Program Schedule

Changes will be made at the discretion of the Program Chairs.
# Monday, July 10

## Tutorials

13:30 – 16:30  
*Chair: Donnie Keithley, Massachusetts Institute of Technology*

<table>
<thead>
<tr>
<th>Time</th>
<th>Tutorial Title</th>
<th>Speaker(s)</th>
<th>Institution</th>
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<tr>
<td>13:00</td>
<td><strong>Tutorial I: TUTORIAL INTRODUCTION TO FIELD ELECTRON EMISSION SYSTEMS</strong></td>
<td>Richard G. Forbes</td>
<td>Surrey University, UK</td>
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<td>13:45</td>
<td><strong>Tutorial II: STRONGFIELD PHYSICS AT NEEDLES AND NANOSTRUCTURES</strong></td>
<td>Peter Hommelhoff</td>
<td>Friedrich-Alexander-Universität, GERMANY</td>
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<tr>
<td>14:30 – 15:00</td>
<td>Refreshment Break</td>
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<td>15:00</td>
<td><strong>Tutorial III: QUANTUM 2.0 WITH FREE ELECTRONS</strong></td>
<td>Ido Kaminer</td>
<td>Israel Institute of Technology, ISRAEL</td>
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<td>15:45</td>
<td><strong>Tutorial IV: QUANTUM SENSORS AND CLOCKS BASED ON ATOMIC VAPORS</strong></td>
<td>John Kitching</td>
<td>National Institute of Standards and Technology (NIST), USA</td>
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## Registration and Wine & Cheese Welcome Reception

17:00 - 19:00
Tuesday, July 11

Welcome Address
08:00 - 08:15

Conference Chair:
Luis F. Velásquez-Garcia, Massachusetts Institute of Technology, USA

Keynote Presentation
08:15 – 09:00

THE LONG AND SHORT OF VACUUM ELECTRONICS AT DARPA
William D. Palmer and David K. Abe
Defense Advanced Research Projects Agency (DARPA), USA

Session 1 - Electron Sources I
09:00 – 10:15
Chair: Alireza Nojeh, University of British Columbia

09:00 ELECTRON EMISSION FROM HFC(100) TIP AT VARIOUS TEMPERATURES
Toshiaki Kusunoki¹ and Noriaki Arai²
¹Hitachi Ltd., JAPAN and ²Hitachi High-Tech, JAPAN

09:15 AN INTEGRATED SILICON NANOWIRE FIELD EMISSION ELECTRON SOURCE ON A CHIP WITH HIGH ELECTRON TRANSMISSION
Philipp Buchner¹, Matthias Hausladen¹, Andreas Schels², Florian Herdl²,
Simon Edler², Michael Bachmann³, and Rupert Schreiner¹
¹Ostbayerische Technische Hochschule Regensburg, GERMANY and ²Ketek GmbH, GERMANY

09:30 ELECTRON-PHOTON INTERACTIONS IN A SCANNING ELECTRON MICROSCOPE
John W. Simonaitis¹, Maurice A.R. Krielaart¹, Stewart A. Koppell¹, Benjamin J. Slayton²,
Joseph Alongi¹, William P. Putnam², Karl K. Berggren¹, and Phillip D. Keathley¹
¹Massachusetts Institute of Technology, USA and ²University of California, Davis, USA

09:45 DEVELOPMENT OF A SELF FOCUSED SPINDT CATHODE FOR MILLIMETER-WAVE TRAVELING WAVE TUBES
Christopher E. Holland¹, David R. Whaley², Paul Schwoebel³, Colby Bellew¹, and Charles A. Spindt¹
¹SRI International, USA, ²L-3Technologies (now Stellant Systems), USA, and ³University of New Mexico, USA

10:00 CHARACTERIZATION AND OPERATION OF GRAPHENE-OXIDE-SEMICONDUCTOR EMITTERS AT ATMOSPHERIC PRESSURE LEVELS
Florian Herdl¹, Maximilian J. Kueddelsmann², Andreas Schels¹, Michael Bachmann³, Simon Edler³,
Dominik Wohlhartstätter³, Felix Düsberg³, Alexander Prugger³, Michael Dillig³, Florian Dams³, Rupert
Schreiner³, Cormac Ó Coileáin¹, Stefan Zimmermann³, Andreas Pahlke³, and Georg S. Duesberg¹
¹University of the Bundeswehr Munich, GERMANY and ²Leibniz University Hannover, GERMANY,
³KETEK GmbH, GERMANY, and ⁴Ostbayerische Technische Hochschule Regensburg, GERMANY
Session 2 - Fundamentals I
10:45 – 12:00
Chair: Donnie Keithley, Massachusetts Institute of Technology

10:45 COULOMB-CORRELATED FEW-ELECTRON STATES IN A TRANSMISSION ELECTRON MICROSCOPE BEAM
Rudolf Haindl¹,², Armin Feist¹,², Till Domröse¹,², Marcel Möller¹,², John H. Gaida¹,², Sergey V. Yalunin¹,², and Claus Ropers¹,²
¹Max Planck Institute for Multidisciplinary Sciences, GERMANY and ²University of Göttingen, GERMANY

11:00 BROADBAND INFRARED HYPERSPECTROSCOPY WITH HIGH SPATIAL RESOLUTION FOR THE STUDY OF NANOSCALE THERMAL EMITTERS IN VACUUM
Mokter M. Chowdhury, Jeff F. Young, George A. Sawatzky, and Alireza Nojeh
University of British Columbia, CANADA

11:15 CIRCUIT MODEL FOR NANOSCALE OPTICAL FREQUENCY ELECTRONICS
Adina R. Bechhofer¹, Shruti Nirantar¹,², Luca Daniel¹, Karl K. Berggren¹, and Phillip D. Keathley¹
¹Massachusetts Institute of Technology, USA and ²RMIT University, AUSTRALIA

11:30 EVIDENCE FOR A FIELD-INDEPENDENT ENHANCEMENT FACTOR IN THE REAL TUNNELING POTENTIAL BARRIER OF NANOTUBE EMITTERS
Caio P. de Castro¹, Thiago A. de Assis¹,², Roberto Rivelino¹, Fernando B. Mota¹, Caio M. C. de Castilho¹, and Richard G. Forbes³
¹Federal University of Bahia, BRAZIL, ²Fluminense Federal University, BRAZIL, and ³University of Surrey, UK

11:45 NUMERICAL MODEL DEVELOPMENT FOR CARBON-BASED FIELD EMISSION ELECTRON SOURCES
Nikolay Egorov, Konstantin Nikiforov, and Marina Bedrina
Saint Petersburg State University, RUSSIA

12:00 - 13:30 Lunch on Own

Plenary Presentation I
13:30 – 14:15

13:30 COMPACT VACUUM QUANTUM DEVICES
John Kitching
National Institute of Standards and Technology (NIST), USA

Session 3 - Other Applications I
14:15 – 15:30
Chair: Jan Dziuban, Wroclaw University of Science and Technology

14:15 IMAGING USING MEMS ELECTRON MICROSCOPE
Michał Krysztof, Marcin Bialas, and Tomasz Grzebek
Wroclaw University of Science and Technology, POLAND
14:30 DEVELOPMENT OF A MICRO MERCURY TRAPPED ION CLOCK PROTOTYPE EMPLOYING A SPINDT CATHODE IONIZATION SOURCE
Christopher E. Holland¹, John D. Prestage², Thai M. Hoang², Sang K. Chung³, Thanh M. Le², Sung-Jin Park¹, and Nan Yu²
¹SRI International, USA, ²Jet Propulsion Laboratory, USA, and ³Eden Park Illumination, USA

14:45 MAGNETIC FOCUSING OF AN ELECTRON BEAM FROM A POINT FIELD EMITTER
Paweł Urbański, Piotr Szyszka, and Tomasz Grzebyk
Wrocław University of Science and Technology, POLAND

15:00 MINIATURIZED SURFACE DIELECTRIC BARRIER DISCHARGE PLASMA ACTUATORS FOR APPLICATION IN CHEMICAL ANALYSIS SYSTEMS
Julian Eiler¹, Christina Högl¹, Matthias Lindner¹, Michael Bachmann², and Rupert Schreiner¹
¹Ostbayerische Technische Hochschule Regensburg, GERMANY and ²Ketek GmbH, GERMANY

15:15 A COMPACT FLAT VACUUM LIGHT SOURCE USING A WIRE CATHODE AND CATHODOLUMINESCENT PHOSPHORS
Jordan T. Ricci, Sergei Mistyuk, and Charles E. Hunt
University of California, Davis, USA

Poster Session Preview
15:30 – 16:00

Poster Session, coffee break
16:00 - 18:00

Electron Sources

P.01 A VACUUM INSULATOR NEGATIVE ELECTRON AFFINITY ELECTRON EMITTER WITH HIGH QUANTUM EFFICIENCY
Juan A. Sanchez Vazquez, Anika T. Priyoti, Ragib Ahsan, Hyun Uk Chae, and Rehan Kapadia
University of Southern California, USA

P.02 LINEAR FEMTOSECOND TUNABLE-WAVELENGTH PHOTOASSISTED COLD FIELD EMISSION
Rudolf Haindl¹,², Kerim Köster¹,², John H. Gaida¹,², Maximilian Franz¹,², Armin Feist¹,², and Claus Ropers¹,²
¹Max Planck Institute for Multidisciplinary Sciences, GERMANY and ²University of Göttingen, GERMANY

P.03 MODULATED ELECTRON BEAM EMISSION UNDER RF AND LASER FIELDS
Lan Jin, Yang Zhou, and Peng Zhang
Michigan State University, USA

P.04 STUDY OF DIELECTRIC NANOLAYERS AND MULTILAYER COATED EMITTERS
Daniel Burda¹,², Mohammad M. Allahami¹,², Miroslav Horáček¹, and Alexandr Knápek²
¹Czech Academy of Sciences, CZECH REPUBLIC, ²Brno University of Technology, CZECH REPUBLIC, and ³Central European Institute of Technology, CZECH REPUBLIC
**Fabrication Technologies**

**P.05**  
EFFECT OF DIELECTRIC SUBSTRATE ON GOLD NANOSCALE LATERAL VACUUM EMISSION DEVICES  
Jonathan O'Mara\(^1,2\), Jonathan Ludwick\(^2,4\), Nathaniel Hernandez\(^2\), Dennis Walker Jr.\(^3\), Tyson Back\(^4\), Marc Cahay\(^2\), and Harris Hall\(^3\)  
\(^1\)KBR, USA, \(^2\)UES Inc., USA, \(^3\)AFRL Sensors Directorate, USA, \(^4\)AFRL Materials and Manufacturing Directorate, USA, and \(^5\)University of Cincinnati, USA

**Fundamentals**

**P.09**  
ADVANTAGES OF K-POWER PLOT FOR EXPERIMENTAL IVC PROCESSING  
Sergey V. Filippov, Anatoly G. Kolosko, and Eugeni O. Popov  
Ioffe Institute, RUSSIA

**P.10**  
MINIMAL PARAMETERS TO PREDICT THE THEORETICAL EMISSION CURRENT VS. FIELD CURVES  
Fernando F. Dall'Agnol\(^1\), Thiago A. de Assis\(^2,3\), and Sergey V. Filippov\(^4\)  
\(^1\)Federal University of Santa Catarina, BRAZIL, \(^2\)Universidade Federal da Bahia, BRAZIL, \(^3\)Universidade Federal Fluminense, BRAZIL, and \(^4\)Ioffe Institute, RUSSIA

**P.11**  
MODELING THE TEMPORAL RESPONSE OF GATED ZNO NANOWIRE FIELD EMITTER ARRAYS  
Chengyun Wang, Yicong Chen, Guofu Zhang, Song Kang, Xinran Li, Juncheng She, Shaozhi Deng, and Jun Chen  
Sun Yat-sen University, CHINA

**P.12**  
SPACE CHARGE AND RESISTANCE EFFECTS ON SATURATION OF FIELD EMISSION  
Guo-Ning Wang\(^1\), Kaviya Aranganadin\(^1\), Yung-Chiang Lan\(^2\), Hua-Yi Hsu\(^1\), John P. Verboncoeur\(^4\), and Ming-Chieh Lin\(^1\)  
\(^1\)Hanyang University, KOREA, \(^2\)National Cheng Kung University, TAIWAN, \(^3\)National Taipei University of Technology, TAIWAN, and \(^4\)Michigan State University, USA

**P.13**  
UNDERSTANDING THE FAILURE MECHANISMS OF SILICON GATED FIELD EMITTERS  
Rushmita Bhattacharjee\(^1\), Ranajoy Bhattacharya\(^1\), Stephen A. Guerrera\(^2\), Nedeljko Karaulac\(^2\), Girish Rughoobur\(^5\), Winston Chern\(^2\), Akintunde I. Akinwande\(^5\), and Jim Browning\(^1\)  
\(^1\)Boise State University, USA and \(^2\)Massachusetts Institute of Technology, USA

**P.14**  
UNIFORM DISTRIBUTION OF INDIVIDUAL CURRENT IN CLUSTER OF EMITTERS  
Sergey V. Filippov\(^1\), Fernando F. Dall'Agno\(^2\), Thiago A. de Assis\(^3,4\), Anatoly G. Kolosko\(^1\), and Eugene O. Popov\(^1\)  
\(^1\)Ioffe Institute, RUSSIA, \(^2\)Federal University of Santa Catarina, BRAZIL, \(^3\)Universidade Federal da Bahia, BRAZIL, and \(^4\)Universidade Federal Fluminense, BRAZIL
Other Applications

P.15  ADVANCED RADIATION SOURCE BASED ON FIELD EMISSION ELECTRON GUN WITH CARBON NANOTUBES
Hanna Lee¹, Jinho Choi¹, Amar Prasad Gupta¹,², Jaekyu Jang³, Kyung-Sik Yoon¹, and Jehwang Ryu¹
¹Kyung Hee University, KOREA and ²CAT Beam Tech Co., Ltd., KOREA

P.16  AN AIR STABLE, ELECTRONICALLY TUNABLE NEGATIVE ELECTRON AFFINITY SILICON PHOTOCATHODE
Anika Tabassum Priyoti, Ragib Ahsan, Hyun Uk Chae, Juan Sanchez Vazquez, and Subrata Das
University of Southern California, Los Angeles, USA

P.19  QUALITATIVE MODELING OF AN ELECTRON OR FINITE-CHORD SLENDER BODY TRANSITING A VACUUM WITH DRAG
Jonathan M. Protz
Independent Consultant, USA

18:00  End of Day
Wednesday, July 12

Announcements
08:00 - 08:10

Conference Chair:
Luis F. Velásquez-Garcia, Massachusetts Institute of Technology, USA

Plenary Speaker II
08:10 – 08:50

08:10 LOW-TEMPERATURE PLASMAS FOR PERSONALIZED HEALTHCARE AND EFFICIENT SPACE PROPULSION
Michael Keidar
George Washington University, USA

Session 4 - Other Applications II
08:50 – 10:05
Chair: Ruppert Schreiner, OTH Regensburg

08:50 DEVELOPMENT OF CNT CATHODES FOR SPACE APPLICATIONS
Georg Hentsch and Martin Tajmar
Technische Universität Dresden, GERMANY

09:05 FULLY 3D-PRINTED, MINIATURE LANGMUIR MULTI-PROBE SENSOR FOR CUBESAT IONOSPHERIC PLASMA DIAGNOSTICS
Zoey Bigelow and Luis Fernando Velásquez-Garcia
Massachusetts Institute of Technology, USA

09:20 MINIATURE, 3-D PRINTED RF QUADRUPOLE MASS FILTERS FOR CUBESATS
Alejandro Diaz and Luis Fernando Velásquez-Garcia
Massachusetts Institute of Technology, USA

09:35 3-D PRINTED, COMPACT, TIME-OF-FLIGHT REFLECTRON MASS FILTERS
Nicholas Lubinsky and Luis Velásquez-Garcia
Massachusetts Institute of Technology, USA

09:50 THE VIABILITY OF NANOCLUSTER CARBON-BASED FIELD EMITTER ARRAYS FOR THE FIELD EMISSION ELECTRICAL PROPULSION SYSTEM
Nirupama Malavalli Prasad¹, Omvir Singh Panwar¹, and Bukinakere S Satyanarayana²
¹BML Munjal University, INDIA and ²GD Goenka University, INDIA

10:05 - 10:25 Refreshment Break

Session 5 - Fabrication Technologies I
10:25 – 11:40
Chair: Marc Cahay, University of Cincinnati

10:25 AN INTEGRATED FIELD EMISSION ELECTRON SOURCE ON A CHIP FABRICATED BY LASER-MICROMACHINING AND MEMS TECHNOLOGY
Matthias Hausladen¹, Philipp Buchner¹, Andreas Schels², Simon Edler³, Michael Bachmann³, and Ruppert Schreiner⁴
10:40 **EXPLORING THE FIELD EMISSION CAPABILITIES OF ALGAN/GAN NANOSCALE VACUUM DIODES**
Nathaniel Hernandez¹, Marc Cahay¹, Jonathan O’Mara²,³, Jonathan Ludwick²,⁴, Dennis E. Walker Jr.,², Tyson Back², and Harris Hall²
¹University of Cincinnati, USA, ²Air Force Research Laboratory, USA, ³KBR, USA, and ⁴UES, USA

10:55 **IN-SITU DIRECT OBSERVATION OF CARBON NANOTUBE SYNTHESIS UNDER ELECTRIC FIELD AND THEIR FIELD EMISSION PERFORMANCE**
Pascal Vincent¹, Federico Panciera², Ileana Florea³, Costel Cojocaru³, Sorin Perisanu¹, Anthony Ayari¹, Julien Chaste², Pierre Legagneux⁴, and Stephen T. Purcell¹
¹University Claude Bernard Lyon 1, CNRS, FRANCE, ²University of Paris-Saclay, CNRS, FRANCE, ³Ecole Polytechnique, FRANCE, and ⁴Thales Research and Technology, FRANCE

11:10 **ENHANCEMENT OF FIELD EMISSION PROPERTIES OF CARBON NANOTUBE FORESTS BY DIRECT GROWTH ON TITANIUM NITRIDE-COATED SUBSTRATES**
Stefanie Haugg, Carina Hedrich, Luis-Felipe Mochalski, Isabel González Díaz-Palacio, Robert Zierold, and Robert H. Blick
Universität Hamburg, GERMANY

11:25 **FIELD EMISSION PROPERTIES OF HIGHLY CONDUCTIVE DIAMOND-LIKE CARBON LAYERS**
Georg Hentsch¹, Martin Tajmar¹, and Volker Weihnacht²
¹Technische Universität Dresden, GERMANY and ²Fraunhofer Institute for Material and Beam Technology (IWS), GERMANY

11:40 - 13:00 Lunch on Own

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**Session 6 - Electron Sources II**
13:00 – 14:15
*Chair: Stephen Purcell, Université Claude Bernard Lyon 1*

13:00 **3D-PRINTED, NON-PLANAR ELECTRON SOURCES FOR NEXT-GENERATION ELECTRON PROJECTION LITHOGRAPHY**
Alex Kachkine, Crystal E. Owens, A. John Hart, and Luis F. Velásquez-García
Massachusetts Institute of Technology, USA

13:15 **APPLICATIONS IN MICROSCOPY AND LITHOGRAPHY FOR A HERALDED ELECTRON SOURCE**
Stewart A. Koppell¹, John W. Simonaitis¹, Maurice A.R. Krielaart¹, Omer E. Ates², William P. Putnam², Karl K. Berggren¹, and Phillip D. Keathley¹
¹Massachusetts Institute of Technology, USA and ²University of California, Davis, USA

13:30 **EFFECT OF O₂ EXPOSURE ON SILICON FIELD EMITTER ARRAYS**
Reza Farsad Asadi¹, Tao Zheng¹, Girish Rughoobur², Ranajoy Bhattacharya³, Jim Browning¹, Akintunde I. Akinwande², and Bruce Gnade³
¹Southern Methodist University, USA, ²Massachusetts Institute of Technology, USA, ³Boise State University, USA, and ⁴University of Texas at Dallas, USA

13:45 **FOCUSING ELECTRODE ON FOCAL SPOT SIZE AND DOSE BY CARBON NANOTUBE BASED COLD CATHODE ELECTRON BEAM (C-BEAM)**
Yi Yin Yu and Kyu Chang Park
Kyung Hee University, KOREA
14:00  ELECTRON EMISSION-DRIVEN GAS-LIQUID PLASMA:  
   SEED STERILIZATION AND SURFACE MODIFICATION  
Siwapon Srisonphan, Naowarat Tephiruk, and Khomsan Ruangwong  
Kasetsart University, THAILAND

14:15 - 14:45  Refreshment Break

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**Plenary Speaker III**

14:45 – 15:30

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14:45  QUANTUM NATURE OF ELECTRON-LIGHT AND ELECTRON-MATTER INTERACTIONS  
Ron Ruimy and Ido Kaminer  
Technion - Israel Institute of Technology, ISRAEL

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**Session 7 - Fundamentals II**

15:30 – 16:45  
Chair: Kyu Chang Park, Kyung Hee University

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15:30  A DELTA BARRIER IN A WELL AND ITS GENERALIZATION FOR EMISSION STUDIES  
Kevin Jensen¹, Jeane Riga², Andrew Shabaev³, Michael Osofsky⁴,  
Joseph Prestigiacomo³, and John J. Petillo¹  
¹Leidos, USA and ²Air Force Research Laboratory, USA, ³Naval Research Laboratory, USA, and ⁴Towson University, USA

15:45  EFFECTS OF DC BIAS ON QUANTUM PATHWAYS INTERFERENCE  
in TWO-COLOR LASER INDUCED PHOTOEMISSION  
Yang Zhou and Peng Zhang  
Michigan State University, USA

16:00  OXIDE ELECTRON EMITTERS: THERMIONIC EMISSION FROM YTTRIUM OXIDE  
Mike Chang, George A. Sawatzky, and Alireza Nojeh  
University of British Columbia, CANADA

16:15  PROGRESS ON THE JOURNEY TO PUT FIELD ELECTRON  
EMISSION ONTO A BETTER SCIENTIFIC BASIS  
Richard G. Forbes¹, Sergey V. Filippov², Anatoly G. Kolosko², and Eugeni O. Popov²  
¹University of Surrey, UK and ²Ioffe Institute, RUSSIA

16:30  OVERVIEW OF ELECTRON EMISSION LAWS FROM 2D MATERIALS  
Lay Kee Ang, Yee Sin Ang, Yi Luo, and Bee Hong Tiang  
Singapore University of Technology and Design, SINGAPORE

16:45  End of Day

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**Excursion – Duck Tour**

17:30 - 18:30  
Please kindly be at Kendall square @ 5:15 PM
Thursday, July 13

Announcements
08:00 - 08:05

Conference Chair:
Luis F. Velásquez-García, Massachusetts Institute of Technology, USA

Plenary Speaker IV
08:05 – 08:50

08:05 MINIATURE MASS SPECTROMETERS FOR ON-SITE CHEMICAL ANALYSIS
Zheng Ouyang
Tsinghua University, CHINA

Session 8 - Electron Sources III
08:50 – 10:05
Chair: Jonathan Shaw, Naval Research Laboratory

08:50 ELECTRON BEAM INDUCED GROWTH OF CARBON NANOTIPS ON TUNGSTEN AND SILICON FIELDEMITTERS
Fabian Hecht, Florian Bauereiß, Josef Sellmair, Philipp Buchner, Matthias Hausladen, and Rupert Schreiner
Ostbayerische Technische Hochschule Regensburg, GERMANY

09:05 A LAB6 NANONEEDLE FIELD-EMISSION ELECTRON SOURCE FOR STABLE IMAGING WITH ATOMIC RESOLUTION IN A TRANSMISSION ELECTRON MICROSCOPE
Shuai Tang1,2, Jie Tang2, Eiji Okunishi3, Jun Uzuhashi2, Tadakatsu Ohkubo2, Masaki Takeguchi2, and Lu-Chang Qin4
1Sun Yat-sen University, CHINA, 2National Institute for Materials Science, JAPAN,
3JEOL Ltd., JAPAN, and 4University of North Carolina, Chapel Hill, USA

09:20 IMPROVEMENT OF ELECTRON EMISSION PROPERTIES OF VOLCANO-STRUCTURED SILICON EMITTERS BY TITANIUM NITRIDE COATING
Hiromasa Murata, Katsuhisa Murakami, and Masayoshi Nagao
National Institute of Advanced Industrial Science and Technology (AIST), JAPAN

09:35 STUDY ON OPTIMIZATION OF CARBON NANOTUBE NANO-COLD CATHODE ARRAY FOR AN ELECTRON BEAM PUMPING ULTRAVIOLET LIGHT EMITTING DEVICE
Lei Luo, Yan Shen, Dong Han, Xiaoyu Qin, Junzhong Liang, Bao-hong Li, Yu Zhang, and Shaozhhi Deng
Sun Yat-sen University, CHINA

09:50 ELECTRON EMISSION CHARACTERISTICS OF FIELD EMITTER ARRAYS COATED WITH OVER-STOICHIOMETRIC HAFNIUM NITRIDE
Tomoaki Osumi1,2, Ryosuke Hori1, Masayoshi Nagao2, Hiromasa Murata2, and Yasuhito Gotoh1
1Kyoto University, JAPAN and
2National Institute of Advanced Industrial Science and Technology (AIST), JAPAN

10:05 - 10:25 Refreshment Break
Session 9 - Fundamentals III
10:25 – 11:40
Chair: Charles Hunt, University of California – Davis

10:25 Adjoint Optimization of Nanoscale Vacuum-Channel Transistor (NVCT) Geometry
Luke C. Adams¹, Gregory R. Werner¹, and John R. Cary¹,²
¹University of Colorado, Boulder, USA and ²Tech-X Corp, USA

10:40 Further Studies on Using the AHFP Exponent to Choose Between Alternative Field Emission Theories
Sergey V. Filippov¹, Richard G. Forbes², Eugeni O. Popov¹, Anatoly G. Kolosko¹, and Fernando F. Dall’Agnol¹
¹Ioffe Institute, Russia, ²University of Surrey, UK, and ³Federal University of Santa Catarina, Brazil

10:55 Study of Silicon Field Emitters Using Monte Carlo Method
Ze Niu, Mike Zhu, and Enrico Bellotti
Boston University, USA

11:10 An Online Tool for Thermal-Field Emission Calculations From Metal and Semiconducting Emitters
Mikael Rinne¹, Salvador Barranco Cárceles², Veronika Zadin¹, Aquila Mavalankar², Ian Underwood², and Andreas Kyritsakis¹
¹University of Tartu, Estonia, ²University of Edinburgh, Scotland, and ³Adaptix Imaging Ltd., UK

11:25 Micron-Scale Electrostatic Charged-Particle Guides: Analysis and Simulation
Benjamin J. Slayton, Ryan S. Kim, and William P. Putnam
University of California, Davis, USA

11:40 - 12:40 Lunch on Own

Plenary Presentation V
12:40 – 13:25

12:40 A Modular, Portable and Static Computed Tomography System for Resource-Constrained Environment
Jake Hecla¹, Dufan Wu²,³, Avilash Cramer¹, Tim Moulton², Amar Prasad Gupta⁴, Kai Yang¹, Wolfgang Krull², and Rajiv Gupta²,³
¹University of California, Berkeley, USA, ²Harvard Medical School, USA, ³Massachusetts General Hospital, USA, and ⁴Kyung Hee University, Korea

Session 10 - Other Applications III
13:25 – 14:40
Chair: Yasuhito Gotoh, Kyoto University

13:25 Application of a Novel Addressable-Array X-Ray Source to Medical Imaging of Extremities
D. Keith Bowen, James D. Cameron, Conrad Dirckx, Paul Edwards, Manuel Fohler, Isabel A. Gomes, Aquila M. Mavalankar, Sian Phillips, Kate L. Renforth, Steven P. Richards, Vadim Y. Soloviev, Silvia Sottini, Alexis Tello Valero, Nivedita Yumnam, and Stephen G. Wells
Adaptix Ltd, UK
13:40  MEMS QUADRUPOLE MASS SPECTROMETER
Piotr Szyszka, Jakub Jendryka, Jan Sobków, Michał Zychla, Marcin Białas, Paweł Knapkiewicz, Jan Dziuban, and Tomasz Grzebyk
Wrocław University of Science and Technology, POLAND

13:55  REVOLUTIONIZING X-RAY IMAGING: SPINDT FIELD EMITTER TUBE WITH CHROMATIC SCAN CAPABILITY ACROSS WIDE VOLTAGE RANGE (30-160KV)
Ukyo Jeong, Ghiyuun Kang, Seungho Lee, Sanghyun Yoon, Jaehyun Ahn, Jaeil Lee, and Ilung Kim
Nano-X imaging Ltd, KOREA

14:10  DESIGN AND CHARACTERIZATION OF A MEDICAL MULTI-BEAM SYSTEM WITH DIRECTLY GROWN CNT FIELD EMISSION EMITTERS
Jinho Choi¹, Hanna Lee¹, Junho Yu¹, Amar Prasad Gupta¹,², Mrinal Bhusal Sharma¹, Jaekyu Jang¹, Jaeik Jung², Won Jung Lee¹, Seung Jun Yeo², Seung Hoon Kim³, Moonkyyoong Kong³, and Jehwang Ryu¹
¹Kyung Hee University, KOREA, ²CAT Beam Tech Co., Ltd., KOREA, ³University of Ulsan College of Medicine, KOREA, and ⁴Kyung Hee University Medical Center, KOREA

14:25  MINIATURE, MONOLITHIC, FULLY ADDITIVELY MANUFACTURED GLASS-CERAMIC QUADRUPOLE MASS FILTERS FOR POINT-OF-CARE MASS SPECTROMETRY
Colin C. Eckhoff¹, Nicholas K. Lubinsky¹, Randall E. Pedder¹, and Luis F. Velásquez-García¹
¹Massachusetts Institute of Technology, USA and ²Ardara Technologies LP, USA

14:40 - 15:00  Refreshment Break

Session 11 - Fabrication Technologies II
15:00 – 16:15
Chair: Rafał Walczak, Wrocław University of Science and Technology

15:00  NOVEL GLASS-SILICON EMITTER CHIP FOR FIELD EMISSION APPLICATIONS
Aleksandra M. Buchta¹, Alexander Kassner¹, Julia Voß², Tobias Leopold², Julian Petring¹, Leonard Diekmann¹, Folke Dencker¹, and Marc C. Wurz¹
¹Leibniz University Hanover, GERMANY and ²LPKF Laser & Electronics SE, GERMANY

15:15  INTEGRATED SILICON ELECTRON SOURCE FOR HIGH VACUUM MEMS DEVICES
Michał Krysztof, Paweł Miera, Paweł Urbański, and Tomasz Grzebyk
Wrocław University of Science and Technology, POLAND

15:30  A NOVEL BACK-FRONT DOUBLE-GATED FIELD EMISSION ELECTRON GUN USING 3D CNT EMITTERS FOR X-RAY SOURCE
Amar Prasad Gupta¹, Jinho Choi¹, Jongmin Lim¹, Mrinal Sharma Bhusal², Jaeik Jung², Seung Jun Yeo², Ahn Jeung Sun¹, and Jehwang Ryu¹
¹Kyung Hee University, KOREA and ²CAT Beam Tech Co., Ltd, KOREA

15:45  EFFICIENT SYNTHESIS OF HIGH-QUALITY CARBON NANOTUBES USING INDUCTION HEATING TECHNOLOGY
Jinho Choi¹, Hanna Lee¹, Junho Yu¹, Amar Prasad Gupta¹,², Mrinal Bhusal Sharma², Jaekyu Jang², Jaeik Jung², Won Jung Lee¹, Seung Jun Yeo², Moonkyyoong Kong³, and Jehwang Ryu¹
¹Kyung Hee University, KOREA, ²CAT Beam Tech Co., Ltd., KOREA, and ³Kyung Hee University Medical Center, KOREA

16:00  TEMPERATURE EFFECTS ON GALLIUM NITRIDE FIELD EMITTER ARRAYS
Ranajoy Bhattacharya¹, Pao-Chuan Shih², Tomás Palacios², and Jim Browning¹
¹Boise State University, USA and ²Massachusetts Institute of Technology, USA
Session 12 - Fundamentals IV
16:15 – 17:30
Chair: Alexandr Knápek, ISI Brno

16:15 SIMULATING NANOSCALE VACUUM CHANNEL TRANSISTOR ARRAYS IN LTSPICE UTILIZING AN EMPIRICAL WARM-BEAM CHILD-LANGMUIR MODEL
Jesse M. Snelling¹, Gregory R. Werner¹, and John R. Cary¹²
¹University of Colorado, Boulder, USA and ²Tech-X Corporation, USA

16:30 BETA FACTOR MAPPING OF INDIVIDUAL EMITTING TIPS DURING INTEGRAL OPERATION OF FIELD EMISSION ARRAYS
Andreas Schels¹, Florian Herdl¹, Matthias Hausladen³, Dominik Wohlfortsätter⁵, Michael Bachmann², Simon Edler⁵, Felix Düsberg⁵, Andreas Pahlke², Philipp Buchner⁵, Rupert Schreiner¹, and Walter Hansch¹
¹University of the Bundeswehr Munich, GERMANY, ²KETEK GmbH, GERMANY, and ³Ostbayerische Technische Hochschule Regensburg, GERMANY

16:45 HOW ACCURATE IS A FIELD EMISSION EXPERIMENT?
Anthony Ayari, Pascal Vincent, Sorin Perisanu, Philippe Poncharal, and Stephen T. Purcell
University Claude Bernard Lyon, CNRS, FRANCE

17:00 SIMULATION OF SEMICONDUCTING FIELD EMITTERS AND ITS THERMAL EFFECTS
Salvador Barranco Cárceles¹, Andreas Kyritsakis², Veronika Zadin², Aquila Mavalankar³, and Ian Underwood¹
¹University of Edinburgh, SCOTLAND, ²University of Tartu, ESTONIA, and ³Adaptix Imaging Ltd., UK

17:15 EFFECT OF ELECTRICAL AGING OF COLD CATHODE C-BEAM ON FOCAL SPOT SIZE AND X-RAY DOSE
Ketan Bhotkar, Yi Yin Yu, Bishwa Chandra Adhikari, and Kyu Chang Park
Kyung Hee University, KOREA

17:30 End of Day

Banquet—Odyssey Dinner Cruise
IVNC 2024 Announcement
Winner SGS Award
19:00 - 22:00
One bus will be picking up dinner cruise attendants from the Hyatt at @ 6 PM sharp; another bus will be picking up dinner cruise attendants from Tang Center @ 6 PM sharp