquette, Teledyne Imaging Sensors

Keynote Address on DARPA Imaging Microsystems Technology (6:00 pm)
Dr. Whitney Mason, DARPA

Tutorial on Bulk Growth of CdTe and CdZnTe (6:30 pm)
Kelly Jones, Raytheon Vision Systems

Tuesday, October 25, 2022
Gasparilla Ballroom
(7:30 am – 6:30 pm)

Workshop Registration Check-In (7:30 am – 6:00 pm)

Welcome by II-VI 2022 Workshop Co-Chairs (8:45 am)
Enrico Bellotti, Boston University
Eric Piquette, Teledyne Imaging Sensors

Keynote Address (9:00 am)
Mike Groenert, U.S. Army Night Vision and Electronic Sensors, Fort Belvoir, VA
"Army Imaging Sensor Priorities"

Session 1: Industrial Overview I
Tuesday, October 25 / 9:30 – 10:30 am
Chair: Enrico Bellotti, Boston University, Boston, MA, US

1.1: Invited Presenter: Multi-Bands and Multi-Materials IR Technologies Development at LYNRED (9:30 am)
Laurent Rubaldo, Yohan Fourreau, Vincent Destefanis, Alexandre Brunner, Nicolas Pere-Laperne, Jocelyn Berthoz,
Nicolas Jamin, Lilian Martineau, Frederic Salvetti, Laurent Baud, Pierre Jenouvrier, David Billon-Lanfrey
LYNRED, Veurey-Voroize, France

Timotée Journot, Olivier Gravrand
CEA-Leti, Grenoble, France

1.2: Invited Presenter: IR Sensing at SCD – From Space Systems to Soldier Applications (10:00 am)
Tuvy Markovitz

BREAK 10:30 – 10:45 am

Session 2: Materials
Tuesday, October 25 / 10:45 am - 12:15 pm
Chair: Tony Almeida, US Army CSISR RTI, Fort Belvoir, VA, USA
2.1: Thermo-Mechanical Stress Profiling for 3D Integration of IRFPA Hybridization (10:45 am)
Sushant Sonde, Yong Chang, Silviu Velicu, EPIR, Inc., Bolingbrook, IL, US
Kiran Sasikumar, Argonne National Laboratory, Lemont, IL, US
Subramanian KRS Sankaranarayanan, Argonne National Laboratory, Lemont, IL, US and University of Illinois, Chicago, IL, US

2.2: Student Presenter: DLTS Study of Defects in HgCdTe Heterostructure Photodiodes (11:00 am)
Kinga Majkowycz, Krzysztof Murawski, Tetjana Manyk, Jaroslaw Rutkowski, Malgorzata Kopytko, Piotr Martyniuk
Military University of Technology, Warsaw, Poland

2.3: Developments and Process Improvements Leading to High Quality and Large Area HgCdTe LPE Detectors (11:15 am)
Mauro F. Vilela, Jack Hogan, Kelly Jones, Gregory M. Venzor, Paul M. Goetz, Michael Seas, Andreas Hampp, Raytheon Vision Systems, Goleta, CA, US

2.4: Student Presenter: Determination of Elasto-Plastic Properties of Hg1-xCdxSe (0 ≤ x ≤ 1) Using Nanoindentation (11:30 am)
Zekai Zhang, Wenwu Pan, Wen Lei, Mariusz Martyniuk, Shuo Ma, Lorenzo Faraone, The University of Western Australia, Crawley, Australia

2.5: Student Presenter: Non-Contact Characterization of Carrier Mobility and Ultrafast Dynamics in Long-Wave Infrared HgCdTe Films using Time-Resolved Terahertz Spectroscopy (11:45 am)
Nils B. Refvik, David N. Purschke, Charles E. Jensen, Howe R. J. Simpson, Frank A. Hegmann, University of Alberta, Edmonton, Alberta, Canada
Wenwu Pan, Wen Lei, Renjie Gu, Jarek Antoszewski, Gilberto A. Umana-Membreno, Lorenzo Faraone, The University of Western Australia, Perth, Australia

2.6: Student Presenter: Probing Carrier Multiplication in Long-WaveE Infrared HgCdTe with Intense Terahertz Pulses (12:00 pm)
David N. Purschke, Hannah Louis, Nils B. Refvik, Charles E. Jensen, Howe R. J. Simpson, Frank A. Hegmann, University of Alberta, Edmonton, Alberta, Canada
Wenwu Pan, Wen Lei, Renjie Gu, Jarek Antoszewski, Gilberto A. Umana-Membreno, Lorenzo Faraone, The University of Western Australia, Perth, Australia

LUNCH 12:15 – 1:30 PM

Session 3: Devices I
Tuesday, October 25 / 1:30 – 3:30 pm
Chair: Dan Lofgreen, Raytheon Vision Systems, USA

3.1: Excess Currents in HgCdTe-based LWIR Photovoltaic Sensor Chip Arrays Designed for Auger-Limited Performance (1:30 pm)
Bo Shojaei, Priyalal Wijewarnasuriya, Donald Lee, Aristo Yulius, Michael Carmody
Teledyne Imaging Sensors, Camarillo, CA, USA

3.2: Rule-22: An Update to Rule-07 (1:45 pm)
Majid Zandian
Teledyne Imaging Sensors, Camarillo, CA, USA

3.3: The Tobin Coefficient: A Relevant Photodetector Performance Metric for IR Imaging (2:00 pm)
Alexandre Kerlain, Diane Sam-Giao, Lynred, Veurey-Voroize, France
Olivier Gravrand, CEA, Grenoble, France
3.4: Student Presenter: Propagation Delay in Multi-Channel SWS-CMOS Based Inverters Using II-VI Gate Insulator (2:15 pm)
Abdulmajeed Almalki, Raja H. Gudlavalleti, John Chandy, Faquir Jain
Department of Electrical and Computer Engineering, University of Connecticut, Storrs, CT, USA

Bander Saman
Department of Electrical Engineering, College of Engineering, Taif University, Taif, Saudi Arabia

Evan Heller
Synopsys Inc., Ossining, NY, USA

3.5: Student Presenter: Experimental Determination of the Dependence Between Spectral Response and Current-Voltage Characteristics for MWIR HgCdTe Detectors Grown on GaAs (2:30 pm)
Andrzej Kowalewski, Pawel Madejczyk, Piotr Martyniuk
Military University of Technology, Warszawa, Poland

3.6: At 60 K Performance of Very Long Wavelength Focal Plane Arrays of 18 mm Pixel Size (2:45 pm)

3.7: Characterization of HgCdTe Heterostructures for Infrared Detectors Operating Up to 8 μm (3:00 pm)
Krzysztof Murawski, Kinga Majkowycz, Piotr Martyniuk, Magoryata Kopytko
Institute of Applied Physics, Military University of Technology, Warsaw, Poland

3.8: Ultimate Performance of n-on-p Infrared Photodetectors Fabricated by RIE Process (3:15 pm)
Nima Dehdashi Akhavan, Gilberto Umana Membreno, Renji Gu, Jarek Antoszewski, Lorenzo Faraone
University of Western Australia, Crawley, Australia

BREAK 3:30 – 3:45 PM

Session 4: Modeling and Simulation I
Tuesday, October 25 / 3:45 – 5:00 pm
Chair: Jonathan Schuster, U.S. Army DEVCOM Army Research Laboratory (ARL), Adelphi, MD, US

4.1: Invited Presenter: K.P Theory of Topological Edge States in HgTe/CdTe and InAs/GaSb/AlSb Wide Barrier Superlattices (3:45 pm)
Philip Klipstein, Semiconductor Devices, Haifa, Israel

4.2: Device Optimization of HgCdTe APDs through Comprehensive Device Modeling (4:15 pm)
Mike Zhu, Enrico Bellotti, Boston University, Boston, MA, US

4.3: First-Principles Study of Coherency Strain Effects on the Phase Diagrams and Critical Temperatures for InAs$_{1-x}$Sb$_x$ Alloys (4:30 pm)
Masahiko Matsubara, Alexandros Kyrtos, Enrico Bellotti, Boston University, Boston, MA, US

4.4: HgCdTe Detector and Focal Plane Array Device Physics Simulation Using DevSim, an Open-Source Device Simulation Tool (4:45 pm)
Katerina Zirou, EPIR Inc., Bolingbrook, IL, US, and University of Illinois at Chicago, Chicago, IL, US
Yong Chang, Sushant Sonde, Silviu Velicu, EPIR Inc., Bolingbrook, IL, US

RECEPTION 5:00 – 6:30 pm
Wednesday, October 26, 2022
Gasparilla Ballroom
(7:45 am – 4:30 pm)

Workshop Registration Check-In (7:45 am – 4:30 pm)

Welcome by II-VI 2022 Workshop Co-Chairs (8:45 am)
Enrico Bellotti, Boston University
Eric Piquette, Teledyne Imaging Sensors

Featured Presentation on The James Webb Space Telescope and Its HgCdTe Near-Infrared Array Detectors by Bernard Rauscher, NASA GSFC (9:00 am)

Session 5: Industrial Overview II
Wednesday, October 26 / 9:30 – 10:30 am
Chair: Eric Piquette, Teledyne Imaging Sensors, Camarillo, CA, US

5.1: Invited Presenter: Status and Future of IR Technology at AIM (9:30 am)
Heinrich Figgemeier
AIM Infrarot-Module GmbH, Heilbronn, Germany

5.2: Invited Presenter: Raytheon Industry Overview (10:00 am)
Kelly Jones, Raytheon, Goleta, CA, US

BREAK 10:30 – 10:45 AM

Session 5: Industrial Overview II (CONT.)
Wednesday, October 26 / 10:45 – 11:15 am
Chair: Eric Piquette, Teledyne Imaging Sensors, Camarillo, CA, USA

5.3: Invited Presenter: Current State of IR Detectors at Leonardo (10:45 am)
James Wilson, Chris Maxey, Ian Baker, Adam Greenen
Leonardo, Southampton, UK

Session 6: Superlattice
Wednesday, October 26 / 11:15 am – 12:15 pm
Chair: Enrico Bellotti, Boston University, Boston, MA, USA

6.1: Demonstration of T2SLs InAs/InAsSb Based Interband Cascade Detector Supported by Immersion Lens for LWIR (11:15 am)
Waldemar Gawroni, Military University of Technology, Warsaw, Poland and VIGO System S.A, Mazowiecki, Poland
Łukasz Kubiszyn, Krystian Michalczewski, Jarosław Juręńczyk, Józef Piotrowski, VIGO System S.A, Mazowiecki, Poland
Piotr Martyniuk, Military University of Technology, Warsaw, Poland
6.2: The Role of Carrier Localization in Determining the Temperature Dependence of the Mid-Wavelength Infrared InAs/InAsSb Type-II Superlattice Energy Gap (11:30 am)
Krzysztof Murawski, Tetiana Manyk, Malgorzata Kopytko, *Military University of Technology, Warsaw, Poland*

6.3: Photo-Hall Characterisation of Lateral & Vertical Electronic Transport in InAs/GaSb type-II Superlattices (11:45 am)
Gilberto Umana-Membreno, Nima Akhavan, Jaroslaw Antoszewski, Lorenzo Faraone
*The University of Western Australia, Crawley WA, Australia*

6.4: Mobility Extraction from Quantum Transport Calculations of Type-II Superlattices (12:00 pm)
John Glennon, Enrico Bellotti, *Boston University, Boston, MA, US*

**LUNCH 12:15 – 1:30 PM**

**Session 7: Devices II**
**Wednesday, October 27 / 1:30 – 3:30 pm**
**Chair:** Jill Nolde, *Naval Research Laboratory, US*

7.1: Invited Speaker: MCT-Graphene Heterostructure for Room Temperature LWIR Imaging (1:30 pm)
Debashis Chanda
*University of Central Florida, Orlando, FL, US*
Srinivas Krishnamurthy
*Sivananthan Laboratories, Bolingbrook, IL, US*
Silviu Velicu
*EPIR Inc., Bolingbrook, IL, US*

7.2: Improving HDVIP Performance at Leonardo DRS Using Photonic Crystal Resonances (2:00 pm)
Patrick Anderson, Justin Wilks, Christina Poole, Sameer Ajmera, Pradip Mitra
*Leonardo DRS - EOIS, Dallas, TX, US*

7.3: Ultra-Small MWIR and LWIR Pixel Pitch Focal Plane Arrays at AIM (2:15 pm)
Heinrich Figgemeier, Rainer Breiter, Detlef Eich, Alexander Epping, Stefan Hanna, Oliver Herrmann, Holger Lutz, Daniel Prigge
*AIM Infrarot-Module GmbH, Heilbronn, Germany*

7.4: Electron Beam Induced Current (EBIC) Analysis of MWIR Fully Depleted Structures (2:30 pm)

7.5: Student Presenter: Dark Current Evolution in Irradiated MWIR HgCdTe Photodiodes (2:45 pm)
Ségolene Dinand, *Airbus Defense and Space, Toulouse, France and CEA-Leti, Grenoble, France*
Nicolas Baier, Eric de Borniol, Olivier Gravrand, *CEA-Leti, Grenoble, France*
Clémentine Durnez, CNES, *Toulouse, France*
Vincent Goiffon, *Université de Toulouse, Toulouse, France*
Serena Rizzolo, Olivier Saint-Pé, *Airbus Defense and Space, Toulouse, France*

7.6: Optimization and Measurement of MCT Planar Diode MTF with Small Pitch and High Operating Temperature (3:00 pm)
Bustillos Vascos, *CEA-Leti, Grenoble, France*

7.7: Student Presentation: Development of a Cryogenic Spot Scan Bench for the PSF Measurement on Mid-Infrared Detectors (3:15 pm)
Session 8: Substrates
Wednesday, October 26 / 3:30 – 4:30 pm
Chair: Fikri Aqariden, Leonardo DRS, EOIS, Dallas, TX, US

8.1: Invited Presenter: TEM/STEM Characterization of Precipitates in CdZnTe Crystals Made by the VGF Method (3:30 pm)
Sara Modni, Sorbonne University Paris 6, Paris, France and CEA Leti, Grenoble, France
Timotée Journot, Stéphanie Anceau, CEA Leti, Grenoble, France
Gilles Patriarche, C2N, Palaiseau, France

8.2: Student Presenter: CdTe/InSb(211) Virtual Substrates for IR Detector Application (4:00 pm)
Tyler T. McCarthy, Zheng Ju, Allison McMinn, Yong-Hang Zhang, Arizona State University, Tempe, AZ, US
Richard Kodama, Fikri Aqariden, Leonardo DRS, Bolingbrook, IL, US
Pok-Kai Liao, Pradip Mitra, Leonardo DRS, Dallas, TX, US

8.3: Student Presenter: CdZnTe Crystal Quality Study by Cathodoluminescence Measurements (4:15 pm)
Valentin Léger, Thomas Bidaud, Stefano Pirotta, Stéphane Collin, Gilles Patriarche, Université Paris-Saclay, Palaiseau, France
Catherine Corbel, Ecole Polytechnique, Institut Polytechnique de Paris, Palaiseau, France
Laurent Rubaldo, LYNRED, Veurey-Voroize, France

Thursday, October 27, 2022
Gasparilla Ballroom
(7:45 am – 4:30 pm)

Workshop Registration Check-In (8:00 am – 12:00 pm)

Welcome by II-VI 2022 Workshop Co-Chairs (9:15 am)
Enrico Bellotti, Boston University
Eric Piquette, Teledyne Imaging Sensors

Session 9: Industrial Overview III
Thursday, October 27 / 9:30 – 10:30 am
Co-Chair: Eric Piquette, Teledyne Imaging Sensors, Camarillo, CA, US
Co-Chair: Enrico Bellotti, Boston University, Boston, MA, US

9.1: IR Focal Plane Technology at Teledyne (9:30 am)
Michael Carmody
Teledyne Imaging Sensors, US

9.2: Invited Presenter: Integrated Sensing (10:30 am)
Philip Perconti, US
Session 9: Industrial Overview III (CONT.)
Thursday, October 27 / 10:45 – 11:15 am
Co-Chair: Eric Piquette, Teledyne Imaging Sensors, Camarillo, CA, US
Co-Chair: Enrico Bellotti, Boston University, Boston, MA, US

9.3: Invited Presenter: Annealing Studies for Quality Improvement of CdZnTe Crystals (10:45 am)
Yasin Ergunt, Merve Uysal, Burak Asici, Huseyin Eroglu, Oguz Altun
ASELSAN Inc., Ankara, Turkey

Session 10: Modeling and Simulation II
Thursday, October 27 / 11:15 am – 12:30 pm
Chair: Priyalal Wijewarnasuriya, Teledyne Imaging Sensors, Camarillo, CA, US

10.1: Nuclear Physics Simulation of HgCdTe Detectors and Focal Plane Arrays Under High Energy Neutron Particles (11:15 am)
Yong Chang, Sushant Sonde, Silviu Velicu, EPIR Inc., Bolingbrook, IL, US
Thomas Kroc, Fermi National Accelerator Laboratory, Batavia, IL, US

10.2: Growth Modeling of Strained HgCdTe Epilayers (11:30 am)
Anthony J. Ciani, Sivananthan Laboratories, Bolingbrook, IL, US
Christoph H. Grein, University of Illinois at Chicago, Chicago, IL, US

10.3: A computational study of radiation damage in HgCdTe (11:45 am)
Jamal Mustafa, Chad Fulk, Michael Seas, David Rhiger
Raytheon Vision Systems, Goleta, CA, US

10.4: Nonequilibrium Green’s Function Modeling of Infrared Superlattice Photodetectors (12:00 pm)
Alberto Tibaldia, Jesus Alberto Gonzalez Montoyaa, Michele Goanoa, Francesco Bertazzia, Dipartimento di Elettronica, Politecnico di Torino, Torino, Italy

10.5: Building an Atoms-to-Systems Modeling and Simulation Platform for Optoelectronics (12:15 pm)
Samiran Ganguly, Nibir K. Dhar, Virginia Commonwealth University, Richmond, VA, US
Avik W. Ghosh, University of Virginia, Charlottesville, VA, US

CASSELLMAN/SPICER AWARD (12:30 PM)