TPV

15th World Conference

on Thermophotovoltaic Generation of Electricity

UHTES

SECOND INTERNATIONAL WORKSHOP

ULTRA-HIGH TEMPERATURE THERMAL ENERGY STORAGE, TRANSFER AND CONVERSION

1 - 3 October 2024 / Madrid - Spain

Conference sessions
Instituto de Energía Solar
ETSI Telecomunicación, Building ”C”
Avda. Complutense 30, Moncloa - Aravaca, 28040 Madrid

Welcome Reception & Dinner
(September 30, 19:30 - 21:30)
Teatro Real, Pl. de Isabel II, s/n. Centro, 28013 Madrid

Gala Dinner
(October 2, 19:30 - 22:00)
Café de Oriente
Museo del Traje, Av. de Juan de Herrera, 2
Moncloa - Aravaca, 28040 Madrid

	September 30 (TPV-15)	October 1 (TPV-15)	October 2 (TPV-15 & UHTES-2)	October 3 (TPV-15)
8:00			Registration	
8:30				
9:00		Registration	Opening Session 2 (OPS2)	
9:30				
10:00		Opening Session 1 (OPS1)	Coffee Break	Oral Session 5 (OS5) *TPV emitters*
10:30			Oral Session 3 (OS3) *Ultra-High Temperature Thermal Batteries Developers*	
11:00		Coffee Break		
11:30		Oral Session 1 (OS1) *TPV cells*		Coffee Break
12:00			Coffee Break	Oral Session 6 (OS6) *Near Field TPV*
12:30			Round Table *Ultra-High Temperature Thermal Batteries Developers*	
13:00				
13:30		Lunch	Lunch	Lunch
14:00				
14:30				
15:00		Oral Session 2 (OS2) *TPV systems*	Oral Session 4 (OS4) *Ultra-High Temperature Energy Storage, transfer, and Conversion*	Oral Session 7 (OS7) *Novel Concepts*
15:30				
16:00				
16:30				Coffee Break
17:00		Coffee Break	Coffee Break	Closing Session (CS)
17:30		Poster Session 1 (PS1)	Poster Session 2 (PS2)	Farewell Drinks
18:00				
18:30				
19:00				
19:30	Welcome reception & Dinner		Gala Dinner	
20:00				
20:30				
21:00				
21:30				
22:00				

September 30 – Welcome reception and networking dinner	
19:30-21:30	Welcome reception and networking dinner Venue: Teatro Real - Pl. de Isabel II, s/n, Centro, 28013 Madrid
October 1 – TPV-15 Conference (day 1)	
Opening Session 1 (OPS1) **10:00-11:00** **Chair: Alejandro Datas (UPM)**	
10:00-10:30	**[OPS1.1] Opening remarks** *Alejandro Datas (Chair of the TPV-15 Conference, UPM)* *Manuel Sierra (Director of Telecommunication School - UPM)* *Ignacio Antón (Director of the Solar Energy Institute - UPM)*
10:30-11:00	**[OPS1.2] Combined Heat and Power via Thermal Energy Storage and Thermophotovoltaics** *Brendan Kayes (Invited)* *Antora Energy (USA)*
11:00-11:30	Coffee break
Oral Session 1 (OS1) - TPV cells **11:30-13:30** **Chairs: Eric Tervo (University of Wisconsin-Madison) and Brendan Kayes (Antora Energy)**	
11:30-12:00	**[OS1.1] Air-bridge TPV Cells: Current Performance and Future Possibilities** *Andrej Lenert (Invited)* *University of Michigan (USA)*
12:00-12:15	**[OS1.2] Fundamental Advantages of Multijunction Thermophotovoltaic Cells** Richard R. King *Arizona State University*
12:15-12:30	**[OS1.3] High TPV performance n/p and p/n InGaAs cells** *I. García, A. Cano, P. Martín, V. Orejuela, I. Rey-Stolle* *Universidad Politécnica de Madrid (Spain)*
12:30-12:45	**[OS1.4] Experimental Efficiency of 11.2 % in Germanium Thermophotovoltaic Devices** *A. M. Medrano[1], E. López[1], Pablo García-Linares[1], J. Villa[1], G. Rivera[2], M. Gamel[2], G. López[2], M. Garín[3], I. Martín[2], C. Cañizo[1], A. Datas[1]* *[1] Universidad Politécnica de Madrid (Spain), [2] Universitat Politècnica de Catalunya (Spain), [3] Universitat Central de Catalunya (Spain)*
12:45-13:00	**[OS1.5] Electrical and Optical Performance of Epitaxial-free Low-doped Germanium Thermophotovoltaic Devices** *M. Gamel[1], G. Rivera[1], A. M. Medrano[2], J. Villa[2], G. López[1], P. García-Linares[2], A. Datas[2], M. Garín[3], I. Martín[1]* *[1] Universitat Politècnica de Catalunya (Spain), [2] Universidad Politécnica de Madrid (Spain), [3] Universitat Central de Catalunya (Spain)*
13:00-13:15	**[OS1.6] Evaluation of TPV devices in different irradiation environments** *N. Das, H. Hier, W. Allmon, S. Karnani, C. M. Waits* *Army Research Laboratory (USA)*
13:15-13:30	**[OS1.7] GeSn Mid-Infrared Thermophotovoltaic Cells Monolithically Integrated on Silicon for Power Beaming and Heat Conversion** *G. Daligou[1], R. Soref[2], P. Del Vecchio[1], A. Attiaoui[1], M. R. M. Atalla[1], O. Moutanabbir[1]* *[1] Ecole Polytechnique de Montréal (Canada), [2] University of Massachusetts Boston (USA)*
13:30-15:00	Lunch

Oral Session 2 (OS2) - TPV systems **15:00-17:00** **Chairs: Andrej Lenert (University of Michigan) and Walker Chan (Mesodyne)**	
15:00-15:30	**[OS2.1] Narrow Bandgap Intersubband Thermophotovoltaic Cells** *Eric Tervo (Invited)* *University of Wisconsin-Madison (USA)*
15:30-15:45	**[OS2.2] Development and experimental characterization of highly packed Ge thermophotovoltaic mini-modules** *J. Villa[1], P. García-Linares[1], I. Izquierdo[1,2], A. M. Medrano[1], E. López[1], A. Datas[1]* *[1] Universidad Politécnica de Madrid (Spain), [2] Termophoton (Spain)*
15:45-16:00	**[OS2.3] Experiment assessing the use of GaSb array with filters for waste heat recovery in the cement, steel, and glass Industries** *G. Buckley, C. M. I. Hussain, B. Norton* *Technological University Dublin (Ireland)*
16:00-16:15	**[OS2.4] Effective Emissivity: How cavity reflectivity affects emitter operating point?** *S. Karnani, H. Hier, W. Allmon, N. Das, and C. Mike Waits* *Army Research Laboratory (USA)*
16:15-16:30	**[OS2.5] Experimental Investigation of Improving Thermophotovoltaic Energy Conversion via Photon Recycling with Ellipsoidal Optical Cavities** *N. Talebzadeh, S. Homaei, K. Ramparsad, P. G. O'Brien* *York University (Canada)*
16:30-16:45	**[OS2.6] Design of Optical Cavity for Thermophotovoltaics Considering Thermal Conditions in Cells** *H. Wang, M. Shimizu, H. Yugami* *Tohoku University (Japan)*
16:45-17:00	**[OS2.7] Enhancing the Capabilities in Thermophotovoltaic Systems by Harnessing Multiple Heat Sources** *S. Homaei, N. Talebzadeh, P. G. O'Brien* *York University (Canada)*
17:00-17:30	Coffee break
Poster Session 1 **17:30-18:30**	
PS1.1	**Silicon Materials Mid-Infrared Direct Spectral Emissivity Measurement at Intermediate Temperatures** *E. Akiki, G. Hamaoui, A. Herve, F. Marty, L. Rousseau, T. Bourouina, P. Basset, E. Nefzaoui* *Univ. Gustave Eiffel (France)*
PS1.2	**Design strategies for very low bandgap InAs/InAsSb thermophotovoltaic cells** *B. Roux[1], J-P. Perez[1], F. Martinez[1], S. Parola[1], L. del Campo[2], L. Cosson[2], O. Rozenbaum[2], P. Christol[1], R. Vaillon[3]* *[1] Univ. Montpellier (France), [2] CNRS-CEMHTI (France), [3] Université de Toulouse (France)*
PS1.3	**Interdigitated Back Contacted c-Ge thermophotovoltaic devices** *M. Gamel[1], G. Rivera[1], G. López[1], M. Garín[2], I. Martín[1]* *[1] Universitat Politècnica de Catalunya (Spain), [2] Universitat Central de Catalunya (Spain)*
PS1.4	**IR laser-fired contacts for rear surface of c-Ge TPV devices** *G. Rivera[1], M. Gamel[1], G. López[1], M. Garín[2], I. Martín[1]* *[1] Universitat Politècnica de Catalunya (Spain), [2] Universitat Central de Catalunya (Spain)*
PS1.5	**Revisiting the Role of Auger Recombination in Germanium Thermophotovoltaic Converters** *P. Martín, V. Orejuela, A. Cano, I. García, I. Rey-Stolle* *Universidad Politécnica de Madrid (Spain)*

PS1.6	**Greenhouse gases emissions and energy payback time of thermophotovoltaic electricity generation** *D. Garraín[1], A. Pino[2], S. Romero[3], V. Medina[3], P. García-Linares[3], A. Datas[3]* *[1]CIEMAT (Spain), [2] Thermophoton (Spain), [3] Universidad Politécnica de Madrid (Spain)*
PS1.7	**Modeling thermophotovoltaics and combustion heat sources for portable power generation** *S.V. Karnani, W. R. Allmon, H. Hier, N.C. Das, C. Mike Waits* *Army Research Laboratory (USA)*
PS1.8	**Study of Cell Interconnection for the Design Optimization of Thermophotovoltaic Modules Under Inhomogeneous Illumination** *I. Izquierdo[1,2], P. García-Linares[1], J. Villa[1], A. Datas[1]* *[1] Universidad Politécnica de Madrid (Spain), [2] Thermophoton (Spain)*
PS1.9	**Photon utilization in near-field thermophotovoltaics** *K. N. Nimje, M. F. Picardi, J. Legendre, G. T. Papadakis* *ICFO – Institut de Ciences Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels (Spain)*
PS1.10	**Radiative Transfer Mechanism and Performance Analysis of Near-Field Thermophotovoltaic System with Plasmonic Emitter** *S. Li[1], J.Zhao[1,2]* *[1] Harbin Institute of Technology (China), [2] Key Laboratory of Aerospace Thermophysics (China)*
PS1.11	**Spectral Efficiency Optimized Near-field Thermophotovoltaics Using Germanium-based PV Cells** *N. Boubrik[1], M. Giroux[1], G. Forcade[1], A. Boucherif[2], S. Molesky[3], K. Hinzer[4], R. St-Gelais[1]* *[1] University of Ottawa (Canada), [2] University of Sherbrooke (Canada), [3] Polytechnique Montreal (Canada), [4] SUNLAB (Canada)*
PS1.12	**An Experimental Study of the Near-Field Behaviour of PIN Junctions** *M. Thomas[1], T. Châtelet[1], B. Behaghel[2], I. Radevici[2], L. van der Krabben[3], A. Shahahmadi[2], J. J. Schermer[3], J. Oksanen[2], P-O. Chapuis[1]* *[1] Univ. Lyon (France), [2] Aalto University (Finland), [3] Radboud University (Netherlands)*
PS1.13	**Development of TPV cells based on inverted epitaxial Indium Gallium Arsenide** *D. Milovich[1,2], E. López[1], A. M. Medrano[1], A. Datas[1]* *[1] Universidad Politécnica de Madrid (Spain), [2] Thermophoton (Spain)*
PS1.14	**A radiative thermal device for refrigeration: the near-field thermophonic cooler** *T. Châtelet, J. Legendre, P.-O. Chapuis and O. Merchiers* *CNRS – INSA – Université Lyon (France)*
PS1.15	**Experimental study and theoretical limits of a new high-power TPV device concept** *Longji Cui* *University of Colorado Boulder (USA)*

October 2 – Hybrid TPV-15 Conference (day 2) & UHTES-2 (single day)	
Opening session 2 (OPS2) **9:00-10:00** **Chair: Alejandro Datas (UPM)**	
9:00-9:10	**[OPS2.1] Opening remarks** *Alejandro Datas* *UPM (Spain)*
9:10-9:20	**[OPS2.2] Heat decarbonization and the Iberian clean-tech ecosystem** *Bianca Dragomir (Invited)* *Cleantech for Iberia (Spain)*
9:20-9:40	**[OPS2.3] The Role of the European Innovation Council in heat decarbonization and thermophotovoltaics** *Marco Pantaleo* and Paolo Bondavalli (Invited)* *European Innovation Council and SMEs Executive Agency (EISMEA)* **Imperial College London, and past program manager at EISMEA*
9:40-10:00	**[OPS2.4] The Role of Breakthrough Energy in heat decarbonization and thermophotovoltaics** *John Lemmon and Alberto Toril (Invited)* *Breakthrough Energy (USA)*
10:00-10:30	Coffee break
Oral Session 3 (OS3) - Ultra-High Temperature Thermal Batteries Developers **10:30-11:40** **Chair: Alberto Toril (Breakthrough Energy)**	
10:30-10:40	**[OS3.1] Antora Energy (USA)** *Brendan Kayes (Invited)*
10:40-10:50	**[OS3.2] Rondo Energy (USA)** *John O'Donnel (Invited)*
10:50-11:00	**[OS3.3] Fourth Power (USA)** *John Lloyd (Invited)*
11:00-11:10	**[OS3.4] Kraft Block (Germany)** *Martin Schichtel (Invited)*
11:10-11:20	**[OS3.5] Thermophoton (Spain)** *Alan Pino (Invited)*
11:20-11:30	**[OS3.6] Exergy3 (United Kingdom)** *Adam Robinson (Invited)*
11:30-11:40	**[OS3.7] Silbat (Spain)** *Ignacio Luque (Invited)*
11:40-12:10	Coffee break
Round table - Ultra-High Temperature Thermal Batteries Developers **12:10-13:30** **Chairs: Alberto Toril and John Lemmon (Breakthrough Energy)**	
12:10-13:30	**Round Table** *Breakthrough Energy (USA), Antora Energy (USA), Rondo Energy (USA), Fourth Power (USA), Kraft Block (Germany), Thermophoton (Spain), Exergy3 (United Kingdom), Silbat (Spain)*
13:30-15:00	Lunch

Oral Session 4 (OS4) - Ultra-High Temperature Thermal Energy Storage, Transfer and Conversion **15:00-17:00** **Chairs: Alejandro Datas, Esther López and Pablo García-Linares (UPM)**	
15:00-15:30	**[OS4.1] Mesodyne LightCell: commercializing thermophotovoltaics for fuel-flexible power, anytime, anywhere** *Walker Chan (Invited)* *Mesodyne (USA)*
15:30-15:45	**[OS4.2] Storage-integrated solar thermophotovoltaics: model and experiments** *Maxime Giteau* *CNRS-PROMES (France)*
15:45-16:00	**[OS4.3] Laboratory-Scale Prototype of Thermal Energy Grid Storage (TEGS) System** *K. Buznitsky, C. Kelsall, S. Verma, A. LaPotin, M. Pishahang, A. Henry* *Massachusetts Institute of Technology (USA)*
16:00-16:15	**[OS4.4] Power-To-Heat-To-Power Storage Systems Used for Cogeneration Hybridized with Lithium-Ion Batteries and Heat Pumps** *A. López-Ceballos, I. Antón, C. Cañizo, A. Datas* *Universidad Politécnica de Madrid (Spain)*
16:15-16:30	**[OS4.5] Metallic phase change materials for high temperature applications** *P. L. Z. Lo Biundo, W. Polkowski, J. M. Jiao, M. Wallin, M. Tangstad* *Norwegian University of Science and Technology (Norway)*
16:30-16:45	**[OS4.6] Thermal design of high-temperature devices for liquid metal based processes** *A. Abánades, L. F. González-Portillo, E. Alonso* *Universidad Politécnica de Madrid (Spain)*
16:45-17:00	**[OS4.7] Horizon Europe project BLAZETEC: Novel high-temperature solid-state converters under development** *Daniele M. Trucchi[1] and the BLAZETEC consortium[2,3,4,5,6,7]* *[1] Consiglio Nazionale delle Ricerche (Italy), [2] Universidad Politécnica de Madrid (Spain), [3] RGS Development (Netherlands), [4] Ionvac Process (Italy), [5] The Cyprus Institute (Cyprus), [6] Centre Suisse d'Electronique et de Microtechnique (Switzerland), [7] Thermophoton (Spain)*
17:00-17:30	Coffee break
Poster Session 2 (PS2) **17:30-18:30**	
PS2.1	**Competitive Analysis for Silbat's LDES Technology** *R. Golchha, I. Luque-Heredia* *Silbat Energy Storage Solutions SL (Spain)*
PS2.2	**Environmental footprint of a latent heat thermophotovoltaic system for long duration high density electrical and thermal energy storage** *D. Ruiz[1], G. San Miguel[1], R. Molinero[2] , A. Benito[2], I. Luque-Heredia[2]* *[1] Universidad Politécnica de Madrid (Spain), [2] Silbat Energy Storage Solutions SL (Spain)*
PS2.3	**Heat losses assessment of an ultra-high temperature latent heat thermophotovoltaic system coupled with concentrated solar power** *M. Zeneli, A. Datas* *Universidad Politécnica de Madrid (Spain)*
PS2.4	**Manufacturing ultra-high temperature FeSiB phase change material via aluminothermic reduction** *J. Jiao, M. Wallin, M. Tangstad* *Norwegian University of Science and Technology (Norway)*

PS2.5	**Micro-encapsulation of Fe-Si ultra-high temperature phase change material** *W. Polkowski[1], P. L. Z. Lo Biundo[1], J. M. Jiao[1], M. Wallin[1], B. Kalicki[2], J. Ciftci[2], A. Polkowska[3], A. Bętkowska[3], F. Kateusz[3], M. Tangstad[1]* *[1] Norwegian University of Science and Technology (Norway), [2] AMAZEMET (Poland), [3] Łukasiewicz Research Network – Krakow Institute of Technology (Poland)*
PS2.6	**Multiphysics Modelling of an Ultra-High Temperature Storage integrated in the SUNSON-BOX Solar-To-Heat-To-Power system** *A. Hernández, I. Fernández-Pacheco, L. E. Acevedo, P. Royo* *IDENER (Spain)*
18:30-19:30	Free time – Walk to Gala Dinner venue (20-minute walk)
19:30 - 22:00	Gala Diner Venue: Museo del Traje - Av. de Juan de Herrera, 2, Moncloa - Aravaca, 28040 Madrid

October 3 – TPV-15 Conference (day 3)

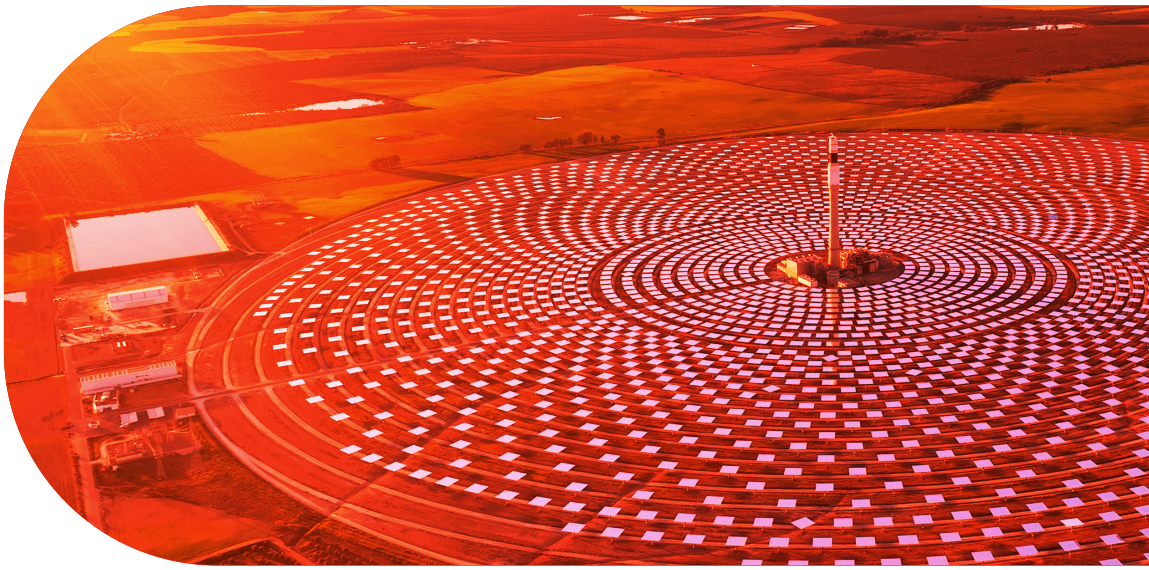
Oral Session 5 (OS5) – TPV Emitters
10:00-11:30
Chairs: Bong Jae Lee (KAIST) and Makoto Shimizu (Tohoku University)

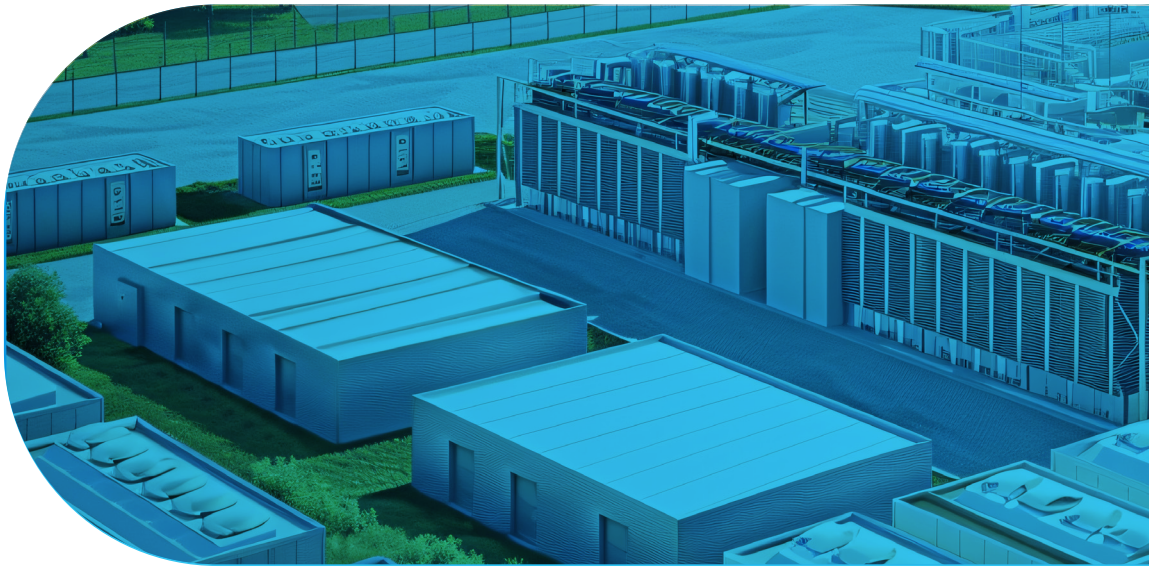
10:00-10:30	**[OS5.1] Fundamental limits in thermophotovoltaic systems and avenues to approach them** **Georgia Papadakis *(Invited)*** *ICFO – Institut de Ciences Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels (Spain)*
10:30-10:45	**[OS5.2] Enhancement of TPV power density with surface-engineered emitters** *S. Verma[1], M. Park[2], S. Lubner[3], A. Henry[1]* *[1] Massachusetts Institute of Technology (USA), [2] Lawrence Berkeley National Laboratory (USA), [3] Boston University (USA)*
10:45-11:00	**[OS5.3] Balancing Power Output and Efficiency in Thermophotovoltaics through Spectral Shaping of Selective Emitters** *N. Hanouf, J. Drévillon, F. Enguehard* *Université de Poitiers-ISAE-ENSMA (France)*
11:00-11:15	**[OS5.4] Silicon-Air Metasurface Fabrication and Characterization for Thermophotovoltaic Selective Filters** *P. Bermel, D. Kortge* *Birck Nanotechnology Center (USA)*
11:15-11:30	**[OS5.5] Directional radiative properties of high-temperature materials: results from the MSCA IF HEASeRS project** *C-A. Asselineau[1,2,3], B. Rousseau[4], J. González-Aguilar[1]* *[1] IMDEA Energy (Spain), [2] UPM (Spain), [3] ANU (Australia), [4] LTeN UMR CNRS (France)*
11:30-12:00	Coffee break

Oral Session 6 (OS6) – Near Field TPV
12:00-13:30
Chairs: Rodolphe Vaillon (CNRS-LAAS) and P-Oliver Chapuis (CNRS-INSA)

12:00-12:30	**[OS6.1] Near-Field Thermal Radiation and Thermophotovoltaic Energy Conversion** *Bong Jae Lee (Invited)* *KAIST (Korea)*
12:30-12:45	**[OS6.2] Large-Area Near-Field Thermophotovoltaic Power Generation Measuring 1.2 mW at 460°C** *J. Selvidge[1], R. M. France[1], J. Goldsmith[1], P. Solanki2, M. A. Steiner[1], E. J. Tervo[1,2]* *[1] National Renewable Energy Laboratory (USA), [2] University of Wisconsin-Madison (USA)*

12:45-13:00	**[OS6.3] Selectively enhanced near-field radiative transfer between Tungsten and GaSb with Si 2D gratings for thermophotovoltaics** *T. Wang, S. Li, J. Zhao* *Harbin Institute of Technology (China)*
13:00-13:15	**[OS6.4] Micro/nanoscale spacers for enhanced thermophotovoltaic and thermionic energy conversion: a comprehensive review** *N. Loubet, K. Bezdjian, E. López, A. Datas* *Universidad Politécnica de Madrid (Spain)*
13:15-13:30	**[OS6.5] Improved Near-Field Thermophotovoltaics with Matched Radiator and Receiver** *M. Giroux[1], S. Molesky[2], R. St-Gelais[1], J. J. Krich[1]* *[1] University of Ottawa (Canada), [2] Polytechnique Montreal (Canada)*
13:30-15:00	Lunch
Oral Session 7 (OS7) – Novel Concepts **15:00-16:45** **Chairs: Maxime Giteau (CNRS-PROMES) and Peter Bermel (Birck Nanotechnology Center - Purdue University)**	
15:00-15:30	**[OS7.1] An analysis of the state of the art and re-introduction of vertical multijunction cells for thermophotovoltaics** *Rodolphe Vaillon (Invited)* *LAAS-CNRS (France)*
15:30-15:45	**[OS7.2] Dual radiative heat engines: combining a TPV cell with an active emitter** *J. Legendre, P-O. Chapuis* *Univ. Lyon (France)*
15:45-16:00	**[OS7.3] Photon-Enhanced Thermionic Emission Devices with Perovskite Photovoltaic Anodes for Conversion of Concentrated Sunlight** *A. Bellucci[1], L. Vesce[2], M. Mastellone[1], Y. Raoui[2], A. Di Carlo[1,2], D. M. Trucchi[1]* *[1] Consiglio Nazionale delle Ricerche – Istituto di Struttura della Materia (Italy), [2] Università di Roma Tor Vergata (Italy)*
16:00-16:15	**[OS7.4] Multi-junction thermoradiative cells** *P. Bohm, A. K. Menon, Z. M. Zhang* *Georgia Institute of Technology (USA)*
16:15-16:30	**[OS7.5] Designing a near-field thermophotonic device in the planar configuration for energy conversion** *W. Sghaier[1], M. Thomas[1], K. Kontou[1], Thomas Châtelet[1], L. M. van der Krabben[2], B. Behaghel[3], P. Kivisaari[3], I. Radevici[3], N. Gruginskie[2], J. J. Schermer[2], J. Oksanen[3], P-O. Chapuis[1]* *[1] Univ. Lyon (France), [2] Radboud University (Netherlands), [3] Aalto University (Finland)*
16:30-16:45	**[OS7.6] Infrared light management with emergent materials and structures for thermal nanophotonics** *J. Toudert, C. Ruiz Herrero, J. le Rouzo, H. A. Yasset, D. Duché* *Aix Marseille Université (France)*
16:45-17:15	Coffee break
Closing session **17:15-17:45**	
17:45-18:45	Farewell Drinks





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