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#### Chair: Baruch Levush, Naval Research Laboratory 1-1. Session Keynote: Obtaining Impedance Matrices of RF Structures using the Joining and Subtraction Formulae (Page 1) Vadim Jabotinski, Leidos David Chernin, Leidos Thomas M. Antonsen, Jr., Leidos Alexander N. Vlasov, US Naval Research Laboratory Session Keynote: Advanced Large-signal Modeling of Multiple-beam Klystrons Using Generalized 1-2: Impedance Matrix Approach (Page 3) Igor A. Chernyavskiy, Naval Research Laboratory John C. Rodgers, Naval Research Laboratory Alexander N. Vlasov, Naval Research Laboratory David K. Abe, Naval Research Laboratory Baruch Levush, Naval Research Laboratory Thomas M. Antonsen, Jr., Leidos, Inc. Khanh T. Nguyen, Beam-Wave Research, Inc. Dean E. Pershing, Beam-Wave Research, Inc. 1-3: Recent Developments on EOS 2D/3D Electron Gun and Collector Modeling Code (Page 5) Quan Hu, University of Electronic Science and Technology of China Yulu Hu, University of Electronic Science and Technology of China Xiaofang Zhu, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China 1-4: A Novel Technique to Model Ultrafast Electron Microscope (Page 7) Thuc Bui, Calabazas Creek Research, Inc. Michael Read, Calabazas Creek Research, Inc. R. Lawrence Ives, Calabazas Creek Research, Inc. 1-5: MICHELLE for High-Level Optimization, Large Scale Problems and HPC Environments (Page 9) John Petillo, Leidos Corporation Serguei Ovtchinnikov, Leidos Corporation Aaron Jensen, Leidos Corporation Alex Burke, Leidos Corporation Eric Nelson, Leidos Corporation George Stantchev, US Naval Research Laboratory Simon Cooke, US Naval Research Laboratory Ben Held, AWR National Instruments Alan Nichols, AWR National Instruments

### Session 2: Space TWTs

Session 1: Modeling - I

Chair: Ernst Bosch, Thales Electron Devices

Tuesday, April 24 / 1:30-2:50 PM / San Carlos III

Tuesday, April 24 / 1:30-3:10

PM / San Carlos IV

- 2-1: Session Keynote: The Flight Operations History of the Cassini X-Band TWTAs (Page 11) Wayne Harvey, California Institute of Technology
  - James Shell, *California Institute of Technology (retired)* Laura L. Burke, *California Institute of Technology*
- 2-2: Space Qualified 200-W Q-band Linearized Traveling-Wave Tube Amplifier (Page 13)

Neal Robbins, *L3 Technologies* David Eze, *L3 Technologies* Helen Cohen, *L3 Technologies* Xiaoling Zhai, *L3 Technologies* William McGeary, *L3 Technologies* William Menninger, *L3 Technologies* Morgan Chen, *L3 Technologies* Eddie Rodgers, *L3 Technologies* 

2-3: 40W Q Wideband Space TWT (Page 15) Tiziana Barsotti, *Thales Electrin Devices* Jean Gastaud, *Thales Electrin Devices* Julien Pontic, *Thales Electrin Devices* Mickael Barentin, *Thales Electrin Devices*  2-5: Medium Power High Efficiency Ka Band (Page 17) Christof Dietrich, *Thales Deutschland GmbH* Wolfgang Dürr, *Thales Deutschland GmbH* Peter Ehret, *Thales Deutschland GmbH* Ernst Bosch, *Thales Deutschland GmbH* 

# Session 3: IOTs/Klystrons I

Chair: David Abe, Naval Research Laboratory

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Stephan Lenci, Communications & Power Industries, LLC Chris Yates, Communications & Power Industries, LLC Nicholas Halatsis, Communications & Power Industries, LLC Takuji Kimura, Communications & Power Industries, LLC Paul Krzeminski, Communications & Power Industries, LLC Janice Oldahm, Communications & Power Industries, LLC Peter Kolda, Communications & Power Industries, LLC Oliver Sablic, Communications & Power Industries, LLC Armel Beunas, Thales Electron Devices Claude Bel. Thales Electron Devices Christian Robert, Thales Electron Devices Jean Claude Racamier. Thales Electron Devices Denis Bussiere, Thales Electron Devices David Bariou, Thales Electron Devices Karim Haj Khlifa, Thales Electron Devices Virgile Hermann, Thales Electron Devices Philippe Cacheux, Thales Electron Devices

# 3-2: Scaled Experimental Studies on Radio Frequency Source for Megawatt-Class Ionospheric

Heaters (Page 21) Brian L. Beaudoin, University of Maryland Antonio Ting, University of Maryland Steven Gold, University of Maryland Amith H. Narayan, University of Maryland Jayakrishnan A. Karakkad, University of Maryland Gregory S. Nusinovich, University of Maryland Thomas M. Antonsen Jr., University of Maryland

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Brandon Weatherford, SLAC National Accelerator Laboratory Richard Kowalczyk, SLAC National Accelerator Laboratory Valery Dolgashev, SLAC National Accelerator Laboratory Jeffrey Neilson, SLAC National Accelerator Laboratory Aaron Jensen, Leidos, Inc. Igor Syratchev, CERN Jinchi Cai, CERN

# 3-4: A 1.3 GHz 100 kW Ultra-high Efficiency Klystron (Page 25) Michael Read, Calabazas Creek Research Inc. R Lawrence Ives, Calabazas Creek Research Inc.

Jeff Neilson, SLAC National Accelerator Laboratory

Aaron Jensen, Leidos, Inc.

#### Session 4: High Power Microwaves - I

Chair: Eric Nelson, Los Alamos National Laboratory

Tuesday, April 24 / 3:30-5:10 PM / San Carlos IV

4-1: High Power Microwave Generation by Cherenkov-Cyclotron Instability in a Metamaterial Structure

with Negative Group Velocity (Page 27) Xueying Lu, Massachusetts Institute of Technology Jacob C Stephens, Massachusetts Institute of Technology Ivan Mastovsky, Massachusetts Institute of Technology Michael A Shapiro, Massachusetts Institute of Technology Richard J Temkin, Massachusetts Institute of Technology 4-2: Review of Metamaterial-Inspired Vacuum Electron Devices (Page 29) Zhaoyun Duan, University of Electronic Science and Technology of China Michael A. Shapiro, Massachusetts Institute of Technology Yubin Gong, University of Electronic Science and Technology of China Edl Schamiloglu, University of New Mexico Nader Behdad, University of Wisconsin-Madison John H. Booske, University of Wisconsin-Madison B. N. Basu, Sir J.C. Bose School of Engineering Richard J. Temkin, Massachusetts Institute of Technology

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Steven C. Exelby, University of Michigan Geoffrey B. Greening, University of Michigan Nicholas M. Jordan, University of Michigan Drew A. Packard, University of Michigan Yue Ying Lau, University of Michigan Ronald M. Gilgenbach, University of Michigan Brad W. Hoff, Air Force Research Laboratory David Simon, Air Force Research Laboratory

**4-4:** Design of a Cascade High-Power Source with High Efficiency (Page 33) Gangxiong Wu, University of Electronic Science and Technology of China Yanyu Wei, University of Electronic Science and Technology of China Qian Li, University of Electronic Science and Technology of China Xia Lei, University of Electronic Science and Technology of China Chong Ding, University of Electronic Science and Technology of China Guo Guo, University of Electronic Science and Technology of China Xianjian Niu, University of Electronic Science and Technology of China Xianjian Niu, University of Electronic Science and Technology of China Lingna Yue, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Dazhi Li, Institute for Laser Technology

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Sukwinder Singh, Indian Institute of Technology Roorkee S Yuvaraj, Indian Institute of Technology Roorkee Gaurav Singh Baghel, Indian Institute of Technology Roorkee M.V. Kartikeyan, Indian Institute of Technology Roorkee

#### **Session 5: Thermionic Cathodes** Chair: Daniel Busbaher, *3M*

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5-1. Perovskite Electron Emitters: Computational Prediction and Preliminary Experimental Assessment of

Novel Low Work Function Cathodes (Page 37) Ryan Jacobs, University of Wisconsin- Madison Lin Lin, University of Wisconsin- Madison Tianyu Ma, University of Wisconsin- Madison Otto Lu-Steffes, L3 Technologies Vasilios Vlahos, L3 Technologies Dane Morgan, University of Wisconsin- Madison John Booske, University of Wisconsin- Madison

# 5-3: Combining Theory and Experiment to Model Electron Emission from Polycrystalline Tungsten

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 Dane Morgan, University of Wisconsin- Madison
 John Booske, University of Wisconsin- Madison 5-5: The Dipole Model at the Atomic Scale: Explaining Variations in Work Function due to Configurational and Compositional Changes in Ba/Sc/O Adsorbates on W (001), (110), and (112) (Page 43)

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Xiaoxia Wang, Chinese Academy of Sciences Pengyu Jiang, Chinese Academy of Sciences Bofeng Wang, Chinese Academy of Sciences Qinglan Zhao, Chinese Academy of Sciences Yun Li, Chinese Academy of Sciences

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Alexander N Vlasov, US Naval Research Laboratory John C Rodgers, US Naval Research Laboratory Reginald L Jaynes, US Naval Research Laboratory Colin D Joye, US Naval Research Laboratory John A Pasour, US Naval Research Laboratory Franklin N Wood, US Naval Research Laboratory Igor A Chernyavskiy, US Naval Research Laboratory Simon J Cooke, US Naval Research Laboratory David K Abe, US Naval Research Laboratory Baruch Levush, US Naval Research Laboratory Thomas M Antonsen Jr., Leidos Inc. David P Chernin, Leidos Inc. Vadim J Jabotinski, Leidos Inc. Khanh T Nguyen, Beam-Wave Research Inc.

# 6-2: 550-W Ka-Band Pulsed Helix TWT for Radar Applications (Page 49)

Chae K. Chong, *L3 Technologies* Robert M. Baird, *L3 Technologies* Dennis A. Layman, *L3 Technologies* Michael L. Ramay, *L3 Technologies* Hung T. Vu, *L3 Technologies* Xiaoling Zhai, *L3 Technologies* 

6-3: Development of the DBS Band, 1,250 Watt CW, Air-Cooled Helix TWT (Page 51)

Merritt Chesnut, Communication and Power Industries, LLC Patrick Casey, Communication and Power Industries, LLC Michael Fernicola, Communication and Power Industries, LLC Kevin Mallon, Communication and Power Industries, LLC Mark Perrin, Communication and Power Industries, LLC Ognian Sabev, Communication and Power Industries, LLC

#### 6-4: Fabrication and Testing of Ka-Band Multi-Beam TWT Circuits (Page 53)

Reginald L. Jaynes, U.S. Naval Research Lab Alexander N. Vlasov, U.S. Naval Research Lab John C. Rodgers, U.S. Naval Research Lab Frank N. Wood, U.S. Naval Research Lab Colin D. Joye, U.S. Naval Research Lab Dean E. Pershing, Beam-Wave Research, Inc. Alan M. Cook, U.S. Naval Research Lab David K. Abe, U.S. Naval Research Lab

# 6-5: Design and Development of a 1,250 Watt Extended CW KU-Band Forced Air-Cooled Helix Traveling Wave Tube (Page 55)

Nileshwar Chaudhary, Communication and Power Industries, LLC (MPP: Helix TWT) Mark Perrin, Communication and Power Industries, LLC Merritt Chesnut, Communication and Power Industries, LLC Tom Grant, Communication and Power Industries, LLC Kevin Mallon, Communication and Power Industries, LLC Patrick Casey, Communication and Power Industries, LLC Ognian Sabev, Communication and Power Industries, LLC Rajni Shah, Communication and Power Industries, LLC

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#### Session 7: Modeling - II

Chair: Simon Cooke, Naval Research Laboratory

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Wednesday, April 25 / 8:30-

10:10 AM / San Carlos III

- 7-1: Efficient Evaluation of the Effects of Manufacturing Tolerances on VED Performance (Page 59) David P. Chernin, *Leidos, Inc.* Thomas M. Antonsen, Jr., *Leidos, Inc. & University of Maryland*
- 7-2: Dual-frequency Multipactor Susceptibility on a Dielectric (Page 61) Asif Iqbal, Michigan State University Peng Zhang, Michigan State University John Verboncoeur, Michigan State University
- 7-3: Molecular Dynamics Simulations of Vacuum Diodes (Page 63) Kristinn Torfason, *Reykjavik University* Hákon Valur Haraldsson, *Reykjavik University* Ágúst Valfells, *Reykjavik University* Andrei Manolescu, *Reykjavik University*
- 7-4: Vacuum Electronics Optimization Using Galaxy Simulation Builder (Page 65) Aaron Jensen, *Leidos, Inc.* Alex Burke, *Leidos, Inc.* David Chernin, *Leidos, Inc.* Serguei Ovtchinnikov, *Leidos, Inc.* John Petillo, *Leidos, Inc.*
- **7-5:** The Research of Excitation Source in FDTD Method for Waveguide (Page 67) Xiaoliang Gu, University of Electronic Science and Technology of China Xiaolin Jin, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China

# Session 8: Gyrotrons

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Ran Yan, University of Electronic Science and Technology of China Yong Luo, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China Xiaoyi Liao, University of Electronic Science and Technology of China

8-5: Comparative Demonstration of Multimode Steady-state Theory for the Gyro-TWT based on a Distributed Loss-loaded Metal Cylindrical Waveguide (Page 73) Jirun Luo, Chinese Academy of Sciences & University of Chinese Academy of Sciences Yanna Tang, Chinese Academy of Sciences & University of Chinese Academy of Sciences Yu Fan, Chinese Academy of Sciences & University of Chinese Academy of Sciences Shuyuan Peng, China Academy of Electronics and Information Technology Qianzhong Xue, Chinese Academy of Sciences & University of Chinese Academy of Sciences

# **Poster Session 1**

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#### 1: TWT Poster II (SWS / other)

P1-1: 3-D Printed Ka-band Sine Waveguide Slow-Wave Structures (Page 75) Chong Ding, University of Electronic Science and Technology of China Yanyu Wei, University of Electronic Science and Technology of China Qian Li, University of Electronic Science and Technology of China Xia Lei, University of Electronic Science and Technology of China Shuangzhu Fang, University of Electronic Science and Technology of China Gangxiong Wu, University of Electronic Science and Technology of China Ruichao Yang, University of Electronic Science and Technology of China Jin Xu, University of Electronic Science and Technology of China Wenxiang Wang, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Dazhi Li, Institute for Laser Technology

#### P1-2: A VSWR Measurement System for High Power Devices in Working Mode (Page 77)

Tieyang Wang, China Electronic Product Reliability and Environmental Testing Research Institute Fangfang Song, China Electronic Product Reliability and Environmental Testing Research Institute Yunfei En, China Electronic Product Reliability and Environmental Testing Research Institute Feng Zou, Chinese Academy of Sciences

P1-3: Design and Cold test of a W-Band Coaxial Staggered Double-grating Slow-wave Structure (Page 79) Yu Fan, Chinese Academy of Sciences & University of Chinese Academy of Sciences Jirun Luo, Chinese Academy of Sciences & University of Chinese Academy of Sciences Yalin Liu, Chinese Academy of Sciences & University of Chinese Academy of Sciences Changqing Zhang, Chinese Academy of Sciences Ding Zhao, Chinese Academy of Sciences Fang Zhu, Chinese Academy of Sciences

#### P1-4: Study on the Ridge Loaded Azimuthal Supported Angular Log-Periodic Strip Meander Line Slow Wave

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#### P1-5. Investigation of Low Voltage Angular Log-periodic Folded Groove Waveguide Slow Wave Structure for G-

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- P1-6: Design of Folded Double-Ridged Waveguide Slow-Wave Structure (Page 85) Wenxin Zhang, Beijing Vacuum Electronics Research Institute Yanmei Wang, Beijing Vacuum Electronics Research Institute Bo Qu, Beijing Vacuum Electronics Research Institute
- P1-7: Quality & Reliability Managements During Production Process of Space TWTA (Page 87) Xiaoning Wang, China Academy of Aerospace Standardization and Product Assurance Xiaobao Su, Chinese Academy of Science Jinjing Wang, China Academy of Aerospace Standardization and Product Assurance

P1-10: Study on the Beam-wave Interaction in Sine Waveguide (Page 89) Xia Lei, University of Electronic Science and Technology of China Qian Li, University of Electronic Science and Technology of China Gangxiong Wu, University of Electronic Science and Technology of China Chong Ding, University of Electronic Science and Technology of China Yanyu Wei, University of Electronic Science and Technology of China Hairong Yin, University of Electronic Science and Technology of China Guo Guo, University of Electronic Science and Technology of China Guo Guo, University of Electronic Science and Technology of China Gunsik Park, Seoul National University

P1-11: Study of Dangling U-Shaped Slot-line Slow Wave Structure (Page 91) Ruichao Yang, University of Electronic Science & Technology of China Chong Ding, University of Electronic Science & Technology of China Lingna Yue, University of Electronic Science & Technology of China Jin Xu, University of Electronic Science & Technology of China Xuebing Jiang, University of Electronic Science & Technology of China Gangxiong Wu, University of Electronic Science & Technology of China Qian Li, University of Electronic Science & Technology of China Xia Lei, University of Electronic Science & Technology of China Shuanzhu Fang, University of Electronic Science & Technology of China Zhigang Lu, University of Electronic Science & Technology of China Guo Guo, University of Electronic Science & Technology of China Yinghui Liu, University of Electronic Science & Technology of China Xinjian Niu, University of Electronic Science & Technology of China Wenxiang Wang, University of Electronic Science & Technology of China Yubin Gong, University of Electronic Science & Technology of China Yanyu Wei, University of Electronic Science & Technology of China Jinjun Feng, Beijing Vacuum Electronics Research Institute Zhida Li, Institute for Laser Technology

- P1-12: Double-Zigzag Slow-Wave Structure for a Plane TWT (Page 93) Yuriy N. Pchelnikov, *Pchelnikov's Consulting*
- P1-13: Preliminary Study of Helix Arranged Coupling Slots in Coupled Cavity Structure (Page 95) Sairong Zhu, University of Electronic Science and Technology of China Yong Yin, University of Electronic Science and Technology of China Bin Wang, University of Electronic Science and Technology of China Hailong Li, University of Electronic Science and Technology of China Lin Meng, University of Electronic Science and Technology of China

### 2: Klystrons Posters

- **P2-1:** Study of a High Order Mode Extended Interaction Oscillator at W-Band (Page 97) Liangjie Bi, University of Electronic Science and Technology of China Yong Yin, University of Electronic Science and Technology of China Bin Wang, University of Electronic Science and Technology of China Hailong Li, University of Electronic Science and Technology of China Lin Meng, University of Electronic Science and Technology of China
- P2-2: Design and Test of a W-band Photonic Bandgap Extended Interaction Klystron Amplifier (Page 99) Jacob C Stephens, Massachusetts Institute of Technology John C Tucek, Northrop Grumman Systems Corp. Mark A Basten, Northrop Grumman Systems Corp Kenneth E Kreischer, Northrop Grumman Systems Corp Michael A Shapiro, Massachusetts Institute of Technology

Richard J Temkin, Massachusetts Institute of Technology P2-3: High Efficiency Klystron Design and Test Result in TETD (Page 101) Kenichiro Suzuki, Toshiba Electron Tubes & Devices Co., Ltd Toshifumi Tanaka, Toshiba Electron Tubes & Devices Co., Ltd Satoshi Fujii, Toshiba Electron Tubes & Devices Co., Ltd Yoshihisa Okubo, Toshiba Electron Tubes & Devices Co., Ltd Increased Efficiency of High-power Multiple-beam Klystrons Based on Optimization of the Output P2-4: Cavity (Page 103) Dmitry A. Komarov, JSC RPE "Toriy" Evgeny P. Yakushkin, JSC RPE "Toriy" Yury N. Paramonov, JSC RPE "Toriy" Sergey E. Sharkov, JSC RPE "Toriy" P2-5: The Design and Calculation of X-band Broadband CW Klystron (Page 105) Yaogen Ding, Chinese Academy of Sciences Ming Xue, Chinese Academy of Sciences Haibing Ding, Chinese Academy of Sciences Zhiqiang Zhang, Chinese Academy of Sciences P2-7: Feasibility Study of a THz Sheet Beam Extended Interaction Oscillator (Page 109) Che Xu, University of Electronic Science and Technology of China Bin Wang, University of Electronic Science and Technology of China Yong Yin, University of Electronic Science and Technology of China Liangjie Bi, University of Electronic Science and Technology of China Hailong Li, University of Electronic Science and Technology of China Lin Meng, University of Electronic Science and Technology of China P2-8: Design Studies for a 2 kW (CW) Power L/S Band Multi Beam Klystron (Page 111) Deepender Kant, CSIR-Central Electronics Engineering Research Institute Ayan Kumar Bandyopadhyay, CSIR-Central Electronics Engineering Research Institute Lalit Mohan Joshi, CSIR-Central Electronics Engineering Research Institute MV Kartikeyan, Indian Institute of Technology

Vijay Janyani, Malaviya National Institute of Technology

#### 3: TWT Poster I (Design)

P3-1: A Magnetic Focused Travelling Wave Tube Based on CNT Cathode (Page N/A) Xinghui Li, National Key Laboratory of Science and Technology on Vacuum Electronics Bo Chen, National Key Laboratory of Science and Technology on Vacuum Electronics Yuan Feng, National Key Laboratory of Science and Technology on Vacuum Electronics Jing Feng, National Key Laboratory of Science and Technology on Vacuum Electronics Yanjun Cui, National Key Laboratory of Science and Technology on Vacuum Electronics Jinjun Feng, National Key Laboratory of Science and Technology on Vacuum Electronics Jinjun Feng, National Key Laboratory of Science and Technology on Vacuum Electronics Fujiang Liao, National Key Laboratory of Science and Technology on Vacuum Electronics

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#### **P3-3:** Improvement Design of K-band 2x2 Channels Integrated TWTs (Page 115) Yuan Feng, National Key Laboratory of Science and Technology on Vacuum Electronics Pan Pan, National Key Laboratory of Science and Technology on Vacuum Electronics Jinjun Feng, National Key Laboratory of Science and Technology on Vacuum Electronics

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Xiaoxiao Li, University of Electronic Science and Technology of China Guo Liu, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China

#### P3-6: Effect of Unevenness of Electron Beam on SNR of TWT (Page 121) Hehong Fan, Southeast University Changsheng Shen, Southeast University Xiaohan Sun, Southeast University Haihua Gong, Beijing Vacuum Electronics Research Institute Jinjun Feng, Beijing Vacuum Electronics Research Institute

- **P3-7:** Lagrangian Large Signal Model for Double Corrugated Waveguide (Page 123) Robert Waring, *Lancaster University* Claudio Paoloni, *Lancaster University*
- P3-9: Performance Analysis for Segmented Multiple Support Rods Helix TWT Suppressing Thermal

Deformation (Page 127) Jinyan Wang, Southeast University Jin Zhang, Southeast University Suiren Wan, Southeast University Xiaohan Sun, Southeast University

#### P3-10: Study of Instabilities in a Double-staggered Waveguide Sheet Beam TWT (Page 129)

Hao Li, University of Electronic Science and Technology of China Jianxun Wang, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China Xiaoxiao Li, University of Electronic Science and Technology of China Yong Luo, University of Electronic Science and Technology of China

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Xinyi Li, University of Electronic Science and Technology of China Zhanliang Wang, University of Electronic Science and Technology of China Zijun Chen, University of Electronic Science and Technology of China Tenglong He, University of Electronic Science and Technology of China Hexin Wang, University of Electronic Science and Technology of China Lingna Yue, University of Electronic Science and Technology of China Tao Tang, University of Electronic Science and Technology of China Zhaoyun Duan, University of Electronic Science and Technology of China Yanyu Wei, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Jinjun Feng, Beijing Vacuum Electronics Research Institute

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Tenglong He, University of Electronic Science and Technology of China Xinyi Li, University of Electronic Science and Technology of China Duo Xu, University of Electronic Science and Technology of China Hexin Wang, University of Electronic Science and Technology of China Ningjie Shi, University of Electronic Science and Technology of China Zhanliang Wang, University of Electronic Science and Technology of China Lingna Yue, University of Electronic Science and Technology of China Tao Tang, University of Electronic Science and Technology of China Zhaoyun Duan, University of Electronic Science and Technology of China Zhaoyun Duan, University of Electronic Science and Technology of China Yanyu Wei, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Jinjun Feng, Vacuum Electronics National Laboratory Beijing Vacuum Electronics Research Institute

**P3-15:** Slow-Wave Structures with the Negative Inductive Coupling (Page 139) Yuriy N. Pchelnikov, *Pchelnikov's Consulting* 

# P3-16: Study for 850 GHz Sheet Beam Staggered Double-Vane Traveling Wave Tube Considering the Metal Loss (Page 141)

Wei Shao, University of Electronic Science and Technology of China Hanwen Tian, University of Electronic Science and Technology of China Zhanliang Wang, University of Electronic Science and Technology of China Zhigang Lu, University of Electronic Science and Technology of China Huarong Gong, University of Electronic Science and Technology of China Tao Tang, University of Electronic Science and Technology of China Zhaoyun Duan, University of Electronic Science and Technology of China Yanyu Wei, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Jinjun Feng, Beijing Vacuum Electronics Research Institute

#### P3-18: W-band Phase-velocity-taper Traveling Wave Tube Based on Sine Waveguide (Page 145)

Shuanzhu Fang, University of Electronic Science and Technology of China Xuebing Jiang, University of Electronic Science and Technology of China Xia Lei, University of Electronic Science and Technology of China Pengcheng Yin, University of Electronic Science and Technology of China Jin Xu, University of Electronic Science and Technology of China Guoqing Zhao, University of Electronic Science and Technology of China Wenxiang Wang, University of Electronic Science and Technology of China Jinjun Feng, Beijing Vacuum Electronics Research Institute Yubin Gong, University of Electronic Science and Technology of China Yanyu Wei, University of Electronic Science and Technology of China

P3-19: The Efficiency Optimization of the Sheet Beam ElO (Page 147) Xiaoxiao Li, University of Electronic Science and Technology of China Jianxun Wang, University of Electronic Science and Technology of China Qizhi Tian, University of Electronic Science and Technology of China Hao Li, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China

P3-20: Optimization of Intermodulation Distortion for a Ku-Band Helix TWT (Page 149) Hai-jian Qiu, University of Electronic Science and Technology of China Yu-lu Hu, University of Electronic Science and Technology of China Quan Hu, University of Electronic Science and Technology of China Xiao-Fang Zhu, University of Electronic Science and Technology of China Zhong-Hai Yang, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China

P3-21: Multi-color Terahertz Smith-Purcell Free-electron Laser Based on Frequency Mixing (Page 151) Linbo Liang, University of Science and Technology of China Weihao Liu, University of Science and Technology of China Qika Jia, University of Science and Technology of China Lin Wang, University of Science and Technology of China Yalin Lu, University of Science and Technology of China

P3-23: Optimization of Group Delay Distortion for a Ka-Band Coupled-Cavity TWT (Page 155) Xiao-yu Hao, University of Electronic Science and Technology of China Yu-lu Hu, University of Electronic Science and Technology of China Quan Hu, University of Electronic Science and Technology of China Xiao-fang Zhu, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China

P3-25: W-band TWT for High Capacity Transmission Hub for Small Cell Backhaul (Page 157) Frédéric André, Thales Electron Devices Quang Trung Le, HF Systems Engineering GmbH Giacomo Ulisse, Goethe University of Frankfurt Viktor Krozer, Goethe University of Frankfurt Rosa Letizia, Lancaster University Ralph Zimmerman, HF Systems Engineering GmbH Claudio Paoloni, Lancaster University

#### Session 9: MMW/Sub-mmw Microfabrication I

Chair: Jack Tucek, Northrop Grumman Corporation

Wednesday, April 25 / 10:30 AM-12:10 PM / San Carlos IV

 9-1: Session Keynote: Monolithically Integrated 140 GHz TWT Arrays (Page 159) Colin D. Joye, US Naval Reserach Laboratory Reginald L. Jaynes, US Naval Reserach Laboratory Jeffrey P. Calame, US Naval Reserach Laboratory John C. Rodgers, US Naval Reserach Laboratory Alan M. Cook, US Naval Reserach Laboratory Scooter D. Johnson, US Naval Reserach Laboratory Alexander T. Burke, Leidos Inc.

- **9-3:** The Enhanced THz Smith-Purcell Radiation from the Grating with Holes (Page 163) Ping Zhang, University of Electronic Science and Technology of China Yaxin Zhang, University of Electronic Science and Technology of China Minchun Tang, Chongqing University
- 9-4: The Sub-THz Clinotron-Multiplier (Page 165) Mihail V. Milcho, Institute for Radiophysics and Electronics of NAS of Ukraine Kostyantyn Ilyenko, Institute for Radiophysics and Electronics of NAS of Ukraine Viktor V. Zavertanniy, Institute for Radiophysics and Electronics of NAS of Ukraine Tetyana Yatsenko, Institute for Radiophysics and Electronics of NAS of Ukraine Anatoly S. Tishchenko, Institute for Radiophysics and Electronics of NAS of Ukraine
- 9-5: Investigation of a THz CW Band-edge Oscillator (Page 167) Jun Cai, National Key Laboratory of Science and Technology on Vacuum Electronics Yinghua Du, National Key Laboratory of Science and Technology on Vacuum Electronics Qingmei Xie, National Key Laboratory of Science and Technology on Vacuum Electronics Xiaoqing Zhang, National Key Laboratory of Science and Technology on Vacuum Electronics Xianping Wu, National Key Laboratory of Science and Technology on Vacuum Electronics Jinjun Feng, National Key Laboratory of Science and Technology on Vacuum Electronics

# Session 10: TWT Design/Modeling

Chair: Claudio Paoloni, Lancaster University

#### Wednesday, April 25 / 10:30 AM-12:30 PM / San Carlos III

**10-1: Back-Off Efficiency Optimization of Traveling-Wave Tubes using Simulated Annealing** (Page 169)

Djamschid Safi, Technische Universität Hamburg-Harburg Philip Birtel, Thales Electronic Systems GmbH Michael Wulff, Technische Universität Hamburg-Harburg Sascha Meyne, Technische Universität Hamburg-Harburg Arne F. Jacob, Technische Universität Hamburg-Harburg

10-2: On Johnson's Backward Wave Oscillation Thresholds in a TWT (Page 171)

Abhijit Jassem, University of Michigan
Patrick Y. Wong, University of Michigan
David P. Chernin, Leidos, Inc.
Y. Y. Lau, University of Michigan
Foivos Antoulinakis, University of Michigan
Thomas A. Hargreaves, L3 Technologies
Carter M. Armstrong, L3 Technologies

10-3: Prediction and Measurement of Return Loss in Helix Output Circuits (Page 173)

Mark Perrin, Communications & Power Industries LLC Jeff Li, Communication & Power Industries LLC Benson Sit, Communication & Power Industries LLC Merritt Chesnut, Communication & Power Industries LLC Nileshwar Chaudhary, Communication & Power Industries LLC Ognian Sabev, Communication & Power Industries LLC Alex Plant, Communication & Power Industries LLC Rasheda Begum, Communications & Power Industries LLC Galen Aymar, Communications & Power Industries LLC Kevin Mallon, Communications & Power Industries LCC Tom Grant, Communications & Power Industries LCC

# 10-4: A Multistage Depressed Collectors Design Tool for Traveling Wave Tubes Based on Non-

dominated Sorting Genetic Algorithm II (Page 175) Tao Huang, University of Electronic Science and Technology of China Qiufeng Cao, University of Electronic Science and Technology of China Jia Liu, University of Electronic Science and Technology of China Dapeng Gong, University of Electronic Science and Technology of China Shifeng Li, University of Electronic Science and Technology of China Zhonghai Yang, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China

 10-5: Origin of Second Harmonic Signals in Octave Bandwidth Traveling-Wave Tubes (Page 177) Patrick Y. Wong, University of Michigan Y. Y. Lau, University of Michigan Brad W. Hoff, Air Force Research Laboratory Ronald M. Gilgenbach, University of Michigan

# 10-6: Re-examination of Absolute Instability Near Band Edges in a Traveling Wave Tube (Page 179)

Foivos Antoulinakis, University of Michigan Patrick Wong, University of Michigan Abhijit Jassem, University of Michigan Y. Y. Lau, University of Michigan

#### Session 11: Klystrons II

Chair: Yaogen Ding, Institute of Electronics, Chinese Academy of Sciences

Wednesday, April 25 / 1:30-3:10 PM / San Carlos IV

#### 11-1: Session Keynote: Miniature Klystron for CubeSats (Page 181)

Bernard Vancil, *e beam, inc.* Charles Osborne, *e beam, inc.* Malcolm Caplan, *Consultant* Danilo Radovich, *Consultant* 

#### 11-2: Low Voltage Ultra-Compact W-band Klystron (Page 183)

Ann Sy, SLAC Yuan Zheng, University of California, Davis Brandon Weatherford, SLAC Erik Jongewaard, SLAC Jeff Neilson, SLAC Neville C. Luhmann, Jr., University of California, Davis Diana Gamzina, SLAC

#### 11-3: Improvement of Output Power in G-band EIK with Optimized and Tapering Gap Length (Page 185)

Renjie Li, *Beihang University* Cunjun Ruan, *Beihang University* Huafeng Zhang, *Beihang University* Yanbin He, *Beihang University* Shengyu Shan, *Beihang University* 

#### 11-4: Design of a Ka-band CW Extended Interaction Klystron (Page 187)

Haibing Ding, Chinese Academy of Sciences Liang Tang, Chinese Academy of Sciences Yihao Song, University of Chinese Academy of Sciences Ying Wang, Chinese Academy of Sciences Ke Tang, Chinese Academy of Sciences Yaogen Ding, Chinese Academy of Sciences

# 11-5: Circuit Design and Simulation of a 220-GHz 100-W Extended Interaction Klystron (Page 189)

Zhaowei Qu, Chinese Academy of Sciences Zhiqiang Zhang, Chinese Academy of Sciences Yaogen Ding, Chinese Academy of Sciences Shuzhong Wang, Chinese Academy of Sciences Qingsheng Li, Chinese Academy of Sciences

# Session 12: Cold Cathodes

Chair: Joan Yater, Institute of Electronics, Naval Research Laboratory

Wednesday, April 25 / 1:30-3:10 PM / San Carlos III

12-1: Field Emission from Gated Planar Graphene Edges (Page 191) Jonathan L. Shaw, Naval Research Lab
J. Brad Boos, KeyW Corporation
Byoung-Don Kong, Pohang University
Jeremy T. Robinson, Naval Research Lab

- 12-3: Engineering the Field Enhancement Factor and Work Function toward Ultra-Low Threshold Field Electron Emitter (Page 193) Fatemeh Rezaeifar, University of Southern California Rehan Kapadia, University of Southern California
- **12-4:** Integrated Waveguide Assisted Electron Emission Device (Page 195) Fatemeh Rezaeifar, University of Southern California Rehan Kapadia, University of Southern California
- 12-5: Characterization of Field Emission from Carbon Nanotube Fibers in Varying Cathode-Anode Gaps (Page

197)
Peng Zhang, Michigan State University
S. B. Fairchild, Air Force Research Laboratory
T. C. Back, Air Force Research Laboratory
Yi Luo, Michigan State University

# Poster Session 2

Wednesday, April 25 / 01:30-5:30 PM / San Carlos I+II

# 4: Power Supplies and Tube Sub-Systems Posters

- P4-1: Study on Ka-band Broadband Mode Converter for gyro-TWT (Page 199) Xu Zeng, Beijing Vacuum Electronics Research Institute Efeng Wang, Beijing Vacuum Electronics Research Institute Jun Cai, Beijing Vacuum Electronics Research Institute Jinjun Feng, Beijing Vacuum Electronics Research Institute
- P4-2: Dual Band and Dual Mode Overmode Waveguide Bend (Page 201) Xiaoyi Liao, University of Electronic Science and Technology of China Zewei Wu, University of Electronic Science and Technology of China Jianxun Wang, University of Electronic Science and Technology of China Guo Liu, University of Electronic Science and Technology of China Xiaotong Guan, University of Electronic Science and Technology of China Yong Luo, University of Electronic Science and Technology of China
- P4-4: Design of a Compact and Broadband 90-degree Waveguide Twist (Page 203) Miao Sun, University of Electronic Science and Technology of China Yong Xu, University of Electronic Science and Technology of China Tinghui Peng, University of Electronic Science and Technology of China Yanfen Shang, University of Electronic Science and Technology of China Qiang Zhen, University of Electronic Science and Technology of China
- P4-5: Design of a Wide Bandwidth Dielectric Loading Directional Coupler for Gyro-TWT (Page 205) Yang Li, University of Electronic Science and Technology of China Yong Xu, University of Electronic Science and Technology of China Miao Sun, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China
- P4-6: Study of a 90-degree TE01-TM11 Oversized Mode Converter (Page 207) Zewei Wu, University of Electronic Science and Technology of China Xiaoyi Liao, University of Electronic Science and Technology of China Jianxun Wang, University of Electronic Science and Technology of China Guo Liu, University of Electronic Science and Technology of China Xiaotong Guan, University of Electronic Science and Technology of China Yong Luo, University of Electronic Science and Technology of China

P4-7: Mutual Coupling Reduction in Patch Antenna Arrays (Page 209) Qian Li, University of Electronic Science and Technology of China Chong Ding, University of Electronic Science and Technology of China Xia Lei, University of Electronic Science and Technology of China Gangxiong Wu, University of Electronic Science and Technology of China Ruichao Yang, University of Electronic Science and Technology of China Minzhi Huang, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Zhigang Lu, University of Electronic Science and Technology of China Zhanliang Wang, University of Electronic Science and Technology of China Hairong Yin, University of Electronic Science and Technology of China Hairong Yin, University of Electronic Science and Technology of China Yubin Gung, University of Electronic Science and Technology of China

- P4-8: Permanent Magnet Focusing System for MM Waveband Magnetron with Axial Cathode Support (Page 211) Tetyana Yatsenko, Institute for Radiophysics and Electronics of NAS of Ukraine Viktor V. Zavertanniy, Institute for Radiophysics and Electronics of NAS of Ukraine Kostyantyn Ilyenko, Institute for Radiophysics and Electronics of NAS of Ukraine
- P4-9: Estimating Internal Heat Flux Distribution of TWT Collector Based on GA-BP Neural Network Model (Page 213) Xingqun Zhao, Southeast University Xiaoting Ying, Southeast University Xiaohan Sun, Southeast University

P4-10: Solid-state Grid Modulator for Power Vacuum Microwave Devices (Page 215) Sergey P. Maslennikov, NRNU MEPhI Yury N. Paramonov, JSC RPE "Toriy" Aleksandra S. Serebryakova, JSC RPE "Toriy"

#### P4-11: Development of a Pulsed TWTA EPC (Page 217) Gang Wang, Chinese Academy of Sciences & University of Chinese Academy of Sciences Yu Chen, Chinese Academy of Sciences Donglei Wang, Chinese Academy of Sciences Chunyu Xu, Chinese Academy of Sciences Yalin Liu, Chinese Academy of Sciences & University of Chinese Academy of Sciences

P4-14: Preliminary Study on Measurement of Output Hot-VSWR in Traveling Wave Tubes (Page 221) Dapeng Gong, University of Electronic Science and Technology of China Tao Huang, University of Electronic Science and Technology of China Jianqing Li, University of Electronic Science and Technology of China Shifeng Li, University of Electronic Science and Technology of China Lizheng Zhao, University of Electronic Science and Technology of China Jie Zhang, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China

#### 5: Thermionic and Scandate Cathodes Posters

P5-1:	New Development in Plasma-sprayed Oxide Cathode Research (Page 223) Min Zhang, Beijing Vacuum Electronics Research Institute Senlin Ke, Beijing Vacuum Electronics Research Institute Yujuan Gao, Beijing Vacuum Electronics Research Institute Haiyan Ren, Beijing Vacuum Electronics Research Institute Wensheng Shao, Beijing Vacuum Electronics Research Institute
P5-2:	M-Type Dispenser Cathode Accelerated Life Testing Within a Pierce Gun Configuration (Page 225) Ognian M. Sabev, <i>Communications and Power Industries</i> Thomas J. Grant, <i>Communications and Power Industries</i>
P5-4:	Scandate Cathode Work Function Measurements at Elevated Temperature (Page 229) Tyler L. Maxwell, University of Kentucky Xiaotao Liu, University of Kentucky Qunfei Zhou, University of Kentucky Matthew J. Beck, University of Kentucky T. John Balk, University of Kentucky Bernard K. Vancil, e beam Inc.
P5-5:	Effects of Scandia Distribution on Surface Structure of Scandate Cathodes (Page 231) Xiaomeng Zhang, University of Kentucky T. John Balk, University of Kentucky Daniel Busbaher, Ceradyne, Inc. Andrew Hunt, nGimat LLC
P5-6:	Characterization of Scandate Cathode at Different Stages of Processing (Page 233) Xiaotao Liu, University of Kentucky Tyler Maxwell, University of Kentucky Qunfei Zhou, University of Kentucky Matthew J. Beck, University of Kentucky T. John Balk, University of Kentucky Bernard Vancil, e beam Inc.
P5-7:	<b>The Effect of Scandia Doping on the Structure and Electron Emission Capacity of the 512 Aluminate</b> (Page 235) Yafen Shang, <i>University of Electronic Science and Technology of China</i> Fengting Luo, <i>University of Electronic Science and Technology of China</i> Jian Fang, <i>University of Electronic Science and Technology of China</i> Qiang Zheng, <i>University of Electronic Science and Technology of China</i> Hao Fu, <i>University of Electronic Science and Technology of China</i> Yong Luo, <i>University of Electronic Science and Technology of China</i> Yong Luo, <i>University of Electronic Science and Technology of China</i>
P5-8:	An Investigation on the Phase Composition and the Electron Emission Capacity of the Aluminate

Impregnants for the Dispenser Cathodes (Page 237) Qiang Zheng, University of Electronic Science and Technology of China Jian Fang, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China Yaping Shen, University of Electronic Science and Technology of China Hao Fu, University of Electronic Science and Technology of China Yong Luo, University of Electronic Science and Technology of China

#### P5-10: Emission Micro-observation of Dispenser Cathode Via DUV-PEEM/TEEM (Page 241) Feng Ren, Chinese Academy of Sciences & University of Chinese Academy of Sciences Shengyi Yin, Chinese Academy of Sciences Zhipeng Lu, Chinese Academy of Sciences & University of Chinese Academy of Sciences

#### Session 13: High Power Microwaves - II

Chair: Eunmi Choi, UNIST

#### Wednesday, April 25 / 3:30-5:30 PM / San Carlos III

- 13-2: Millimeter Wave Overmoded Relativistic Backward Wave Oscillator (Page 243) Ahmed Elfrgani, University of New Mexico Artem Kuskov, University of New Mexico Mikhail I. Fuks, University of New Mexico Edl Schamiloglu, University of New Mexico
- **13-3:** Development of a 2450 MHz, 50 kW CW Klystron (Page 245) Claudio Motta, University of Sao Paulo Daniel Lopes, University of Sao Paulo Jiro Takahashi, University of Sao Paulo

#### **Session 14: Magnetrons and Gyrotrons**

Chair: Stephen Cauffman, CPI MPPD

#### Thursday, April 26 / 8:30-10:10 AM / San Carlos IV

- 14-1: A 100 kW 1.3 GHz Phase Locked Magnetron for Accelerators (Page 249) Michael Read, Calabazas Creek Research, Inc.
  R. Lawrence Ives, Calabazas Creek Research, Inc.
  Thuc Bui, Calabazas Creek Research, Inc.
  George Collins, Calabazas Creek Research, Inc.
  Brian Chase, Fermi National Accelerator Laboratory
  John Reid, Fermi National Accelerator Laboratory
  - Chris Walker, Communications and Power Industries LLC Jeff Conant. Communications and Power Industries LLC
- 14-2: Experimental Study on Frequency Modulation of an Injection-Locked Magnetron Based on Full
  - Wave Voltage Doubler (Page 251) Bo Yang, Kyoto University Tomohiko Mitani, Kyoto University Naoki Shinohara, Kyoto University
- 14-3: Harmonic-Frequency Locking in Planar Magnetrons (Page 253)

Drew A. Packard, University of Michigan Geoffrey B. Greening, University of Michigan Nicholas M. Jordan, University of Michigan Steven C. Exelby, University of Michigan Patrick Y. Wong, University of Michigan Y. Y. Lau, University of Michigan Ronald M. Gilgenbach, University of Michigan Brad W. Hoff, Air Force Research Lab Jason F. Hammond, Air Force Research Lab

#### 14-4: Simulating Magnetrons with VSim (Page 255) Diana M. Cheatham, *Tech-X Corporation* David N. Smithe, *Tech-X Corporation* Nicholas A. Roberds, *Tech-X Corporation* John R. Cary, *Tech-X Corporation*

### Session 15 :G-Band / THz TWTs

Chair: Jinjun Feng, Beijing Vacuum Electronics Research Institute

#### Thursday, April 26 / 8:30-10:10 AM / San Carlos III

**15-2:** Narrowband THz Generation by Ultra-Relativistic Beam (Page 259) Dan Wang, *Tsinghua University*  Sergey Antipov, Euclid Techlabs LLC Xiaolu Su, Tsinghua University YingChao Du, Tsinghua University Qili Tian, Tsinghua University Yifan Liang, Tsinghua University Lujia Niu, Tsinghua University Wenhui Huang, Tsinghua University Wei Gai, Tsinghua University Chuanxiang Tang, Tsinghua University Lixin Yan, Tsinghua University

**15-3:** Performance Estimate of a Low-THz Helical Groove-Guide TWT (Page 261) Heino Henke, *Technische Universität Berlin* Markus Jäger, *Technische Universität Berlin* 

# **Poster Session 3**

Thursday, April 26 / 8:30 AM-12:30 PM / San Carlos I+II

#### 6: High Power Microwave Posters

P6-1: Rising Sun Magnetron with Diffraction Output (Page 263) Emil Szkop, KUBARA LAMINA S.A. Martyna Wozniak, KUBARA LAMINA S.A. Michal Rychlewski, KUBARA LAMINA S.A. Andrzej Rózycki, KUBARA LAMINA S.A. Dariusz Baczewski, KUBARA LAMINA S.A. Mariusz Blazejewicz, KUBARA LAMINA S.A. Dariusz Laskowski, Military University of Technology Roman Kubacki, Military University of Technology

P6-4: Researching on the Wideband Elliptical-section TE01-TE11 Mode Converter (Page 269)

Keqiang Wang, University of Electronic Science and Technology of China Hao Li, University of Electronic Science and Technology of China Yong Luo, University of Electronic Science and Technology of China Tianming Li, University of Electronic Science and Technology of China Haiyang Wang, University of Electronic Science and Technology of China Biao Hu, University of Electronic Science and Technology of China Yihong Zhou, University of Electronic Science and Technology of China Jianing Zhao, University of Electronic Science and Technology of China

P6-7: MAGIC Simulation of Microwave Generation Using an Active Metamaterial Powered by an Electron

Beam (Page 273) Meiqin Liu, University of New Mexico & Xi'an Jiaotong University Chunliang Liu, Xi'an Jiaotong University Mikhail I. Fuks, University of New Mexico Edl Schamiloglu, University of New Mexico

P6-9: Analysis of High-order Mode Self-oscillation in an Oversized Coaxial Relativistic Klystron Amplifier at Ka Band (Page 277)

 Shifeng Li, University of Electronic Science and Technology of China & China Academy of Engineering Physics Zhaoyun Duan, University of Electronic Science and Technology of China Hua Huang, China Academy of Engineering Physics Zhenbang Liu, China Academy of Engineering Physics Fei Wang, University of Electronic Science and Technology of China Xin Wang, University of Electronic Science and Technology of China Zhanliang Wang, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China
 P6-10: Regularities and Mechanisms of Development of Instabilities in the System with Intense Relativistic Electron Beam (Page 279) Semen Kurkin, Saratov State University & Yuri Gagarin State Technical University of Saratov Artem Badarin, Saratov State University & Yuri Gagarin State Technical University of Saratov

Nikita Frolov, Saratov State University & Yuri Gagarin State Technical University of Saratov Alexey Koronovskii, Saratov State University

Alexander Hramov, Saratov State University & Yuri Gagarin State Technical University of Saratov

P7-1:	Relativistic Magnetron with Diffraction Output (MDO) with a Permanent Magnet Anode Block Configuration (Page 281) Artem Kuskov, <i>University of New Mexico</i> Ahmed Elfrgani, <i>University of New Mexico</i> Edl Schamiloglu, <i>University of New Mexico</i>
P7-4:	Research on Eigenvalues of TM Modes in Coaxial Resonator with Inner-Outer Corrugations (Page 285) Zhipeng Wang, University of Electronic Science and Technology Sheng Yu, University of Electronic Science and Technology Qiao Li, University of Electronic Science and Technology Rutai Chen, University of Electronic Science and Technology Wenjin Huang, University of Electronic Science and Technology
P7-5:	Design Collector for High Average-power/CW Gyro-devices (1) - Methods of Raising Dissipated Power Density (Page 287) Di Wang, University of Electronic Science and Technology of China Ran Yan, University of Electronic Science and Technology of China Xiaoyi Liao, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China
P7-8:	Influence of Residual Gas Ionization on Interaction for High Average Power Gyro-TWT (Page 293) Yuanyuan Lian, University of Electronic Science and Technology of China Ran Yan, University of Electronic Science and Technology of China Xiaoyi Liao, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China Yong Luo, University of Electronic Science and Technology of China
P7-10:	Design of High Power Average Gyro-TWT Collector(2) - Maximizing the Collection Area and Improving the Collection Uniformity (Page 295) Minhang Mu, University of Electronic Science and Technology of China Ran Yan, University of Electronic Science and Technology of China Xiaoyi Liao, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China
P7-12:	Experimnents on a 140GHz TE22, 6-mode Gyrotron (Page 299) Bentian Liu, <i>Beijing Vacuum Electronics Research Institute</i> Jinjun Feng, <i>Beijing Vacuum Electronics Research Institute</i> Yang Zhang, <i>Beijing Vacuum Electronics Research Institute</i> Yichi Zhang, <i>Beijing Vacuum Electronics Research Institute</i> Zhiliang Li, <i>Beijing Vacuum Electronics Research Institute</i> Xu Zeng, <i>Beijing Vacuum Electronics Research Institute</i> Kang An, <i>Beijing Vacuum Electronics Research Institute</i>
P7-13:	Investigation on a Frequency Tunable Megawatt-Class Gyrotron at 0.24 THz (Page 301) Qiao Liu, University of Electronic Science and Technology of China Yinghui Liu, University of Electronic Science and Technology of China Xinjian Niu, University of Electronic Science and Technology of China Hui Wang, University of Electronic Science and Technology of China Jianwei Liu, University of Electronic Science and Technology of China Guo Guo, University of Electronic Science and Technology of China Jianhua Xu, University of Electronic Science and Technology of China

- P7-14: Design of Interaction Cavity of a 263GHz Gyrotron Oscillator for DNP-NMR (Page 303) Zhiliang Li, *Beijing Vacuum Electronics Research Institute* Jinjun Feng, *Beijing Vacuum Electronics Research Institute* Bentian Liu, *Beijing Vacuum Electronics Research Institute*
- P7-15: A Novel Terahertz Harmonic Gyrotron with Dual Confocal Cavity (Page 305) Xiaotong Guan, University of Electronic Science and Technology of China Wenjie Fu, University of Electronic Science and Technology of China Dun Lu, University of Electronic Science and Technology of China Tongbin Yang, University of Electronic Science and Technology of China Yang Yan, University of Electronic Science and Technology of China
- P7-16: Design Studies of a Magnetron Injection Gun for a 2MW, Multi-frequency (220/251.5/283 GHz) Triangular Corrugated Coaxial Cavity Gyrotron (Page 307)

S. Yuvaraj, Indian Institute of Technology Roorkee Delphine Alphonsa Jose, Indian Institute of Technology Roorkee Madan Singh Chauhan, Indian Institute of Technology Roorkee M. V. Kartikeyan, Indian Institute of Technology Roorkee Stefan Illy, Karlsruhe Institute of Technology (KIT) Manfred K. Thumm, Karlsruhe Institute of Technology (KIT) P7-17: Design and Simulation of Quasi-optical Mode Generator for a W-band Gyrotron (Page 309) ZhiHui Geng, Chinese Academy of Sciences P7-18: Thermal-hydraulic Design and Analysis for High Power Gyro-TWT Collector (Page 311) Yaping Shen, University of Electronic Science and Technology of China Wei Jiang, University of Electronic Science and Technology of China Qiang Zheng, University of Electronic Science and Technology of China Yafen Shang, University of Electronic Science and Technology of China Xiaoyi Liao, University of Electronic Science and Technology of China Hao Fu, University of Electronic Science and Technology of China P7-19: Study on Radiation Field of Gyrotron Quasi-optical Launcher (Page 313) Guo-Hui Zhao, University of Chinese Academy of Sciences & Chinese Academy of Sciences Qian-Zhong Xue, University of Chinese Academy of Sciences & Chinese Academy of Sciences Yong Wang, University of Chinese Academy of Sciences & Chinese Academy of Sciences

# Session 16: Power Supplies and Tube Sub-SystemsThursday, April 26 / 10:30 AM-<br/>12:10 PM / San Carlos IVChair: Yehuda Goren, Teledyne Electronic Technologies12:10 PM / San Carlos IV

16-4:	Daresbury Laboratory Short Pulse Klystron Modulators (Page 315)
	Christopher Chipman, Diversified Technologies, Inc.
	Marcel Gaudreau, Diversified Technologies, Inc.
	Luan Jashari, Diversified Technologies, Inc.
	John Kinross-Wright, Diversified Technologies, Inc.
	Michael Kempkes, Diversified Technologies, Inc.
	Rebecca Simpson, Diversified Technologies, Inc.
	Alan Wheelhouse, Science & Technology Facilities Council (STFC)
	Stephen Griffiths, Science & Technology Facilities Council (STFC)
16-5	Solid-State Thyratron Replacement (Page 317)
	Ian Roth, Diversified Technologies, Inc.
	Margal Gaudroon Diversified Technologies Inc

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Marcel Gaudreau, *Diversified Technologies, Inc.* Neal Butler, *Diversified Technologies, Inc.* Michael Kempkes, *Diversified Technologies, Inc.* Rebecca Simpson, *Diversified Technologies, Inc.* 

#### Session 17: Scandate Cathodes

Chair: Jinshu Wang, Beijing University of Technology

Thursday, April 26 / 10:30 AM-12:30 PM / San Carlos III

17-2: Improvements in Scandate Powder Synthesis (Page 321) Bernard Vancil, *e beam, inc.* Charles Osborne, *e beam, inc.* Allen Vancil, *e beam, inc.* Wayne Ohlinger, *Consultant* Michael Green, *Consultant* Ivor Brodie, *Consultant*

# 17-3: Analysis of Faceted Tungsten Grains on the Surfaces of Scandate Cathodes Fabricated from L-S and L-

L Powders (Page 323) Xiaotao Liu, University of Kentucky Qunfei Zhou, University of Kentucky Tyler Maxwell, University of Kentucky T. John Balk, University of Kentucky Bernard Vancil, e beam Inc. Matthew J. Beck, University of Kentucky

17-4: Mapping Conditions for the Formation of High-Performance Scandate Cathodes: New Insights into the

Role of Sc (Page 325) Qunfei Zhou, University of Kentucky Xiaotao Liu, University of Kentucky Tyler Maxwell, University of Kentucky T. John Balk, *University of Kentucky* Matthew J. Beck, *University of Kentucky* Bernard Vancil, *e beam Inc.* 

# 17-5: Low Energy Electron Microscopy Observation of De-wetting of Scandium on W(100), W(110) and

W(111) (Page 327) Michael Mroz, *Ohio University* Samuel Tenney, *Brookhaven National Laboratory* Martin E. Kordesch, *Ohio University* 

#### 17-6: Materials Characterization of Surface Phases in Scandate Cathodes (Page 329)

T. John Balk, University of Kentucky Xiaotao Liu, University of Kentucky Qunfei Zhou, University of Kentucky Tyler Maxwell, University of Kentucky Matthew J. Beck, University of Kentucky Bernard Vancil, e beam, inc

# Session 18: MMW/Sub-mmw Microfabrication II

Chair: Colin Joye, Naval Research Laboratory

Thursday, April 26 / 1:30-3:10 PM / San Carlos IV

18-1: Session Keynote: W-band TWT Circuit Fabricated by 3D-Printed Mold Electroforming (Page 331)

Alan M. Cook, U. S. Naval Research Laboratory Colin D. Joye, U. S. Naval Research Laboratory Reginald L. Jaynes, U. S. Naval Research Laboratory Jeffrey P. Calame, U. S. Naval Research Laboratory

18-4: Effect of Fabrication Tolerance on 0.346 THz Double Corrugated Waveguide for Backward

Wave Oscillators (Page 335)
Xiang Li, Lancaster University
Diana Gamzina, SLAC National Accelerator Laboratory
Rosa Letizia, Lancaster University
Michelle Gonzales, University of California, Davis
Ye Tang, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Yuan Zheng, University of California, Davis
Branko Popovic, University of California, Davis
Logan Himes, University of California, Davis
Robert Barchfeld, University of California, Davis
Hanyan Li, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Pan Pan, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Jinjun Feng, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Jinjun Feng, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Jinjun Feng, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Jinjun Feng, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Jinjun Feng, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Jinjun Feng, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Jinjun Feng, Beijing Vacuum Electronic Research Institute and Vacuum Electronics National Lab
Vacuum Electronic Research Institute and Vacuum Electronics National Lab

**18-5:** Simulation and Cold Test of 220GHz Staggered Double Vane Slow Wave Structure (Page 337) Hanwen Tian, University of Electronic Science and Technology of China Wei Shao, University of Electronic Science and Technology of China Zhanliang Wang, University of Electronic Science and Technology of China Tao Tang, University of Electronic Science and Technology of China Zhigang Lu, University of Electronic Science and Technology of China Huarong Gong, University of Electronic Science and Technology of China Zhaoyun Duan, University of Electronic Science and Technology of China Yanyu Wei, University of Electronic Science and Technology of China Yubin Gong, University of Electronic Science and Technology of China Jinjun Feng, Beijing Vacuum Electronics Research Institute

#### Session 19: TWTs II

Chair: Philippe Thouvenin, Thales Electron Devices

Thursday, April 26 / 1:30-3:10 PM / San Carlos III

- **19-1:** Fabrication and Cold-test of a Wideband Ka-Band Dielectric-Loaded Traveling-Wave Tube (Page 339) Muhammed Zuboraj, Los Alamos National Laboratory William Romero, Los Alamos National Laboratory Frank Fierro, Los Alamos National Laboratory
  - Frank Fierro, *Los Alamos National Laboratory* Evgenya Simakov, *Los Alamos National Laboratory* Bruce Carlsten, *Los Alamos National Laboratory*

19-2:	Impacts of an Embedded FiberInside a Helix TWT on Its Performance (Page 341) Jin Zhang, Southeast University Jinyan Wang, Southeast University Xiaohan Sun, Southeast University Baoliang Hao, Beijing Vacuum Electronics Research Institute Lei Zhang, Beijing Vacuum Electronics Research Institute Yanmei Wang, Beijing Vacuum Electronics Research Institute Jinjun Feng, Beijing Vacuum Electronics Research Institute
19-3:	Transmission Characteristics of Planar Tape-Helix: Simulation and Measurements (Page 343) Ajith Kumar M M, Nanyang Technological University Sheel Aditya, Nanyang Technological University Chen Zhao, Nanyang Technological University
19-4:	High Frequency Characteristics of a Metamaterial Slow Wave Structure (Page 345)Xin Wang, University of Electronic Science and Technology of ChinaZhaoyun Duan, University of Electronic Science and Technology of ChinaFei Wang, University of Electronic Science and Technology of ChinaShifeng Li, University of Electronic Science and Technology of ChinaShengkun Jiang, University of Electronic Science and Technology of ChinaLeidong Jin, University of Electronic Science and Technology of ChinaZhanliang Wang, University of Electronic Science and Technology of ChinaYanyu Wei, University of Electronic Science and Technology of ChinaYubin Gong, University of Electronic Science and Technology of China
19-5:	<b>Folded Waveguide Traveling Wave Tube in a Parallel Configuration with a Single Electron Beam</b> (Page 347) Giacomo Ulisse, <i>Goethe University of Frankfurt</i> Viktor Krozer, <i>Goethe University of Frankfurt</i>

# **Poster Session 4**

Thursday, April 26 / 1:30-5:30 PM / San Carlos I+II

# 8: Materials, Guns, Manufacturing Posters

P8-2:	Correlation between Growth Mechanism of Microcrystalline Diamond-Ultrananocrystalline Diamond
	Composite and Mechanical Properties of Its Thin THz TWT Windows (Page 349)
	Ming Q Ding, Beijing Vacuum Electronics Research Institute
	Lili Li, Beijing Vacuum Electronics Research Institute
	Yinghua Du, Beijing Vacuum Electronics Research Institute
	Lin Chen, Beijing Vacuum Electronics Research Institute
	Jun Cai Beijing Vacuum Electronics Research Institute
	Jinjun Feng, Beijing Vacuum Electronics Research Institute
P8-5:	<b>Design of the Planar Distributed Three-Beam Gun for W-band Staggered Double Vane TWT</b> (Page 353) Zhang Huafeng, <i>Beihang University</i> Ruan Cunjun, <i>Beihang University</i>
P8-8:	Energy Distribution of Electrons from cathode in Magnetron Injection Gun (Page 357)
	Alok Mishra, CSIR-Central Electronics Engineering Research Institute
	M. V. Kartikeyan, Indian Institute of Technology Roorkee
	A. K. Sinha, CSIR-Central Electronics Engineering Research Institute
	A. Bera, CSIR-Central Electronics Engineering Research Institute
P8-9:	The Phase-space Volume Effect on the Electron Beam Forming in the EOS of Ka-band Devices with a High
	Aspect Ratio Field-emission Cathode (Page 359)
	Yury N. Paranomov, JSC RPE "Toriy"
	Selgey F. Molev, JSC RFE Toriv" Eduard K. Muraviev, ISC RPF "Toriv"
	Alexander N. Darmaey, JSC RPE "Toriy"
	Dmitry A. Komarov, JSC RPE "Toriy"
	Vasily I. Shesterkin, JSC RPE "Almaz"
	Tatyana N. Sokolova, JSC RPE "Almaz"
	Dmitry A. Bessonov, JSC RPE "Almaz"
P8-14:	Development of Electron-optical System with Convergent Sheet Beam for Terahertz TWT (Page 367)

Anton A. Burtsev, Yuri Gagarin State Technical University of Saratov Aleksei V. Danilushkin, Yuri Gagarin State Technical University of Saratov Igor A. Navrotsky, Yuri Gagarin State Technical University of Saratov George V. Sakhadzhi, JSC NPP "Almaz" Kirill V. Shumikhin, JSC NPP "Almaz"

#### 9: Modeling Posters

P9-1: MICHELLE Simulation and Performance Using Domain Decomposition (Page 369)

Aaron Jensen, Leidos Corporation Alex Burke, Leidos Corporation John Petillo, Leidos Corporation Serguei Ovtchinnikov, Leidos Corporation Eric Nelson, Leidos Corporation George Stantchev, US Naval Research Lab Simon Cooke, US Naval Research Lab Ben Held, National Instruments Alan Nichols, National Instruments

P9-2: MICHELLE Post Processing for Large Scale Problems and HPC Environments using ParaView with a

Custom GUI Interface (Page 371) Alex Burke, Leidos Corporation John Petillo, Leidos Corporation Serguei Ovtchinnikov, Leidos Corporation Aaron Jensen, Leidos Corporation Erik Nelson, Leidos Corporation George Stantchev, US Naval Research Laboratory Simon Cooke, US Naval Research Laboratory Ben Held, National Instruments Alan Nichols, National Instruments

- **P9-3:** Experimental Particle-In-Cell Simulation of Positive Ion Influence on Vacuum Diode (Page N/A) Shih-Chung Tuan, Oriental Institute of Technology Shen Shou Max Chung, Air Force Institute of Technology
- P9-4: Scattering Parameter Simulation of Microwave Window with Conformal FDTD Method (Page 373) Xiaolin Lin, University of Electronic Science and Technology of China Xiaoliang Gu, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China
- **P9-9:** Dispersion Characteristics of Planar Tape-Helix using Effective Dielectric Constant Method (Page 381) Ajith Kumar M M, Nanyang Technological University Sheel Aditya, Nanyang Technological University
- **P9-10:** Analysis of Electromagnetic Performance of Helix TWT with Beam Loaded (Page 383) Xiaofang Zhu, University of Electronic Science and Technology of China Yulu Hu, University of Electronic Science and Technology of China Quan Hu, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China
- **P9-11:** Recent Development of Nonlinear Distortion in Space Traveling-Wave Tubes (Page 385) Yu-lu Hu, University of Electronic Science and Technology of China Hai-jian Qiu, University of Electronic Science and Technology of China Quan Hu, University of Electronic Science and Technology of China Xiao-fang Zhu, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China
- **P9-12:** The Correct Determination of the Equivalent Parameters of Slow-Wave Structures (Page 387) Yuriy N. Pchelnikov, *Pchelnikov's Consulting*

#### **10: THz and Microfabrication Posters**

P10-2: Preliminary Experimental Study of Graphene-based Terahertz Radiation Excited by an Electron Beam (Page 393) Xiaodong Feng, University of Electronic Science and Technology of China Min Hu, University of Electronic Science and Technology of China Jun Zhou, University of Electronic Science and Technology of China Sen Gong, University of Electronic Science and Technology of China Tao Zhao, University of Electronic Science and Technology of China

Tao Zhao, University of Electronic Science and Technology of China Renbin Zhong, University of Electronic Science and Technology of China Shenggang Liu, University of Electronic Science and Technology of China

P10-4:	A Fabrication Method of High Frequency Structure for THz Travelling Wave Tubes (Page 397) Qinglun Liu, Chinese Academy of Sciences Futing Yi, Chinese Academy of Sciences
	Mingguang Huang, Chinese Academy of Sciences
	Gang Wang, Chinese Academy of Sciences
	Liucong Yao, Chinese Academy of Sciences
	Xiaohua Hu, Chinese Academy of Sciences
	Yongliang Liu, Chinese Academy of Sciences
	Yunjin Li, Chinese Academy of Sciences
	Liaoyu Xue, Chinese Academy of Sciences
P10-6:	Effects of Beam Tunnels on 220GHz Rectangular Beam Folded Waveguide Traveling Wave Tubes (Page 399) Fengying Lu, University of Chinese Academy of Sciences & Chinese Academy of Sciences Yong Wang, University of Chinese Academy of Sciences & Chinese Academy of Sciences Long Yao, University of Chinese Academy of Sciences & Chinese Academy of Sciences Jie Yang, University of Chinese Academy of Sciences & Chinese Academy of Sciences
P10-7:	<b>Study of Double-Beam Folded Waveguide Back Wave Oscillator in Terahertz Band</b> (Page 401) Luanfeng Gao, University of Electronic Science and Technology of China Yulu Hu, University of Electronic Science and Technology of China Quan Hu, University of Electronic Science and Technology of China Xiaofang Zhu, University of Electronic Science and Technology of China Bin Li, University of Electronic Science and Technology of China
D10-8-	Design of Three-section Traveling Wave Tube with Folded-Waveguide Circuit Shielded by Photonic
F 10-6.	Crystals (Page 403) Hongxia Yi, Chinese Academy of Scences Junting Cui, Chinese Academy of Scences Mingguang Huang, Chinese Academy of Scences Liu Xiao, Chinese Academy of Scences
P10-9:	Study of Insertion Loss for a Ka-Band Meander Line Slow-Wave Structure (Page 405) Wang Shaomeng, Nanyang Technological University Sheel Aditya, Nanyang Technological University
D10 10.	Research of Electrodynamic Characteristics of a Double-gap Klystron Resonator with Quasi-fractal
P10-10:	Microstrip Elements (Page 407) Alexey Y. Miroshnichenko, Yuri Gagarin State Technical University of Saratov Vladislav A. Tsarev, Yuri Gagarin State Technical University of Saratov Natalia A. Akafyeva, Yuri Gagarin State Technical University of Saratov Yuriy N. Pchelnikov, Pchelnikov's Consulting

#### Session 20: Materials and Manufacturing

Chair: Bernard Vancil, eBeam, Inc.

Thursday, April 26 / 3:30-4:30 PM / San Carlos IV

20-1: Additively Manufactured WR-10 Copper Waveguide (Page 409) Timothy Horn, North Carolina State University Ilbey Karakurt, University of California, Berkeley Christopher Ledford, North Carolina State University Michelle Gonzalez, University of California, Davis Diana Gamzina, SLAC Neville C. Luhmann, Jr., University of California, Davis Liwei Lin, University of California, Berkeley 20-2: Dielectric and Thermal Conductivity Characterization of Aluminum Nitride-Based Microwave Absorbing Ceramics for Vacuum Electronics (Page 411)

Jeffrey P. Calame, Naval Research Laboratory Ender Savrun, Sienna Technologies, Inc.

#### Session 21: W-Band TWTs

Chair: John Booske, University of Wisconsin-Madison

Thursday, April 26 / 3:30-5:10 PM / San Carlos III

21-1: A W-band Efficiency-improved Folded Waveguide Traveling Wave Tube (Page 415) Fei Li, Chinese Academy of Sciences Mingguang Huang, Chinese Academy of Sciences Yuhui Sun, Chinese Academy of Sciences

Liu Xiao, Chinese Academy of Sciences Jiandong Zhao, Chinese Academy of Sciences Jingtian Wang, Chinese Academy of Sciences Hongxia Yi, Chinese Academy of Sciences Zhuo Wang, Chinese Academy of Sciences

#### 21-4: Toward 100 Gbps Wireless Networks Enabled by Millimeter Wave Traveling Wave Tubes (Page 417)

Claudio Paoloni, Lancaster University Rosa Letizia, Lancaster University Viktor Krozer, Goethe University of Frankfurt Marc Marilier, OMMIC S.A.S. Sebastian Boppel, Leibniz-Institut für Höchstfrequenztechnik Antonio Ramirez, Fibernova Systems Borja Vidal, Universitat Politècnica de València Ernesto Limiti, University of Rome, Tor Vergata Ralph Zimmerman, HF Systems Engineering GmbH

#### 21-5: Design and Test of a W-band 100-Watts Extended Interaction Oscillator (Page 419)

Zhaowei Qu, Chinese Academy of Sciences Zhiqiang Zhang, Chinese Academy of Sciences Yaogen Ding, Chinese Academy of Sciences Shuzhong Wang, Chinese Academy of Sciences Qingsheng Li, Chinese Academy of Sciences

# **Additional Papers**

#### P2-6: The Project of a Multibeam Klystron on a Higher Mode for Linear Electron Acceleartors (Page 107)

- A. N. Yanakov
- V. I. Pugnin
- S. V. Evseev
- D. S. Moiseyev
- A. S. Kotov

#### P3-8: Effect of Pitch Variation on the Linearity of Helix TWTs (Page 125)

- P. Narasimhan
- P. Pareek
- S. Chakraborty
- S. K. Ghosh

# P3-11: Preliminary Design of a Three-Slot-Staggered-Ladder Coupled-Cavity Structure for W-band

- Pulse Power Traveling Wave Tube (Page 131)
- Z. Su
- Z. Lu
- Z. Wang
- T. Tang
- Y. Gong

# P3-12: A Study of Thermal Behavior of Travelling Wave Tube (Page 133)

- C. Mistry
- S. Chakraborty
- S. Arya
- A. M. Latha
- A. R. Choudhury
- S. K. Ghosh

#### P3-17: Optimization of Resistive Attenuator Coating for TWT Performance Improvement (Page 143)

- S. Chakraborty
- C. Mistry
- P. Pareek
- N. Purushottaman
- A. R. Choudhury
- M. K. Alaria
- S. K. Ghosh

#### P3-22: Particle-in-Cell Simulation of a Novel Rectangular Beam Folded-waveguide Traveling Wave Tube (Page 153)

- F. Lu
  - Y. Wang
  - B. Xi
  - X. Wang

#### 9-2: Design and Simulation of a 0.2-THz Traveling-Wave Tube with a Converging Sheet Electron Beam (Page 161)

- T. A. Karetnikova
- A. G. Rozhnev
- N. M. Ryskin
- A. A. Burtsev
- I. A. Navrotsky
- A. V. Danilushkin

# P4-13: Higher Harmonics Generation in Low-Voltage Vircator System (Page 219)

- A. V. Starodubov
- S. A. Makarkin
- V. V. Galushka
- A. M. Pavlov
- A. A. Serdobintsev
- A. A. Koronovskii
- Y. A. Kalinin

#### P5-3: Investigation of Sc2O3 Contents for Nano-sized Scandia Doped Dispenser Cathode (Page 227)

- Z. Pan
  - Y. Wang
  - Y. Yang
  - J. Wang

#### P5-9: Thermoelectron Emission Microscopy of Zr-coated Scandate Disperse Cathode (Page 239)

- Z. Lu
- Z. Zhang
- S. Yin
- F. Ren

#### 13-4: Experimental Demonstration of the High-order Mode Oscillation in an Intense Relativistic Klystron Amplifier (Page 247)

- Y.-H. Liu
- X.-J. Niu
- H. Wang
- G. Guo
- J.-W. Liu

#### **15-1:** Progress of G-band Folded Waveguide Pulsed Traveling Wave Tube (Page 257)

- L. Wenqiang
- H. Yinhu
- H. Peng
- S. Rui
- J. Yi
- M. Qiaosheng
- M. Guowu
- C. Hongbin

#### P6-2: Analysis of the Dispersion Characteristics of the Photonic Crystal in the Generator with Intense Relativistic Electron Beam (Page 265)

- A. Badarin
- S. Kurkin
- N. Frolov
- A. Koronovskii
- A. Hramov
- A. Rak

#### P6-3: Photonic Crystal Application for Microwaves Output Induced by the Beam-Plasma Instability in the Absense of lons (Page 267)

- N. Frolov
- S. Kurkin

#### P6-6: Nonlinear Power Effects on Multifunction Amplifier Chip for Ka-band T/R Module (Page 271)

- G. Guo
- X. Xu
- X. Niu
- C. Guo

#### P6-8: Effect of External Electrical Circuits on the Operating Conditions of High-Power Multiple-beam Klystron Collectors (Page 275)

- D. A. Komarov
- S. P. Maslennikov
- Y. N. Paramonov
- E. P. Yakushkin

#### P7-3: Gyrotrons on the Cone-shaped Waveguide (Page 283)

- S. Kolosov
- V. Zapevalov
- I. Zaitseva

#### P7-6: Design of a W-Band, 100kW, Frequency Doubling Gyroklystron Amplifier (Page 289)

- M. S. Chauhan
- S. Yuvaraj
- P. K. Jain
- M. V. Kartikeyan

#### P7-7: Development of Lab-prototype for 170 GHz Short Pulse Gyrotron (Page 291)

- M. K. Alaria
- R. Poonia
- U. Singh
- N. Singh
- A. Bera
- A. K. Sinha

#### P7-11: PIC Simulation of a W-band Gyro-TWT Amplifier (Page 297)

- X. S. Xi
- G. Z. Hui

#### 17-1: Nano-sized Scandia Doped Dispenser Cathode with Annular Shape for the Hollow Electron Lenses for CERN High Luminosity LHC project (Page 319)

- Y. Yang
- Y. Wang
- W. Liu
- Z. Pan
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#### 18-3: A Novel Microfabrication Technology of Planar Microstrip Slow-Wave Structures for Millimeter-Band Traveling-Wave Tubes (Page 333)

- A. V. Starodubov
- A. A. Serdobintsev A. M. Pavlov
- V. V. Galushka
- D. M. Mitin
- N. M. Ryskin

#### P8-4: Microstructure and Mechanical Properties of Tantalum/Molybdenum Laser Welding for Electron

- Gun (Page 351)
- B. Wang
- X. Hu
- G. Zhou
- J. Zhou
- X. Li
- Y. Zhang
- Z. Zhang

#### P8-6: Synthesis of Electron Optics with Convergent Sheet Beam at Magnetically Shielding Cathode (Page 355)

- A. A. Burtsev
  - A. V. Danilushkin

#### P8-10: A Correct Method for Determining the Distribution of the Form Factor of Matrix Field-emission

- Structures (Page 361)
- D. S. Korolev
- S. V. Korolev

#### P8-11: Software-hardware Complex for Determining Surface Chemical and Phase Its Composition during Modification (Page 363)

- S. V. Korolev
- D. Korolev
- P8-12: Multibeam Electron-Optical Systems with Curvilinear Axis of the Beam Forming and Transportation (Page 365) Y. N. Paramonov
  - S. P. Morev
  - V. M. Sablin

#### P9-5: Approximate Analytic Solution for the Magnetic Field Distribution in the Annual MFS Cells of Microwave Power Tubes (Page 375)

- Y. N. Paramonov
- S. P. Morev
- E. K. Muraviev
- M. V. Efremova

#### P9-7: Modeling of the Thermodynamics with the Participation of Emission Materials (Page 377)

- V. A. Nelub
- A. S. Borodulin
- A. V. Bosov
- S. V. Korolev
- D. S. Korolev

#### P9-8: Emission Distribution of the Emission Materials and the Correct Method of Its Determination (Page 379)

- A. V. Bosov
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- D. S. KOIOICV

#### P9-13: Analysis of the Test Method for the Helical Waveguide Dispersion Characteristics of Ka Band (Page 389) J. Zhang

E. Wang

# P10-1: THz Electromagnetic Radiation in Beam-Plasma System under Different Plasma Distribution (Page 391)

- Q. Zhou
- H. Ma D. Zhu
- L. Yue
- Z. Wang
- H. Gong
- Z. Duan
- Y. Wei
- Y. Gong

#### P10-3: Design of Ultra-Thin Dielectric Waveguide Meander Line for 850GHz Traveling Wave Tube (Page 395)

- L. Wang
- N. Bai
- J. Zhang
- C. Shen X. Sun
- P. Pan
- J. Cai
- J. Feng

#### 20-1: Update on Development of New Generation of Cathodes Using Additive Manufacturing Methods (Page 413) D. Busbaher

#### 21-6: Study of Electromagnetic Parameters of a V-band Planar Meander Slow-Wave Structure (Page 421)

- A. V. Starodubov
- A. A. Serdobintsev
- A. M. Pavlov
- V. V. Galushka
- D. M. Mitin
- A. G. Rozhnev
- R. A. Torgashov
- G. V. Torgashov
- N. M. Ryskin