7th IIR Conference on Thermophysical Properties and Transfer Processes of Refrigerants

TPTPR2025

College Park, Maryland USA

JUNE 15-18

June 15-18, 2025

University of Maryland • College Park, Maryland, USA

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The Center for Environmental Energy Engineering (CEEE) is proud to host TPTPR 2025.

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CENTER FOR ENVIRONMENTAL ENERGY ENGINEERING

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Research Professor and EEHP Director
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Dr. Vikrant Aute
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Center for Environmental Energy Engineering
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Postdoctoral Faculty Research Associate
Center for Environmental Energy Engineering
University of Maryland

Leanne Poteet, Program Secretariat
Program Manager
Center for Environmental Energy Engineering
University of Maryland

Beth Panitz, Program Secretariat
Communications Coordinator
Center for Environmental Energy Engineering
University of Maryland

Welcome

Dear Colleagues and Attendees,

The demand for low-Global Warming Potential (GWP) refrigerants is surging due to stringent environmental regulations and the need for sustainable HVACR solutions. This shift seeks to replace high-GWP refrigerants like HFCs, which significantly drive climate change.

Understanding the thermophysical properties (like density, viscosity, thermal conductivity and specific heat) and heat transfer characteristics (such as boiling, condensation and convective heat transfer coefficients) of new refrigerants is critical for their effective application in cooling and heating systems. These properties determine how efficiently a refrigerant can absorb, transfer and release heat in components like evaporators, condensers and compressors.

The Seventh IIR Conference on Thermophysical Properties and Transfer Processes of Refrigerants (TPTPR) is a pivotal platform for sharing our new knowledge to tackle this global challenge. Hosted by the Center for Environmental Energy Engineering (CEEE) at the University of Maryland, a leader in innovative, safe and sustainable technologies, the conference showcases researchers' work on eco-friendly alternatives to conventional refrigerants and systems.

From over 50 submitted abstracts, we are excited to present 43 pioneering papers exploring the thermophysical properties and heat transfer characteristics of new refrigerants and their mixtures, and their applications to heat exchangers and systems.

We sincerely thank the authors for their exceptional contributions and the session chairs, plenary speakers and volunteers whose dedication made this program possible. Thank you for joining this critical conversation.

Sincerely,

The Organizing Committee
Yunho Hwang, Center for Environmental Energy Engineering
Vikrant C. Aute, Center for Environmental Energy Engineering

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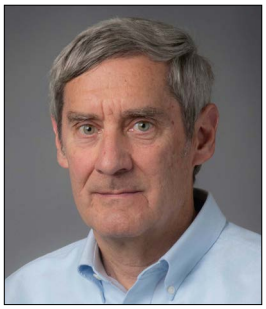


Mark O. McLinden

Monday | 8:30 am

Thermodynamics of Refrigerants: Or, Why Did We Ever Go With the F-gases?

Mark O. McLinden is a research chemical engineer for the National Institute of Standards and Technology (NIST), in Boulder, Colo. He received his B.S. degree from the University of Missouri-Columbia and M.S. and Ph.D. degrees from the University of Wisconsin-Madison, all in chemical engineering. He joined what was then the National Bureau of Standards (NBS) in 1984 and worked in the Thermal Machinery Group of NBS–Gaithersburg, where he developed a nist-equation of state for refrigerant mixtures, carried out analytical studies on the optimum thermodynamic characteristics of refrigerants and constructed an experimental apparatus to measure evaporative heat transfer coefficients. He joined the Thermophysical Properties Division of NIST in Boulder in 1988, where his research through the 1990s focused on the properties of alternatives to the ozone-depleting CFC and HCFC refrigerants.

His current focus is on highly accurate measurements of fluid properties over wide ranges of temperature and pressure and the design and fabrication of instruments for such measurements. The current interest in low–Global Warming Potential (GWP) alternatives to HFC refrigerants has reignited his research in the refrigerants area. He is the author or coauthor of more than 60 peer-reviewed publications and has received several awards related to his refrigerants research.

Mark B. Shiflett

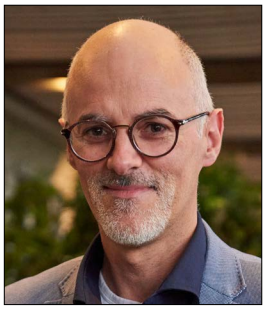
Monday | 9:15 am

Environmentally Applied Refrigerant Technology Hub (EARTH)— a New NSF Engineering Research Center

Mark B. Shiflett is a Foundation Distinguished Professor in the Department of Chemical and Petroleum Engineering at the University of Kansas (KU). He is the director of the Environmentally Applied Refrigerant Technology Hub (EARTH), a new National Science Foundation Engineering Research Center. He is also the director of the Wonderful Institute for Sustainable Engineering at KU and editor-in-chief for "Journal of Ionic Liquids." He is co-founder and chief science officer for two companies, Icorium Engineering Company and Pvera Tech, LLC. Professor Shiflett joined KU in August 2016 after retiring from the DuPont Company, where he was a Technical Fellow in the Central Research and Development organization at the Experimental Station in Wilmington, Del. Professor Shiflett was also an adjunct professor at the University of Delaware in the Department of Chemical and Biomolecular Engineering.

Dr. Shiflett is an inventor on 48 U.S. patents and has published 150 articles with over 10,000 citations. He was awarded the DuPont Bolton Carothers award in 2005, the ACS Hero of Chemistry award in 2006 and the University of Delaware presidential citation in 2007 for his development of HFC refrigerant mixtures to replace ozone-depleting CFCs.

Plenary Speakers | Tuesday



Claudio Zilio

Tuesday | 8:30 am

Chasing Low-GWP Refrigerants From a Heat Transfer Perspective

Claudio Zilio is a mechanical engineer and is a Full Professor at the University of Padova in Italy, where he teaches the courses "Applied Thermodynamics" and "Thermal Systems." He has been involved with several European research projects, primarily concerning refrigeration technology and heat transfer, and he is the author or coauthor of more than 200 papers dealing with topics such as thermodynamics of inverse cycles; heat transfer, both theoretical and technological aspects; energy applications related to HVAC of buildings; refrigeration for foodstuff preservation; and refrigerating equipment.

Dr. Zilio is a member of the editorial board of ASHRAE's "Science and Technology for the Built Environment" journal. He is secretary of International Institute of Refrigeration Commission B2 and president of AiCARR, the Italian Association for Air Conditioning, Heating and Refrigeration.

Vikrant C. Aute

Tuesday | 9:15 am

Reimagining Heat Exchangers for Space Conditioning, Refrigeration and Power Generation

Vikrant C. Aute is a research professor and director of the University of Maryland Center for Environmental Energy Engineering (CEEE), a leader in HVAC&R innovation. His research focuses on heat exchanger innovation, thermal storage, multidisciplinary optimization and the application of artificial intelligence and machine learning to improve HVAC&R systems. At CEEE, he spearheads the development of modeling and optimization platforms that transform the way HVAC&R components and systems are designed.

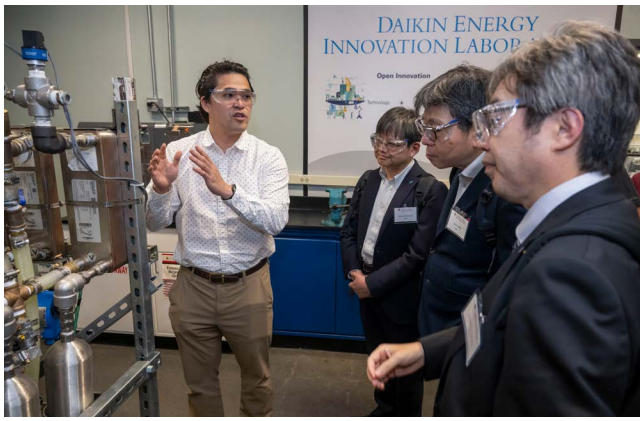
Dr. Aute is a Fellow of the American Society of Mechanical Engineers and ASHRAE. He is an active member of ASHRAE and has served on multiple technical, standards and standing committees as a voting member. He is a certified Professional Scrum Master and a Microsoft Certified Professional. He received the 2024 Dean's Outstanding Performance Award for Professional Track Faculty from the A. James Clark School of Engineering at the University of Maryland.

Tours of UMD Engineering Labs

Monday, June 16 | 3:00-5:00 pm

Meet in First Floor Entryway, A. James Clark Hall

Get an insider's look at how University of Maryland researchers are developing the next generation of eco-friendly heating, ventilation, air conditioning and refrigeration (HVAC&R) technologies to help slow climate change. See where our researchers are creating advanced heat transfer technologies, solid-state refrigerants with zero global warming potential and more.



Daikin Energy Innovation Laboratory

0147 Engineering Lab Building | 8136 Paint Branch Drive

The Daikin Energy Innovation Laboratory is a 3,600 square foot state-of-the-art facility that features the latest equipment for energy engineering, including flame resistant climate chambers, heat transfer measurement technologies and facilities for experimental alternative cooling technologies. See where our researchers are developing elastocaloric cooling devices that offer a solid-state alternative to vapor-compression technology by using shape memory alloys as refrigerants. The lab is run by the university's Center for Environmental Energy Engineering (CEEE).

George E. Dieter, Jr. Materials Instructional Lab

1135 Jeong H. Kim Building | 8228 Paint Branch Drive

At the Dieter Lab, tour attendees will learn more about the University of Maryland's research on elastocaloric cooling, a revolutionary technology that has been shown to offer efficient cooling, with zero direct global warming potential. In this lab, researchers test the materials and components of the elastocaloric prototype devices developed in the Daikin Energy Innovation Laboratory. In addition to sample preparation (for microscopy, calorimetry, etc.), our engineers conduct a range of mechanical tests such as tension, compression, bending, torsion, fatigue, hardness and impact, using specialized instrumentation. The work is a collaboration between CEEE and the Department of Materials Science and Engineering.

Nanoscale Energy & Interfacial Transport Laboratory

2135 & 3139 Jeong H. Kim Building | 8228 Paint Branch Drive

The Nanoscale Energy and Interfacial Transport lab investigates heat transfer at nano-, micro- and mini-scale to develop novel microfluidic two-phase cold plates, phase change materials and packaging for novel wide band gap power electronics with applications in data centers, power electronics and high frequency systems. The researchers also work extensively on developing machine learning tools for device thermal performance prediction in power electronics and thermal-fluids performance of cold plates. The lab works with both industry and government research organizations to investigate fundamental transport phenomena with the goal of developing disruptive technologies.

Small and Smart Thermal Systems Laboratory

3131-3135 Jeong H. Kim Building | 8228 Paint Branch Drive

The Small and Smart Thermal Systems (S2TS) Laboratory focuses on pioneering applications in energy conversion, heat/mass exchangers, process intensification, electronics cooling, and innovative component design and manufacturing for energy systems. The research encompasses state-of-the-art manufacturing techniques, including additive manufacturing and the application of micro- and nano-systems for process intensification and optimization. S2TS is at the forefront of decarbonization efforts, conducting energy audits, energy profiling and energy modeling. The lab is dedicated to developing advanced energy auditing software with machine learning capabilities for precise and efficient energy and carbon assessments and compliance projections. S2TS is home to CEEE's Advanced Heat Exchangers and Process Intensification industrial consortium, and is affiliated with the Center for Advanced Life Cycle Engineering.

Program at a Glance

SUNDAY, JUNE 15

4:00 PM	Registration | 4:00-7:00 PM
6:00 PM	Welcome Reception | 6:00-8:00 PM

MONDAY, JUNE 16

7:00 AM	Registration | 7:00 AM-4:00 PM
7:30 AM	Breakfast
8:00 AM	Opening Ceremony
8:30 AM	Plenary Speaker Mark O. McLinden, NIST
9:15 AM	Plenary Speaker Mark B. Shiflett, University of Kansas
10:00 AM	Coffee Break
10:30 AM	A1: Thermophysical Properties 1 A2: Refrigeration Oils
12:00 N	Lunch
1:00 PM	B1: Thermophysical Properties 2 B2: Not-in-Kind Technologies
3:00 PM	Lab Tours | 3:00-5:00 PM

TUESDAY, JUNE 17

7:00 AM	Registration | 7:00 AM-10:00 AM
7:30 AM	Breakfast
8:30 AM	Plenary Speaker Claudio Zilio, University of Padova
9:15 AM	Plenary Speaker Vikrant C. Aute, CEEE, University of Maryland
10:00 AM	Coffee Break
10:30 AM	C1: Refrigerant Mixtures C2: Condensation Heat Transfer
12:00 N	Lunch
1:00 PM	D1: Low-GWP Refrigerants for Heat Pumps D2: Boiling Heat Transfer
3:00 PM	Coffee Break
3:30 PM	E1: Low-GWP Refrigerant Behaviors E2: Heat Transfer Enhancements
5:30 PM	Conference Banquet | 5:30-8:30 PM

WEDNESDAY, JUNE 18

7:30 AM	Breakfast
8:00 AM	F1: Workshop: Low-GWP Refrigerants and Data Center Cooling Fluids
10:00 AM	Coffee Break
10:30 AM	F2: Workshop: AI/ML for Transport Processes - Challenges and Opportunities
12:00 N	Lunch & Closing Ceremony

All sessions and meals will be in the A. James Clark Hall, 8278 Paint Branch Drive.
Plenary sessions, workshops and meals will be in Clark Hall's Stanley R. Zupnik '59 Forum (Room 1101).

Conference Schedule

Sunday

4:00 pm-7:00 pm	**Conference Registration** | First Floor Entryway, A. James Clark Hall
6:00 pm-8:00 pm	**Welcome Reception** | Forum, Room 1101, A. James Clark Hall

Monday

7:00 am-4:00 pm	**Conference Registration** | First Floor Entryway, A. James Clark Hall	
7:30 am-8:30 am	**Breakfast** | Forum, Room 1101, A. James Clark Hall	
8:00 am-8:30 am	**Conference Opening Ceremony** | Forum, Room 1101, A. James Clark Hall	
8:30 am-9:15 am	**Plenary Speaker:** Dr. Mark O. McLinden | Forum, Room 1101, A. James Clark Hall	
9:15 am-10:00 am	**Plenary Speaker:** Dr. Mark B. Shiflett | Forum, Room 1101, A. James Clark Hall	
10:00 am-10:30 am	**Coffee Break**	
	Clark Hall, Room 2121	**Clark Hall, Room 2132**
10:30 am-12:00 noon	**Session A1** Thermophysical Properties 1	**Session A2** Refrigeration Oils
12:00 noon-1:00 pm	Lunch | Forum, Room 1101, A. James Clark Hall	
	Clark Hall, Room 2121	**Clark Hall, Room 2132**
1:00 pm-3:00 pm	**Session B1** Thermophysical Properties 2	**Session B2** Not-in-Kind Technologies
3:00 pm-5:00 pm	**Lab Tours** | Meet in First Floor Entryway, A. James Clark Hall	

Conference Schedule

Tuesday

7:00 am-10:00 am	**Conference Registration** | First Floor Entryway, A. James Clark Hall	
7:30 am-8:30 am	**Breakfast** | Forum, Room 1101, A. James Clark Hall	
8:30 am-9:15 am	**Plenary Speaker:** Dr. Claudio Zilio | Forum, Room 1101, A. James Clark Hall	
9:15 am-10:00 am	**Plenary Speaker:** Dr. Vikrant C. Aute | Forum, Room 1101, A. James Clark Hall	
10:00 am-10:30 am	**Coffee Break**	
	Clark Hall, Room 2121	**Clark Hall, Room 2132**
10:30 am-12:00 noon	**Session C1** Refrigerant Mixtures	**Session C2** Condensation Heat Transfer
12:00 noon-1:00 pm	**Lunch** | Forum, Room 1101, A. James Clark Hall	
	Clark Hall, Room 2121	**Clark Hall, Room 2132**
1:00 pm-3:00 pm	**Session D1** Low-GWP Refrigerants for Heat Pumps	**Session D2** Boiling Heat Transfer
3:00 pm-3:30 pm	**Coffee Break**	
	Clark Hall, Room 2121	**Clark Hall, Room 2132**
3:30 pm-5:00 pm	**Session E1** Low-GWP Refrigerant Behaviors	**Session E2** Heat Transfer Enhancements
5:30 pm-8:30 pm	**Conference Banquet** | Forum, Room 1101, A. James Clark Hall	

Wednesday

7:30 am-8:30 am	**Breakfast** | Forum, Room 1101, A. James Clark Hall
	Forum, Clark Hall
8:00 am-10:00 am	**Session F1** Workshop: Low-GWP Refrigerants and Data Center Cooling Fluids
10:00 am-10:30 am	**Coffee Break**
	Forum, Clark Hall
10:30 am-12:00 noon	**Session F2** Workshop: AI/ML for Transport Processes - Challenges and Opportunities
12:00 noon-1:00 pm	**Lunch and Closing Ceremony** | Forum, Room 1101, A. James Clark Hall

Technical Sessions

MONDAY, JUNE 16

10:30 AM - 12:00 NOON

A1: Thermophysical Properties 1 | Clark 2121

Session Chair: Mark O. McLinden

1117 The Gaseous Sound Speed and Density Measurements for R1132(E) and Its Binary Mixture with R1234yf

Kano, Yuya; Nishihashi, Kanako; Kayukawa, Yohei; Kuramoto, Naoki

National Institute of Advanced Industrial Science and Technology (AIST), Japan

1126 Speed of Sound Measurement of R1132(E) in the Liquid Phase Using an Ultrasonic-Pulse Sensor

Nishihashi, Kanako; Yuya, Kano; Kayukawa, Yohei; Kuramoto, Naoki

National Institute of Advanced Industrial Science and Technology (AIST), Japan

1133 Evaluation of R-1132(E)/R-32 Mixtures: pVT Properties, Critical Parameters and Binary Interaction Parameters

Thu, Kyaw (1,2); Miyane, Kozue (1); Higashi, Yukihiro (1); Akasaka, Ryo (1,3)

1: Research Center for Next Generation Refrigerant Properties (NEXT-RP) International Institute for Carbon-Neutral Energy Research (WPI-I2CNER), Japan; 2: Department of Advanced Environmental Science and Engineering Interdisciplinary Graduate School of Engineering Sciences, Kyushu University, Japan; 3: Department of Mechanical Engineering Faculty of Science and Engineering, Kyushu Sangyo University, Japan

1107 Experimental Investigation of Thermophysical Properties of Low-Global Warming Potential Refrigerant Lubricant Mixtures Across Extreme Temperature Ranges

Venkatesan, Ganesh B.; Barta, Riley B.

Ray W. Herrick Laboratories, School of Mechanical Engineering, Purdue University, USA

A2: Refrigeration Oils | Clark 2132

Session Chair: Adrian Mota Babiloni

1119 Effect of POE/CuO Nano-lubricant on the Performance of an R134a Domestic Reciprocating Compressor

Ndanduleni, Asasei U.C.; Ramathe, Teboho; Huan, Zhongjie

Tshwane University of Technology, South Africa

1127 Foaming Characteristics of Refrigeration Oil Mixed with R454B, R32, and R1234yf Refrigerants by Stirring Action

Rakpakdee, Wannarat (1); Kato, Yuto (2); Fukuta, Mitsuhiro (1); Motozawa, Masaaki (1); Goto, Satoshi (3)

1: Department of Mechanical Engineering, Shizuoka University, Hamamatsu, Japan; 2: Graduate School of Integrated Science and Technology, Shizuoka University, Japan; 3: ENEOS Corporation, Lubricants R & D Department Yokohama, Kanagawa, Japan

1106 Test Stand and Model Development for Assessing Two-Phase Flow of Low-GWP Zeotropic Refrigerant Mixtures with Lubricants

Shepard, Kyle F. A.; Cox, Joshua M.; Barta, Riley B.

Purdue University, USA

1120 Monitoring the Transient Concentration of Refrigerant in Oil Using Ultrasonic TOF Method

Wang, Che; Wu, Juncheng; Wu, Jianhua

Xi'an Jiaotong University, China, People's Republic of

MONDAY, JUNE 16

1:00 PM - 3:00 PM

B1: Thermophysical Properties 2 | Clark 2121

Session Chair: Mark B. Shiflett

1146 REFPROP Revision Control Method

Johnson, Phillip A.; Proper, John P.; Rydkin, Ivan; Via, Austin C.

Daikin Applied, USA

1125 Modeling of Thermophysical Properties of Refrigerants Using Neural Networks for Improving Heat Pump Optimization

Dawoud, Maged (1,2,3)

1: Technische Universität Berlin, Germany; 2: Forschungszentrum Jülich GmbH, Germany; 3: KU Leuven, Belgium

1111 Improved Heat Pump Simulation Under Consideration of the Refrigerant-Oil Solubility

Kunath, Max; Rudzik, Tim; Xu, Yixia; Thomas, Christiane

Technical University Dresden, Germany

1121 Fast Evaluation of Refrigerant Thermophysical Properties Using Neural Networks for Transient Simulations

Ma, Jiacheng (1); Thorade, Matthis (2); Gohl, Jesse (1); Nirmala (2)

1: Modelon Inc., USA; 2: Modelon Deutschland GmbH, Germany

1134 Development of Evaluation Method of Self-Decomposition Reactions of Next-Generation Refrigerants; 1st Report: Development of Ignition Method

Higashi, Tomohiro; Ito, Makoto; Hashimoto, Katsumi; Kotari, Masashi

Central Research Institute of Electric Power Industry, Japan

B2: Not-in-Kind Technologies | Clark 2132

Session Chair: Jinyoung Seo

1157 Performance Evaluation of HFO-Based Ionic Liquid Pairs for Double-Effect Absorption Refrigeration System

Lee, Yong Gyun; Kim, Dong Kyu

Chung-Ang University, Korea, Republic of (South Korea)

1130 Potentials of Absorption Thermal Energy Storage Systems in Seasonal Application

Höffner, Dorian; Ziegler, Felix; Elbel, Stefan

Technische Universität Berlin, Germany

1128 Experimental Validation of Thermo-mechanical Properties for Novel Elastocaloric Material

Mevada, Het (1); Liu, Boyang (2); Kabirifar, Parham (2); Takeuchi, Ichiro (2); Hwang, Yunho (1)

1: Center for Environmental Energy Engineering, Department of Mechanical Engineering, University of Maryland, College Park, Maryland, USA; 2: Department of Materials Science and Engineering, University of Maryland, College Park, Maryland, USA

1118 Thermodynamic Analysis of an Absorption Refrigeration Cycle Operating with the Working Fluid Pair (CO2-propylene Carbonate)

Coulier, Yohann (1); Hajlaoui, Alaa (1); Andanson, Jean-Michel (1); Rodier, Laurence (1); Altamirano, Amin (2)

1: University Clermont Auvergne / Institut of Chemistry of Clermont-Ferrand, France; 2: Laboratory of Refrigeration and Energy Systems / Conservatoire National des Arts et Métiers, France

1122 Impact of Transport Properties of Isopropanol/Acetone on the Performance of Electrochemical Looping Heat Pumps

Dai, Chaoran; Zhu, Mingjie; Braun, James E; Groll, Eckhard A; Ziviani, Davide

Ray W Herrick Laboratories, School of Mechanical Engineering, Purdue University, USA

TUESDAY, JUNE 17

10:30 AM - 12:00 NOON

C1: Refrigerant Mixtures | Clark 2121

Session Chair: Mitsuhiro Fukuta

1112 Refrigerant Mixture Composition Determination with Different Methods During Dynamic Start-Up, Charging, and Enforced Leakage Events in a Laboratory High-Temperature Heat Pump

Brendel, Leon Philipp Martin; Arpagaus, Cordin; Bertsch, Stefan S.

Eastern Switzerland University of Applied Sciences, Switzerland

1105 Thermodynamic Study of CO2 – Acetone Mixture in a Refrigeration Cycle

Rodier, Laurence; Coulier, Yohann; Hajlaoui, Alaa

Clermont Auvergne University, France

1165 Performance of Low-GWP Zeotropic Refrigerants R454C and R455A in a Medium Temperature Display Case

Birbarah, Patrick; Inampudi, Sugun Tej; Karwa, Nitin; Gao, Kaimi

Honeywell International, USA

1138 Application of Zeotropic Refrigerants in Large Chillers

Low, Robert Elliott (1); Kim, Sarah (2)

1: Orbia F&EM, United Kingdom; 2: Orbia F&EM, USA

C2: Condensation Heat Transfer | Clark 2132

Session Chair: Akio Miyara

1141 Experimental Analysis on Condensation Heat Transfer of Propane and a Propane/CO2 Mixture in a Minichannel

Azzolin, Marco; Seresin, Simone; Mattiuzzo, Nicolò; Magnabosco, Alessandra; Tancon, Marco; Bortolin, Stefano

University of Padova, Italy

1114 Condensation Heat Transfer and Pressure Drop of R1336mzz(Z) in a Smooth Horizontal Tube at High Saturation Temperatures

Ahmadpour, M.M.; Fronk, Brian M.

The Pennsylvania State University, USA

1103 Optimizing Flow Condensation Models for Next-Generation Refrigerants in Axial Micro-fin Aluminum Tubes

Hu, Yifeng; Yana Motta, Samuel Fortunato; Yang, Cheng-Min; Jajja, Saad Ayub; Fricke, Brian Albert; Nawaz, Kashif

Oak Ridge National Laboratory, USA

1148 A Simple Model for Heat Transfer in Annular Two-Phase Flow

Yankowski, Chase; Mullin, Braedon; Lin, Lingnan

University of Maryland, USA

TUESDAY, JUNE 17

1:00 PM - 3:00 PM

D1: Low-GWP Refrigerants for Heat Pumps | Clark 2121

Session Chair: Samuel Yanna Motta

1100 Proposal of a Transcritical R-1234ze(E) High-Temperature Heat Pump for Industrial Heating

Forés-Palanques, Alejandro; Udroiu-Bucur, Cosmin-Mihai; Navarro-Esbrí, Joaquín; Giménez-Prades, Pau; Alarnaot-Alarnaout, Ghad; Mota-Babiloni, Adrián

ISTENER Research Group, Department of Mechanical Engineering and Construction, Universitat Jaume I, Spain

1101 Comparative Study of Mid- and Low-Pressure Refrigerants in Heat Pumps Connected to District Heating and Cooling Networks

Mota Babiloni, Adrián (1); Alarnaot-Alarnaout, Ghad (1); Pallotta, Giovanna (2); Barragán Cervera, Ángel (1); Giménez-Prades, Pau (1); Forés-Palanques, Alejandro (1); Navarro Esbrí, Joaquín (1)

1: ISTENER Research Group, Department of Mechanical Engineering and Construction, Universitat Jaume I; 2: Department of Engineering, University of Sannio

1150 Performance of the Ground-Source Heat Pump System for Hot Water Supply with a Small Refrigerant Charge

Kamiyama, Shotaro (1); Noguchi, Ryogo (1); Jige, Daisuke (1); Inoue, Norihiro (1); Nagano, Katsunori (2)

1: Tokyo University of Marine Science and Technology, Japan; 2: Hokkaido University, Japan

1108 Future Outlook on Vapor Injection and Thermal Energy Storage Integration for Air Source Heat Pump Defrosting: A Review

Yang, Jangho; Muehlbauer, Jan; Hwang, Yunho

Center for Environmental Energy Engineering, Department of Mechanical Engineering, University of Maryland, USA

1153 Feasibility Study on Ammonia Heat Pump System Using Electrochemical Compressor

Chu, Chan Ho (1); Kim, Young Ki (1); Kim, Dong Kyu (1,2)

1: Chung-Ang University, Korea; 2: National Institute of Standards and Technology, USA

D2: Boiling Heat Transfer | Clark 2132

Session Chair: Claudio Zilio

1142 Experimental Study on Performance Comparison of R410A Saturated Flow Boiling in 3D Printed and Extruded Micro-channels Tubes

Guo, Luyao (1,2); Lin, Xiaojie (3); Huang, Long (1)

1: Xi'an Jiaotong-Liverpool University; 2: University of Liverpool; 3: Zhejiang University

1139 Flow Boiling Heat Transfer Investigation of New Refrigerant Blends in a Minichannel

Mattiuzzo, Nicolò; Azzolin, Marco; Berto, Arianna; Bortolin, Stefano; Del Col, Davide

University of Padova, Italy

1140 Experimental Study on Boiling Heat Transfer and Flow Regime of R454C in Parallel Staggered-finned Minichannels

Numata, Natsumi; Nishizaki, Ayami; Jige, Daisuke; Inoue, Norihiro

Tokyo University of Marine Science and Technology

1147 Experimental Flow Boiling Heat Transfer Performance of R290/R600a 50%/50% and R134a/R290/R600a 40%/30%/30% in a Horizontal Helical Evaporation Coil

Ramathe, Teboho; Ndanduleni, Casey; Huan, Zhongjie

Tshwane University of Technology, South Africa

1167 Wall Superheat at the Onset of Nucleate Boiling of Pure Refrigerants and Zeotropic Refrigerant Mixture

Asano, Hitoshi; Akai, Shota; Tsugita, Yosei; Sugimoto, Katsumi

Kobe University, Japan

TUESDAY, JUNE 17

3:30 PM - 5:00 PM

E1: Low-GWP Refrigerant Behaviors | Clark 2121

Session Chair: Lingnan Lin

1124 Consideration and Evaluation of the Velocity Slip for Improved Prediction of the Refrigerant Charge

Rudzik, Tim; Kunath, Max; Xu, Yixia; Thomas, Christiane

Technische Universität Dresden, Germany

1109 Cooling Effects at Decompression of a CO2-Water System at Temperatures from 273.15 K to 313.15 K and Pressures up to 30 MPa

Matthes, Manuel; Richter, Markus; Urbaneck, Thorsten

Chemnitz University of Technology, Chemnitz, Germany

1115 Simulation of Fractionation of Low GWP Zeotropic Refrigerants on Modular Refrigeration Unit Performance After Leak Events [poster]

Gresh-Sill, Patrick J.; Fronk, Brian M.

The Pennsylvania State University, USA

E2: Heat Transfer Enhancements | Clark 2132

Session Chair: Marco Azzolin

1129 Heat Transfer and Visual Observation of Pool Boiling of Next-Generation Low-Pressure Refrigerant: R1336mzz(Z)

Yang, Cheng-Min; Muneeshwaran, M; Brechtl, Jamieson; Nawaz, Kashif

Oak Ridge National Laboratory, USA

1123 Experimental Study on Micro-channel Condenser with Header-Orifice Liquid-Vapor Separator in Domestic Refrigerators

Xu, Shijie (1); Li, Yiming (1); Sun, Bin (2); Wang, Guoqing (2); Shi, Yinghui (2); Qian, Suxin (1); Yu, Jianlin (1)

1: Institute of Refrigeration and Cryogenic, Xi'an Jiaotong University, China; 2: Hisense Refrigerator (Shandong) Co., Ltd., China

1131 Experimental Analysis of Local Heat Transfer Distribution of Low GWP Refrigerant in a Plate Heat Exchanger

Diaw, Saide (1); Hassan, Afnan (1,2); Nagatoshi, Yujiro (1); Miyara, Akio (3,4)

1: Graduate School of Science and Engineering, Saga University, Saga, Japan; 2: Department of Mechanical Engineering, Chittagong University of Engineering & Technology, Chattogram, Bangladesh; 3: Department of Mechanical Engineering, Saga University, Saga, Japan; 4: International Institute for Carbon Neutral Energy Research, Kyushu University, Fukuoka, Japan

WEDNESDAY, JUNE 18

8:00 AM - 10:00 AM

F1: Workshop: Low-GWP Refrigerants and Data Center Cooling Fluids | Forum

Chair: Yunho Hwang

Sarah Kim, Orbia | Advances in Low-GWP Refrigerants for Refrigeration and Air-Conditioning

Ankit Sethi, SK | Refrigerant Options for MAC and Fluids for Data Center Cooling

Samuel Yana Motta, ORNL | Technologies and Working Fluids Options for Next-Generation Data Center Cooling

WEDNESDAY, JUNE 18

10:30 AM - 12:00 NOON

F2: Workshop: AI/ML for Transport Processes - Challenges and Opportunities | Forum

Chair: Vikrant C. Aute

Simone Mancin, University of Padova | AI/ML for Estimation of Heat Transfer Coefficients

Jay Lee, University of Maryland | Trends and Recent Advances of Industrial AI and Non-Traditional Machine Learning for Complex Industrial Systems

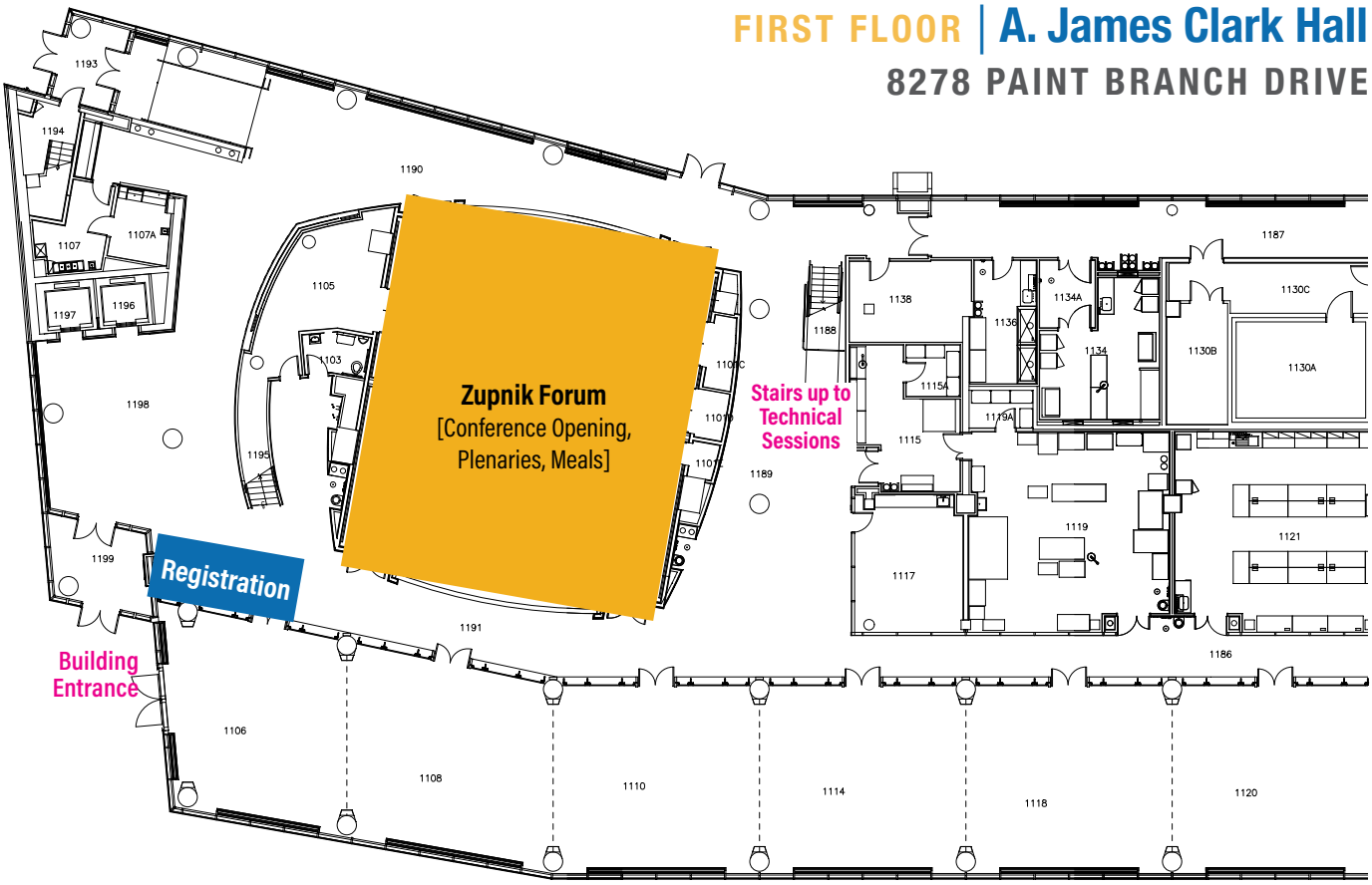
Vikrant Aute, University of Maryland | AI/ML for Transport Processes - Challenges and Opportunities: A Brief Background and Motivation

Author List

Author List

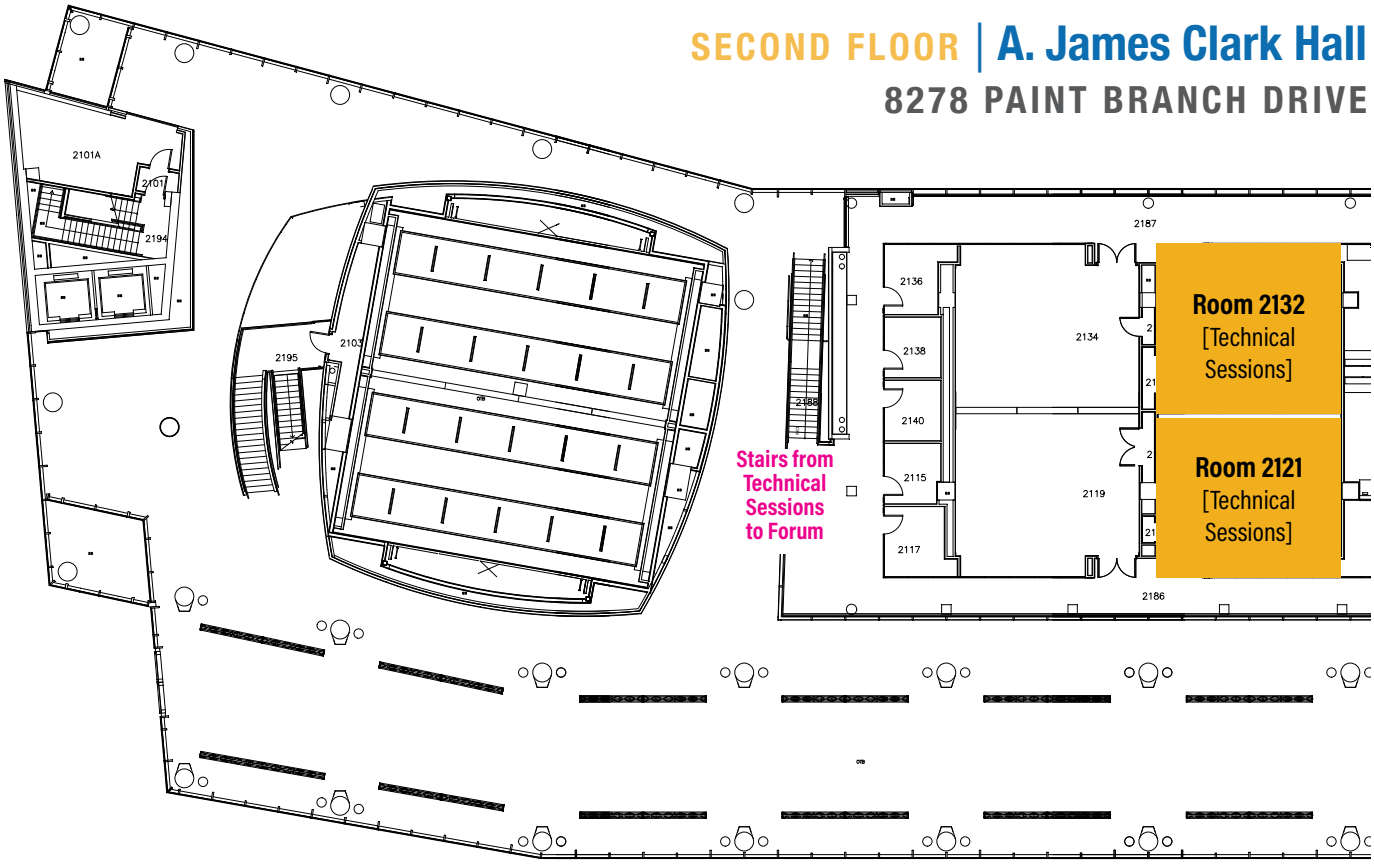
FIRST FLOOR | A. James Clark Hall

8278 PAINT BRANCH DRIVE



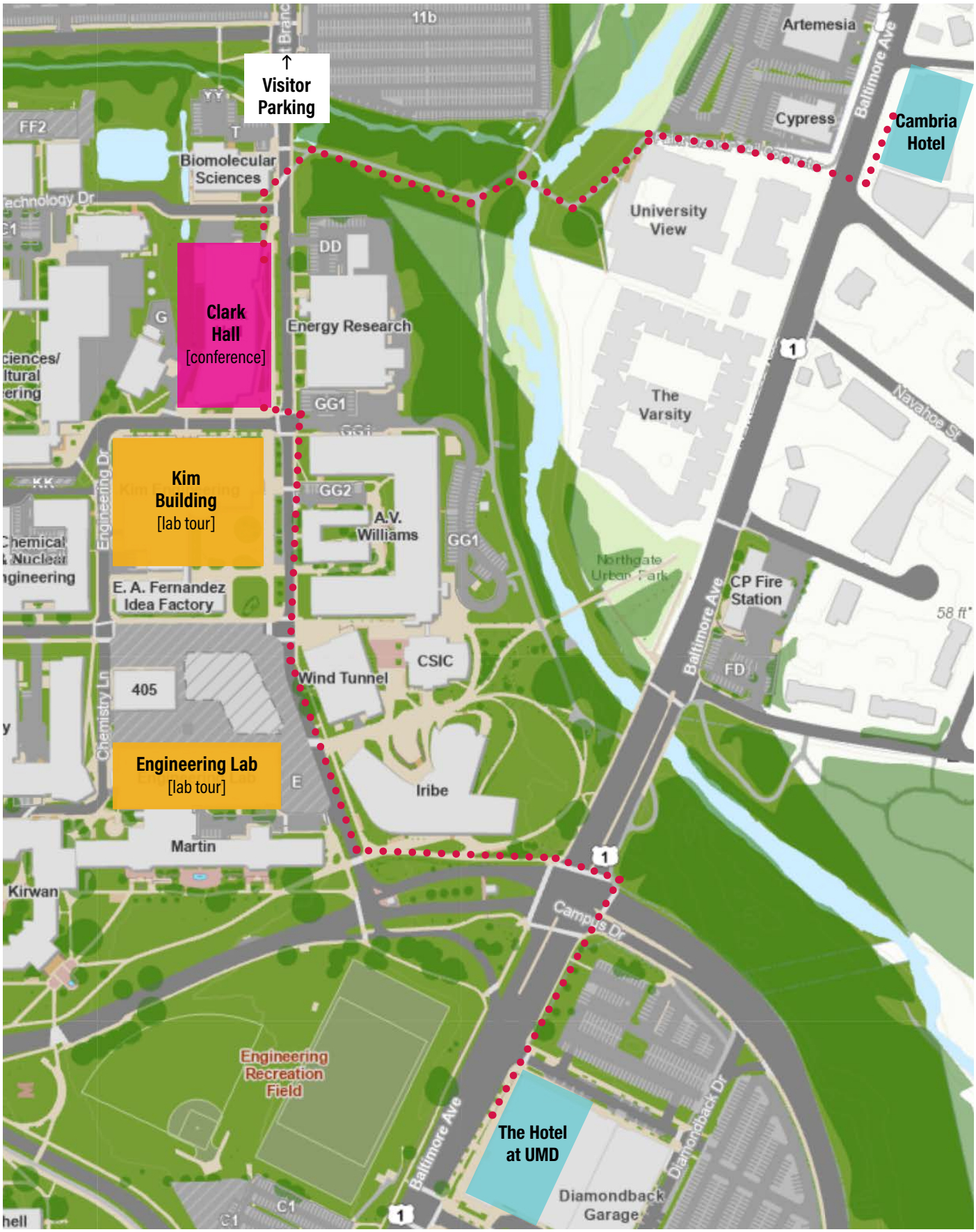
SECOND FLOOR | A. James Clark Hall

8278 PAINT BRANCH DRIVE



Dynamic UMD campus map

Campus Map



General Information

Transportation to the Conference

By plane: The airports nearest to College Park are Baltimore/Washington International (25 miles/40 km), Reagan National (16 miles/26 km) and Dulles International Airport (37 miles/60km).

By train: Amtrak offers service to Union Station in Washington, DC (8 miles/14 km) and New Carrollton, Md. (6 miles/9 km).

By Metro: The Metrorail rapid transit system has a stop in College Park, with access from Union Station, Dulles International Airport and Reagan National Airport. A complimentary shuttle service is provided from the College Park Metro station to campus. The shuttle operates Monday-Friday during the summer. The schedule is available at https://transportation.umd.edu/shuttle-um.

Parking

The xFinity Center Visitor Lot (8468 Paint Branch Drive) is the closest visitor lot to the conference facilities. Rates are $4 per hour, with a $20 daily maximum. For details, see Visitor Parking. Parking in certain university surface lots (and in the lower levels of the Regents Drive Garage, not in "visitor parking" at the top) is free after 4 p.m., Monday–Friday, and anytime on Saturday and Sunday. Read signs closely.

Conference Facilities

Conference activities will take place in one building:

A. James Clark Hall. Registration, sponsor exhibitions, technical sessions, plenary sessions, and all meals will be held in this modern space, equipped with the latest audiovisual technology. Plenary speeches will be on the first level in Room 1011 (The Forum). Some technical sessions will be held in second floor classrooms. See the schedule to locate the room for each session. Stop by the registration desk with any questions and for our "lost and found" area.

You're welcome to grab a seat in any public area to network, take a break or prepare for your presentation.

Looking to see more of the campus? Join us for a guided tour of the University of Maryland engineering labs that are developing eco-friendly HVAC&R technology. The tour is scheduled for Monday, June 16, at 3:00 p.m.-5:00 p.m.

Accessibility

All conference facilities offer accessible entrances and amenities. If you have specific concerns, please notify us prior to the conference at tptpr2025@umd.edu or stop by the registration desk during the conference.

Smoking

Smoking is prohibited on campus, with the exception of four designated smoking areas. The closest smoking area is on the on the south side of the Xfinity Center, to the left of the arena's main staircase. The University of Maryland is a cannabis-free campus. You cannot use or possess any form of cannabis, including recreational or medical cannabis, anywhere on University of Maryland premises. This means no vaporizers, no edibles and no smoking.

Dining

Your conference registration includes a welcome reception on Sunday with heavy hors d'oeuvres and mini desserts; lunch on Monday, Tuesday and Wednesday; and a conference dinner banquet on Tuesday evening.

In addition, Adele H. Stamp Student Union offers a variety of options for a quick meal or snack, including the Maryland Dairy, which offers University of Maryland-themed flavors like Fear the Turtle.

A vast array of dining options are located just off campus. Whether you're looking for sushi, tacos, salads, pizza or burgers, you'll find it along Baltimore Avenue (Route 1). College Park offers everything from quickservice dining options to upscale restaurants, including GrillMarx Steakhouse and Raw Bar in The Hotel at the University of Maryland.

Pictures and Videotaping

Conference attendees may NOT take pictures or videos at any presentation without the consent of the author or presenter. An official photographer will take pictures during the conference. Attendees may NOT take pictures during the lab tours because the research is often highly sensitive.

General Information

Internet Access

The University of Maryland provides two wireless networks for visitors to campus:

Eduroam If you use eduroam at your home institution, you are welcome to use the service to easily connect to the University of Maryland's Wi-Fi service.

UMD-guest If you are using a device that can receive SMS text messages, choose the umd-guest network option and follow the prompts to request an account. Wait for a text message. Access the text message to get your username and password, which can be used on up to three devices. Guest Wi-Fi accounts expire after 24 hours. You can repeat the process if you need additional time.

If you are unable to access the Internet using either of these two networks, please stop by the registration desk for assistance.

Attendees are encouraged to download offline maps for the DMV (DC, Maryland, Virginia) area before leaving your home region.

Instructions can be found at:

Apple Devices

Android Devices

Presentation Updates

If you have last-minute changes to your presentation (different from what was uploaded into Conftool), please see your session chair to make arrangements to upload your new file.

Conferences & Visitors Center

Stop by the University of Maryland Conferences & Visitor Services Welcome Desk for a warm Terrapin welcome. Friendly and informed staff members are available to provide parking information, directions and a campus map. The Welcome Desk is located in Turner Hall, 7736 Baltimore Ave, College Park, Md. Hours of operation are Monday – Friday, 8:00 a.m. – 5:00 p.m. Visitor information is also available online.

Time Zone

During the conference, College Park, Md., will be on Eastern Daylight Time.

University Health Center

All campus guests may utilize services offered by the University Health Center (UHC), at 3983 Campus Drive. Office visits and laboratory services can be billed to many private insurance plans or paid for directly by the treated guest. (The UHC cannot bill Medicare, Medicaid, Kaiser Permanente and TRICARE Prime.) Arrangements for special medical needs (e.g., allergy injections, insulin storage) may be made by calling 301-314-8180. Free COVID-19 self-tests are available.

In Case of Emergency

If you see something, say something. Report crimes, hazards, traffic accidents, medical emergencies, chemical spills and other emergencies by dialing 911 or calling the University of Maryland Police Department at 301-405-3333. Report a fire by calling 911.

Safety and Security

A full-service Department of Public Safety is located on Route 1 in the Pocomoke Building at 7569 Baltimore Ave., College Park, Md., just south of The Hotel at the University of Maryland. The department provides integrated safety and security services to the campus community. For additional security information, see https://prepare.umd.edu/.

Exploring the Washington, D.C., Area

Metrorail (or Metro, as the locals call it) offers rail service throughout the Washington, D.C., metropolitan area, serving 98 stations in Maryland, Washington, D.C., and Virginia. A campus shuttle provides free transportation to the College Park Metro Station. A map of the metro system is in the visitors guide provided at the registration desk. For information on things to do in the area, see the Washington DC Official Visitors Guide.

Sessions at a Glance

MONDAY, JUNE 16

8:30–10:00 AM

Plenary Speakers | Forum

10:30 AM–12:00 NOON

A1: Thermophysical Properties 1 | Rm 2121
Chair: Mark O. McLinden
- ID 1117
- ID 1126
- ID 1133
- ID 1107

A2: Refrigeration Oils | Rm 2132
Chair: Adrian Mota Babiloni
- ID 1119
- ID 1127
- ID 1106
- ID 1120

1:00–3:00 PM

B1: Thermophysical Properties 2 | Rm 2121
Chair: Mark B. Shiflett
- ID 1146
- ID 1125
- ID 1111
- ID 1121
- ID 1134

B2: Not-in-Kind Technologies | Rm 2132
Chair: Jinyoung Seo
- ID 1157
- ID 1130
- ID 1128
- ID 1118
- ID 1122

3:00–5:00 PM

Lab Tours
Meet in First Floor Entryway
A. James Clark Hall

TUESDAY, JUNE 17

8:30–10:00 AM

Plenary Speakers | Forum

10:30 AM–12:00 NOON

C1: Refrigerant Mixtures | Rm 2121
Chair: Mitsuhiro Fukuta
- ID 1112
- ID 1105
- ID 1165
- ID 1138

C2: Condensation Heat Transfer | Rm 2132
Chair: Akio Miyara
- ID 1141
- ID 1114
- ID 1103
- ID 1148

1:00–3:00 PM

D1: Low-GWP Refrigerants for Heat Pumps | Rm 2121
Chair: Samuel Yanna Motto
- ID 1100
- ID 1101
- ID 1150
- ID 1108
- ID 1153

D2: Boiling Heat Transfer | Rm 2132
Chair: Claudio Zilio
- ID 1142
- ID 1139
- ID 1140
- ID 1147
- ID 1167

3:30–5:00 PM

E1: Low-GWP Refrigerant Behaviors | Rm 2121
Chair: Lingnan Lin
- ID 1124
- ID 1109
- ID 1115 [poster]

E2: Heat Transfer Enhancements | Rm 2132
Chair: Marco Azzolin
- ID 1129
- ID 1123
- ID 1131

WEDNESDAY, JUNE 18

8:00–10:00 AM

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