2012 IEEE Thirteenth International Vacuum Electronics Conference

(IVEC 2012)

Monterey, California, USA 24 – 26 April 2012



IEEE Catalog Number: CFP12VAM-PRT **ISBN:**

978-1-4673-0188-6

INTERNATIONAL VACUUM ELECTRONICS AND VACUUM ELECTRON SOURCES CONFERENCE MONTEREY CALIFORNIA APRIL 24-26, 2012

Table of Contents

Welcome

Will Menninger (General Chair IVEC-IVESC 2012)

IVEC/IVESC 2012 Committee

EDS VACUUM ELECTRONICS TECHNICAL COMMITTEE

Plenary Talks

- PL.1:
 Tizard's Mission and the Cavity Magnetron (Page 1)

 Stephen Phelps (Author and Broadcaster)
- PL.2: The Kepler Mission: Zeroing in on Habitable Earths (Page 3) Douglas A. Caldwell (NASA Ames Research Center), Kepler Mission Team (NASA Ames Research Center)
- PL.3: Saving Lives, Keeping Safe and Searching for Gold: The Electron Linear Accelerator Business (Page 7) George A. Zdasiuk (Varian Medical Systems, Inc.)
- PL.4: Compact Electron Accelerators based on Lasers and Plasmas: Towards a 10 GeV Machine (Page 11) Wim Leemans (Lawrence Berkeley National Laboratory)
- PL.6: THz Vacuum Electronics (Page 17)
 - W. Devereux Palmer (U.S. ARL Army Research Office)

Session 1: Modeling I

- Session Chair: Igor Chernyavskiy (Naval Research Laboratory)
- 1.1: GPU-Accelerated 3D Large-Signal Device Simulation Using the Particle-in-Cell Code
- 'Neptune' (Page 21)
 Simon J. Cooke (U.S. Naval Research Laboratory),
 Igor A. Chernyavskiy (U.S. Naval Research Laboratory),
 George M. Stantchev (U.S. Naval Research Laboratory),
 Baruch Levush (U.S. Naval Research Laboratory),
 Thomas M. Antonsen, Jr. (Science Applications International Corporation)
 1.2: Parallel Adaptivity in Beam Optics Analyzer (Page 23)
- Thuc Bui (Calabazas Creek Research Inc.), Michael Read (Calabazas Creek Research Inc.), R. Lawrence Ives (Calabazas Creek Research Inc.), Saurabh Tendulkar (Simmetrix Inc.), Mark Beall (Simmetrix Inc.)
- 1.3: 3D Magnetron Simulation by Means of Graphical Processing Units with CST STUDIO SUITE™ (Page 25) Monika C. Balk (CST AG)
- 1.4: Integrated EM & Thermal Simulation with VORPAL Software (Page 27) David Smithe (*Tech-X Corporation*), Robert Crockett (*Tech-X Corporation*), Haipeng Wang (*Thomas Jefferson National Accelerator Facility*), Gary Cheng (*Thomas Jefferson National Accelerator Facility*)
 1.5: New Progress in the High-Frequency Circuit Simulator (Page 29)
- 1.5: New Progress in the high-requency circuit Simulator (Page 29) Li Xu (University of Electronic Science and Technology of China), ZhongHai Yang (University of Electronic Science and Technology of China), JianQing Li (University of Electronic Science and Technology of China), Bin Li (University of Electronic Science and Technology of China)

Session 2: THz I

Session Chair: W. Devereux Palmer (U.S. Army Research Office)

2.1: A 100 mW, 0.670 THz Power Module (Page 31) John C. Tucek (Northrop Grumman Electronic Systems), Mark A. Basten (Northrop Grumman Electronic Systems), David A. Gallagher (Northrop Grumman Electronic Systems), Kenneth E. Kreischer (Northrop Grumman Electronic Systems),

Richard Lai (Northrop Grumman Electronic Systems), Vesna Radisic (Northrop Grumman Electronic Systems), Kevin M. Leong (Northrop Grumman Electronic Systems), Robert Mihailovich (Teledyne Scientific and Imaging LLC) 2.2: Fabrication and Testing of the 0.650 THz Helical BWO (Page 33) James A. Dayton, Jr. (Teraphysics Corp.), Carol L. Kory (Teraphysics Corp.), Gerald T. Mearini (Teraphysics Corp.), Dean Malta (RTI International), Matthew Lueck (RTI International), Bernard Vancil (e-Beam, Inc.) 2.3: Experimental Testing of an Electron Gun and Beam Transport System for a 670 GHz Extended Interaction Klystron (Page 35) Jeffrey Calame (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), Richard Dobbs (Communications and Power Industries LLC), Dave Berry (Communications and Power Industries LLC), Khanh Nguyen (Beam-Wave Research, Inc.), Edward Wright (Beam-Wave Research, Inc.), David Chernin (Science Applications International Corporation) 2.4: Terahertz Beamstick Performance Diagnostics Using MICHELLE (Page 37) Khanh T. Nguyen (Beam-Wave Research, Inc.), Edward L. Wright (Beam-Wave Research, Inc.), Jeffrey Calame (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), John Pasour (U.S. Naval Research Laboratory), Richard Dobbs (CPI Canada), Dave Berry (CPI Canada), David Chernin (Science Applications International Corporation), John Petillo (Science Applications International Corporation) A 0.85 THz Vacuum-Based Power Amplifier (Page 39) 2.5: Mark A. Basten (Northrop Grumman Electronic Systems), John C. Tucek (Northrop Grumman Electronic Systems), David A. Gallagher (Northrop Grumman Electronic Systems), Kenneth E. Kreischer (Northrop Grumman Electronic Systems), Robert Mihailovich (Teledyne Scientific and Imaging, LLC) **Session 3: Scandate Cathodes** Session Chair: Bernard Vancil (e-Beam, Inc.) 3.3: Reactive Desorption of Barium Oxide and Scandium Oxide from Model Thin Film Scandate Cathodes (Page 45) Congshang Wan (Ohio University), Martin E. Kordesch (Ohio University) Scandate-added Tungsten Dispenser Cathode Fabrication for 220 GHz Sheet Beam 3.4: Traveling Wave Tube Amplifier (Page 47) Jinfeng Zhao (University of California, Davis), Diana Gamzina (University of California, Davis), Anisullah Baig (University of California, Davis), Larry Barnett (University of California, Davis), Neville Luhmann, Jr. (University of California, Davis), Na Li (Beijing Vacuum Electronics Research Institute), Ji Li (Beijing Vacuum Electronics Research Institute) Poster Session I P1.1: Simulation Study of a C-Band High Power Klystron (Page NA) Rui Zhang (Chinese Academy of Sciences), Yong Wang (Chinese Academy of Sciences) Time-Domain PIC-Modeling of the Multiple Cavity Klystron Oscillator with Delayed P1.2: Feedback (Page 51) Valeriy Valeryevich Emelyanov (Saratov State University), Nikita Michaylovich Ryskin (Saratov State University) Simulating a New Low Q 6-Cell X-Band Klystron Output Cavity (Page 53) P1.3: Aaron Jensen (SLAC National Accelerator Laboratory), Chris Adolphsen (SLAC National Accelerator Laboratory), Michael Fazio (SLAC National Accelerator Laboratory), Andy Haase (SLAC National Accelerator Laboratory), Erik Jongewaard (SLAC National Accelerator Laboratory), Jeff Neilson (SLAC National Accelerator Laboratory), Daryl Sprehn (SLAC National Accelerator Laboratory), Arnold Vlieks (SLAC National Accelerator Laboratory) P1.4: Industrialization Effort of the SLAC XL5 Klystron (Page 55) Adam Balkcum (Communications and Power Industries LLC),

Adam Baketin (Communications and Power Industries LLC),
 Brad Stockwell (Communications and Power Industries LLC),
 Rasheda Begum (Communications and Power Industries LLC),
 Lydia Cox (Communications and Power Industries LLC),
 Scott Forrest (Communications and Power Industries LLC),
 Alex Plant (Communications and Power Industries LLC),
 Erica McCay (Communications and Power Industries LLC),

Adam Dohner (Communications and Power Industries LLC), Edward Eisen (Communications and Power Industries LLC), Stephan Lenci (Communications and Power Industries LLC). Armand Staprans (Communications and Power Industries LLC), Louis Zitelli (Communications and Power Industries LLC), Andrew Haase (SLAC National Accelerator Laboratory), Michael Fazio (SLAC National Accelerator Laboratory), Erik Jongewaard (SLAC National Accelerator Laboratory), Daryl Sprehn (SLAC National Accelerator Laboratory) P1.5: Equivalent Gap Impendence of TM310-mode in Cylindrical Coaxial Output Resonant Cavity of Klystron (Page 57) Dong Yu He (Inner Mongolian University of Science and Technology), Liu Tian Da (Inner Mongolian University of Science and Technology), Huang Chuan Lu (Chinese Academy of Sciences), Xie Xing Juan (Chinese Academy of Sciences) P1.6: Research Progress of High Peak Power Klystron in China (Page 59) Yong Wang (Chinese Academy of Sciences), Rui Zhang (Chinese Academy of Sciences), Wenxin Liu (Chinese Academy of Sciences), Pukun Liu (Chinese Academy of Sciences) P1.7: Design of Multiple-beam Klystron Cavities (Page 61) Robson Keller B Silva (Instituto de Pesquisas Energeticas e Nucleares IPEN/CNEN-SP), Claudio C Motta (University of Sao Paulo) P1.8: Design and Calculation of an S-band High-Average Power Broadband Multi-beam Klystrons (Page 63) Yaogen Ding (Chinese Academy of Sciences), Zhaochuan Zhang (Chinese Academy of Sciences), Bin Shen (Chinese Academy of Sciences), Zhiqiang Zhang (Chinese Academy of Sciences), Jing Cao (Chinese Academy of Sciences), Dongping Gao (Chinese Academy of Sciences) P1.9: Micro Reentrant Cavity for 100 GHz Klystron (Page 65) Mauro Mineo (University of Rome Tor Vergata), Claudio Paoloni (University of Rome Tor Vergata) The Design Of W-Band Extended Interaction Klystron Electron Optics System (Page 67) P1.10: Shuzhong Wang (Chinese Academy of Sciences), Cunjun Ruan (Chinese Academy of Sciences), Yong Zhong (Chinese Academy of Sciences) Pseudospark-Sourced Micro Electron Beam for a W-band Klystron Amplifier (Page 71) P1.12: Huabi Yin (University of Strathclyde), Adrian W. Cross (University of Strathclyde), David Bowes (University of Strathclyde), Wenlong He (University of Strathclyde), Kevin Ronald (University of Strathclyde), Alan D. R. Phelps (University of Strathclyde), Daohui Li (Queen Mary University of London), Xiaodong Chen (Queen Mary University of London) Recent Results of High Power Tests of Normal Conducting Single-cell Standing Wave P1.13: Structures (Page NA) Valery Dolgashev (SLAC National Accelerator Laboratory), Sami Tantawi (SLAC National Accelerator Laboratory) Anahid Dian Yeremian (SLAC National Accelerator Laboratory), Yasuo Higashi (KEK), Bruno Spataro (INFN-LNF) Calculation the Nine Cavities Section of Linear Collider (Page 73) P1.14: Stanislav Vasilevich Kolosov (Belarus State University of Informatics and Radioelectronics (BSUIR)), Alexander Alexandrovich Kurayev (Belarus State University of Informatics and Radioelectronics (BSUIR)). Alaxander Vasilevich Senko (Belarus State University of Informatics and Radioelectronics (BSUIR)) Design and simulation for a 120-kW-Average-Power Window Test (Page 75) P1.15: Fang Zhu (Chinese Academy of Sciences), Zhaochuan Zhang (Chinese Academy of Sciences), Jirun Luo (Chinese Academy of Sciences) Thermal Analysis of an S-band Output RF Vacuum Window (Page 77) P1.16: Shun Dai (National Astronomical Observatories, Chinese Academy of Sciences), Fang Zhu (Institute of Electronics, Chinese Academy of Sciences) P1.17: Optimization of Couplers of TWT using TDR method (Page 79) P. Raja Ramana Rao (Defence Research & Development Organization), Subrata Kumar Datta (Defence Research & Development Organization), Lalit Kumar (Defence Research & Development Organization) The Multistage Depressed Collector Design Using EOS (Page 81) P1.18: Quan Hu (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), ZhongHai Yang (University of Electronic Science and Technology of China), Bin Li (University of Electronic Science and Technology of China)

P1.19: Real Analysis of Residual Gas in Electrical Tube (Page 83) Mei Xiao (Southeast University), Xiaobing Zhang (Southeast University) P1.20: Design of Circular Waveguide Tapers for a Ka-Band Two-Cavity Gyroklystron Amplifier (Page 85) XiaoFang Zhu (University of Electronic Science and Technology of China), JunJian Ma (University of Electronic Science and Technology of China), XiaoLin Jin (University of Electronic Science and Technology of China) Some Results of Investigation of Power Multi-beam Monotron Oscillator (Page 87) P1.21: Natalia A. Akafyeva (Saratov State Technical University), Alexey Yu. Miroshnichenko (Saratov State Technical University), Vladislav A. Tsarev (Saratov State Technical University) P1.22: Conceptual Design For Multi-Spectral Component Characterization of a Vircator (Page 89) Renu Bahl (Institute For Plasma Research), Anitha Vidyadhar (Institute For Plasma Research), Rajesh Kumar (Institute For Plasma Research). Sanjay Kulkarni (Institute For Plasma Research), Yogesh Chander Saxena (Institute For Plasma Research), Chenna Reddy (Institute For Plasma Research) P1.27: Enhanced Field Emission from ZnO/ CNT Nanostructure with Minimized Screening Effect (Page 99) Shuyi Ding (Southeast University), Chi Li (Southeast University), Wei Lei (Southeast University), Xiaobing Zhang (Southeast University), Baoping Wang (Southeast University) Improved Field Emission Property of ZnO/CNTs Composites by Adding a Graphene P1.28: Resistive Layer (Page 101) Chao Wang (Southeast University), Zhiwei Zhao (Southeast University), Yongqiang Chen (Southeast University), Jun Yan (Southeast University) Simulations and Experimental Study of Electric Field Screening by the Proximity of P1.30: Field Emitters (Page 105) Wilkin Tang (U.S. Air Force Research Laboratory), Don Shiffler (U.S. Air Force Research Laboratory), Sabrina Maestas (U.S. Air Force Research Laboratory), Ken Golby (Science Applications International Corporation), Matthew LaCour (Science Applications International Corporation), Susan Heidger (U.S. Air Force Research Laboratory) **Session 4: Gyrotron Fusion** Session Chair: R. Lawrence Ives (Calabazas Creek Research, Inc.) Progress of the Development of Gyrotron and Gyrotron System for ITER (Page 107) 4.1: Ken Kajiwara (Japan Atomic Energy Agency), Yasuhisa Oda (Japan Atomic Energy Agency), Atsushi Kasugai (Japan Atomic Energy Agency), Koji Takahashi (Japan Atomic Energy Agency), Keishi Sakamoto (Japan Atomic Energy Agency) 4.2: Recent High-Power Gyrotron Activities at 95, 110 and 170 GHz (Page 109) Kevin Felch (Communications and Power Industries LLC), Monica Blank (Communications and Power Industries LLC) Philipp Borchard (Communications and Power Industries LLC), Pat Cahalan (Communications and Power Industries LLC), Steve Cauffman (Communications and Power Industries LLC) 4.3: High Power Gyrotron Development at KIT for ECH&CD of Fusion Plasmas (Page 111) John Jelonnek (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT, IHM), Stefano Alberti (Centre de Recherche en Physique des Plasmas, Association Euratom-Confédération Suisse). Kostas Avramidis (National Technical University of Athens), Harald Braune (Max-Planck-Institut fuer Plasmaphysik, Teilinstitut Greifswald, Association EURATOM-IPP), Volker Erckmann (Max-Planck-Institut fuer Plasmaphysik, Teilinstitut Greifswald, Association EURATOM-IPP), Gerd Gantenbein (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT), Jean-Philippe Hogge (Centre de Recherche en Physique des Plasmas, Association Euratom-Confédération Suisse), Stefan Illy (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT), Jianbo Jin (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT), Stefan Kern (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT), Frank Noke (Max-Planck-Institut fuer Plasmaphysik, Teilinstitut Greifswald, Association EURATOM-IPP) Ioannis Pagonakis (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT), Bernhard Piosczyk (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT) Frank Purps (Max-Planck-Institut fuer Plasmaphysik, Teilinstitut Greifswald, Association EURATOM-IPP). Tomasz Rzesnicki (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT),

Andrey Samartsev (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT), Andreas Schlaich (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT), Martin Schmid (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT), Manfred Thumm (Karlsruhe Institute of Technology (KIT), Association EURATOM-KIT) Mode Excitation During the Voltage Rise in Megawatt Gyrotrons (Page 113) 4.4: David S. Tax (Massachusetts Institute of Technology), William C. Guss (Massachusetts Institute of Technology), Michael A. Shapiro (Massachusetts Institute of Technology), Richard J. Temkin (Massachusetts Institute of Technology) Stability of Gyrotron Operation in Very High-Order Modes (Page 115) 4.5: Oleksandr V. Sinitsyn (University of Maryland), Gregory S. Nusinovich (University of Maryland), Thomas M. Antonsen, Jr. (University of Maryland) Design and Test of an Internal Coupler to Corrugated Waveguide for High Power 4.6: Gyrotrons (Page 117) Jeffrey M. Neilson (Calabazas Creek Research, Inc.), David Tax (Massachusetts Institute of Technology). William Guss (Massachusetts Institute of Technology). Sudheer Jawla (Massachusetts Institute of Technology), Elizabeth Kowalski (Massachusetts Institute of Technology), Michael Shapiro (Massachusetts Institute of Technology), Richard Temkin (Massachusetts Institute of Technology) Session 5: TWTs I Session Chair: David Whaley (L-3 Communications EDD) Development of High Power K/Ka-Band Helix TWT (Page 119) 5.1: Chae K. Chong (L-3 Communications Electron Technologies, Inc.), Dennis A. Layman (L-3 Communications Electron Technologies, Inc.), Richard J. Stolz (L-3 Communications Electron Technologies, Inc.), Baruch Levush (U.S. Naval Research Laboratory), John Pasour (U.S. Naval Research Laboratory) 5.2: High-Power Broadband Cascaded-TWT Development (Page 121) Khanh T. Nguyen (Beam-Wave Research, Inc.), David K. Abe (U.S. Naval Research Laboratory), Lars Ludeking (ATK-Mission Research), Edward L. Wright (Beam-Wave Research, Inc.), Baruch Levush (U.S. Naval Research Laboratory), Dean Pershing (Beam-Wave Research, Inc.), John Pasour (U.S. Naval Research Laboratory), John Petillo (Science Applications International Corporation), David Chernin (Science Applications International Corporation) 5.3: RF Circuit Design for 700W CW Ka-Band Coupled-Cavity TWT (Page 123) 5.3: Jose Luis Ramirez-Aldana (Communications and Power Industries LLC), Rasheda Begum (Communications and Power Industries LLC), Thomas Grant (Communications and Power Industries LLC), Michael Cusick (Communications and Power Industries LLC), Jim Legarra (Communications and Power Industries LLC), Thomas Hunter (Communications and Power Industries LLC) 5.4: Broadband Helix TWT with Low Harmonic Power (Page NA) Luwei Liu (University of Electronic Science and Technology of China), Yanyu Wei (University of Electronic Science and Technology of China), Zhaoyun Duan (University of Electronic Science and Technology of China), Zhigang Lu (University of Electronic Science and Technology of China), Hairong Yin (University of Electronic Science and Technology of China), Minzhi Huang (University of Electronic Science and Technology of China), Tao Tang (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), Yubin Gong (University of Electronic Science and Technology of China) 5.5: Design and Fabrication of Q-band Folded Wavequide Traveling-Wave Tube (Page 125) Huarong Gong (University of Electronic Science and Technology of China), Yubin Gong (University of Electronic Science and Technology of China), Tao Tang (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) A Compact S-Band 1 kW Traveling-Wave Tube for Microwave Power Module (Page 127) 5.6: Hoyoung Song (University of Colorado at Colorado Springs), Leslie Tekamp (University of Colorado at Colorado Springs), Carl Everleigh (Kwangwoon University), Sang Hoon Kim (Kwangwoon University), Jin Joo Choi (Kwangwoon University), Seon Joo Kim (Kwangwoon University), Sung Hoon Jang (Kwangwoon University) Session 6: Cold Cathodes I

Session Chair: Jonathan Shaw (U.S. Naval Research Laboratory)

6.2: Uniformity of Field Emission Electron Beam and Picosecond Field Emission from Metallic Field Emitter Arrays under High Electric Field (Page 131)

Soichiro Tsujino (Paul Scherrer Institut), Martin Paraliev (Paul Scherrer Institut), Eugenie Kirk (Paul Scherrer Institut), Hans-H. Braun (Paul Scherrer Institut)

Reduced Graphene Oxide Cold Cathodes: Preparation, Actively-Controlled Field 6.3: Emission Properties and the Related Physical Mechanism (Page 133) Juncong She (Sun Yat-sen University), Yuan Huang (Sun Yat-sen University), Wenjie Yang (Sun Yat-sen University), Weiliang Wang (Sun Yat-sen University), Zhibing Li (Sun Yat-sen University), Shaozhi Deng (Sun Yat-sen University), Ningsheng Xu (Sun Yat-sen University) 6.5: Spectral Analysis of Current Fluctuations in CdS Nanocombs and Nanowires Array (Page 137) Ranjit V. Kashid (University of Pune), Padmakar G. Chavan (University of Pune), Imtiaz S. Mulla (University of Pune), Dilip S. Joag (University of Pune), Mahendra A. More (University of Pune) Session 7: MMW Klystrons/IOTs Session Chair: Richard Kowalczyk (L-3 Communications EDD) Fabrication of a W-Band Sheet Beam Extended Interaction Klystron (EIK) (Page 139) 7.1: John A. Pasour (U.S. Naval Research Laboratory), Edward Wright (Beam-Wave Research), Khanh Nguyen (Beam-Wave Research), Adam Balkcum (Communications and Power Industries LLC), Baruch Levush (U.S. Naval Research Laboratory) 7.2: High Power EIK Amplifier for Interferometric Space-borne Applications (Page 141) Wayne Harvey (California Institute of Technology), Igor Botvinnik (California Institute of Technology), Michael Tope (California Institute of Technology), Albert Roitman (Communications and Power Industries, Canada Inc.), Edward Sokol (Communications and Power Industries, Canada Inc.), David Berry (Communications and Power Industries, Canada Inc.), Brian Steer (Communications and Power Industries, Canada Inc.) High-Power Multiple-Beam IOT Design (Page 143) 7.3: Edward Wright (Beam-Wave Research, Inc.). Khanh Nguyen (Beam-Wave Research, Inc.), John Pasour (U.S. Naval Research Laboratory), Igor Chernyavskiy (U.S. Naval Research Laboratory), Simon Cooke (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), John Petillo (Science Applications International Corporation), Thomas Antonsen, Jr. (Science Applications International Corporation), Jonathan Page (Communications and Power Industries LLC), Mike Cusick (Communications and Power Industries LLC), Ed Davies (Communications and Power Industries LLC), Paul Krzeminski (Communications and Power Industries LLC), John DeFord (Simulation Technology and Applied Research, Inc.), Ben Held (Simulation Technology and Applied Research, Inc.) 7.4: On Linearization of TV Klystrodes by Internal Feedbacks (Page 145) Anatoly V. Galdetskiy (FSUE Istok) Theory and Experimental Investigation on the High Performance Transport of Sheet 7.5:

7.5: Theory and Experimental Investigation on the High Performance Transport of Sheet Electron Beam for the XSBK and WSBK (Page 147) Cunjun Ruan (Chinese Academy of Sciences), Shuzhong Wang (Chinese Academy of Sciences), Ding Zhao (Chinese Academy of Sciences), Yin Han (Chinese Academy of Sciences), Qingsheng Li (Chinese Academy of Sciences)

Session 8: MPMs/Systems

Session Chair: John Tucek (Northrop Grumman Electronic Systems)

- 8.1: MPM for ECM Systems (Page 149) Philippe Trani (*Thales Electron Devices*), Patrick Antoine (*Thales Electron Devices*)
- 8.2: A 40W Ku-Band NanoMPM for Mobile Communication (Page 151) Dan Springmann (L-3 Communications, Electron Devices Division), Marc Barsanti (L-3 Communications, Electron Devices Division), Nate Brown (L-3 Communications, Electron Devices Division), Danny Chan (L-3 Communications, Electron Devices Division), Adrian Donald (L-3 Communications, Electron Devices Division), Ramon Duggal (L-3 Communications, Electron Devices Division), Tom Schoemehl (L-3 Communications, Electron Devices Division)
- 8.3: Multi PRF TWT for ISR and FCS Applications (Page 153) William Crespo (U.S. Naval Surface Warfare Center, Crane Division), Jaime Galvan (U.S. Naval Surface Warfare Center, Crane Division),

Kenneth Bryan Mitsdarffer (U.S. Naval Surface Warfare Center, Crane Division)

Magnetic Interaction between Traveling Wave Tubes and Its Effect on Performance 84. and Reliability (Page 155) Chris Wheeland (L-3 Communications, Electron Devices Division), Michael Boyle (L-3 Communications, Electron Devices Division), Marc Barsanti (L-3 Communications, Electron Devices Division), Richard True (L-3 Communications, Electron Devices Division) Enhanced Smith-Purcell radiation in frequency independent dielectric Grating (Page 157) 8.5: Anirban Bera (Seoul National University), Ranjan Kumar Barik (Seoul National University), Sun-Hong Min (Seoul National University), Ojoon Kwon (Seoul National University), InKuen Baek (Seoul National University), Seontae Kim (Seoul National University), Matlabjon A. Sattorov (Seoul National University), Gun-Sik Park (Seoul National University)

Session 9: Dispenser Cathodes

Session Chair: Louis Falce (Consultant for Calabazas Creek Research, Inc.)

- 9.4: Microstructural Influence of OsRu Thin Films on Dispenser Cathodes (Page 163) Phillip Daniel Swartzentruber (University of Kentucky), T. John Balk (University of Kentucky), Scott Roberts (Semicon Associates), Michael Effgen (Semicon Associates)
- **Poster Session II**
- P2.1: Design and Development of 5-MW X-Band Klystron for Medical and Cargo Screening Applications (Page 167)

Andy Shabazian (Communications and Power Industries LLC), Rasheda Begum (Communications and Power Industries LLC), Bradford Stockwell (Communications and Power Industries LLC)

P2.2: A 1MW S-Band Klystron For Weather Radar (Page 169) Deepika Gajaria (Communications and Power Industries LLC), Rasheda Begum (Communications and Power Industries LLC), Adam Balkcum (Communications and Power Industries LLC), Bet Goory (Communications and Power Industries LLC),

Pat Casey (Communications and Power Industries LLC), Scott Forrest (Communications and Power Industries LLC), Steve Lenci (Communications and Power Industries LLC)

P2.3: Pulsed UHF Klystron Developments at CPI (Page 171) Steve Lenci (Communications and Power Industries LLC), Edward Eisen (Communications and Power Industries LLC), Galen Aymar (Communications and Power Industries LLC), Rasheda Begum (Communications and Power Industries LLC), Brad Stockwell (Communications and Power Industries LLC), John Atkinson (Communications and Power Industries LLC)

P2.4: Research on X-Band Sheet Beam Electron Optics System (Page 173) Ding Zhao (Chinese Academy of Sciences), Cunjun Ruan (Chinese Academy of Sciences), Xi Lu (Chinese Academy of Sciences), Yong Zhong (Chinese Academy of Sciences), Xiudong Yang (Chinese Academy of Sciences)

- P2.5: Electron Gun Design for Multi-Beam Pulsed Amplifier (Page 175) Ashok Kumar Nehra (CSIR-Central Electronics Engineering Research Institute), Rajkumar Gupta (CSIR-Central Electronics Engineering Research Institute), Purna Chandra Panda (CSIR-Central Electronics Engineering Research Institute), Sudhir Mohan Sharma (CSIR-Central Electronics Engineering Research Institute), Yaduvendra Choyal (Devi Ahilya University), Rajendra Kumar Sharma (CSIR-Central Electronics Engineering Research Institute)
- P2.7: Fabrication and Emission Property of Polycrystalline (CexPr1-x)B6 Bulk Prepared by Spark Plasma Sintering (Page 179) Xiaona Li (Beijing University of Technology), Jiuxing Zhang (Beijing University of Technology), Xin Zhang (Beijing University of Technology), Lihong Bao (Beijing University of Technology),
 - Ning Zhang (Beijing University of Technology)
- P2.12: Development of 155mm Impregnated Scandate Dispenser Cathode (Page NA) Hui Wang (Beijing Vacuum Electronics Research Institute)

P2.13: Microwave Plasma Window Breakdown Theory and Experiments (Page 189) Peng Zhang (University of Michigan - Ann Arbor), Matthew Franzi (University of Michigan - Ann Arbor), Yue Ying Lau (University of Michigan - Ann Arbor), Ronald M. Gilgenbach (University of Michigan - Ann Arbor)

P2.14: Development of a Wide-Band Window in HE1,1 Guide for Gyrotrons (Page 191) Michael Read (Calabazas Creek Research, Inc.), R. Lawrence Ives (Calabazas Creek Research, Inc), Jeff Neilson (LEXAM Research, Inc.), Richard Temkin (Massachusetts Institute of Technology),

Sudheer Jawla (Massachusetts Institute of Technology), John Doane (General Atomics), David Tax (Massachusetts Institute of Technology) P2.15: Terahertz Dual-Mode Horn Antenna with a Vacuum Window (Page 193) Mikko Kotiranta (Goethe University of Frankfurt am Main), Wolff von Spiegel (Goethe University of Frankfurt am Main), Viktor Krozer (Goethe University of Frankfurt am Main), David Bariou (Thales Electron Devices), Alain J. Durand (Thales Electron Devices) P2.16: Design and Fabrication of Components for a 220 GHz 50 W Sheet Beam Travelling Wave Tube Amplifier (Page 195) Takuji Kimura (Communications and Power Industries LLC), John Atkinson (Communications and Power Industries LLC), Scott Forrest (Communications and Power Industries LLC), Thomas Grant (Communications and Power Industries LLC), Tom Hunter (Communications and Power Industries LLC), Mark Field (Teledyne Scientific and Imaging LLC), Robert Borwick (Teledyne Scientific and Imaging LLC), Berinder Brar (Teledyne Scientific and Imaging LLC) A study of Millimeter-Wave Space TWT Life Testing (Page NA) P2.17: Liang Xiao Feng (Beijing Vacuum Electronics Research Institute) P2.18: Envelope Model of Beam Radius Variations in Steady State Beam-Circuit Interaction Codes (Page 197) David Chernin (Science Applications International Corporation), Thomas M. Antonsen, Jr. (University of Maryland), Baruch Levush (U.S. Naval Research Laboratory) Counter Streaming Beams Model in MICHELLE eBEAM (Page 199) P2.19: Serguei Ovtchinnikov (Science Applications International Corporation), Simon Cooke (U.S. Naval Research Laboratory), Masis Mkrtchyan (Science Applications International Corporation), Roman Shtokhamer (Science Applications International Corporation), Alexander Vlasov (U.S. Naval Research Laboratory), John Petillo (Science Applications International Corporation), Baruch Levush (U.S. Naval Research Laboratory) P2.20: The Dispersion Characteristics of Helically Corrugated Waveguide (Page 201) Liang Zhang (University of Strathclyde), Adrian W. Cross (University of Strathclyde), Wenlong He (University of Strathclyde) Craig W. Robertson (University of Strathclyde), Alan R. Young (University of Strathclyde), Colin G. Whyte (University of Strathclyde), Kevin Ronald (University of Strathclyde), Philip MacInnes (University of Strathclyde), Craig R. Donaldson (University of Strathclyde), Alan D.R. Phelps (University of Strathclyde) 2 MW CW RF Load for Testing Gyrotrons (Page 203) P2.21: R. Lawrence Ives (Calabazas Creek Research, Inc.), George Collins (Calabazas Creek Research, Inc.), Maxwell Mizuhara (Calabazas Creek Research, Inc.), Jeff Neilson (Lexam Research, Inc.) Experimental Program to Test a High-Power, 670 GHz Gyrotron, and its Applicability to P2.23: the Remote Detection of Concealed Radioactive Materials (Page 207) Carlos A. Romero-Talamás (University of Maryland), Gregory S. Nusinovich (University of Maryland), John C. Rodgers (University of Maryland), Dmytro Kashyn (University of Maryland), Brian Lenardo (University of Maryland), Raymond C. Elton (University of Maryland), Anatoly Shkvarunets (University of Maryland), Victor L. Granatstein (University of Maryland), Mikhail Yu. Glyavin (Institute of Applied Physics of the Russian Academy of Sciences) Conversion of TE01 to TE11 Using Modified Converter for Gyroklystron (Page 209) P2.24: Xin-hua Yu (Guilin University of Electronic Technology), Xi Gao (Guilin University of Electronic Technology), Xin-jian Niu (University of Electronics Science and Technology of China) P2.25: Recirculating Planar Magnetrons: Simulations and Experiment (Page 211) Matthew Franzi (University of Michigan), Ronald Gilgenbach (University of Michigan) >David French (U.S. Air Force Research Laboratory), Brad Hoff (U.S. Air Force Research Laboratory), Y. Y. Lau (University of Michigan), David Simon (University of Michigan), John W. Luginsland (U.S. Air Force Office of Scientific Research) P2.26: Extension of the Locking Bandwidth of the Magnetron Ka-band (Page 213) Igor Shamilyevich Bakhteev (Electrical Engineering and Electronics Department, Saratov State Technical University). Alexander Viktorovich Lyashenko (Saratov State Technical University),

Mikhail Aleksandrovich Fursaev (Saratov State Technical University), Valeriy Pavlovich Eremin (Saratov State Technical University)

P2.27: Experimental Study of 293kW Ka-Band Gyrotron-Traveling Wave-Tube (Page 215)
 E. Feng Wang (Beijing Vacuum Electronics Research Institute),
 Xun Zeng (Beijing Vacuum Electronics Research Institute),
 BenTian Liu (Beijing Vacuum Electronics Research Institute),
 ZhiLiang Li (Beijing Vacuum Electronics Research Institute),
 JinJun Feng (Beijing Vacuum Electronics Research Institute),
 JinJun Feng (Beijing Vacuum Electronics Research Institute),
 JinJun Feng (Beijing Vacuum Electronics Research Institute)

 P2.28: The Design and Experimental Study of a Ku-Band Gyro-TWT (Page NA)

Jianxun Wang (University of Electronic Science and Technology), Yong Luo (University of Electronic Science and Technology), Xue Deng (University of Electronic Science and Technology), Yong Xu (University of Electronic Science and Technology)

P2.29: Updates on a W-band Gyro-BWO using a Helically Corrugated Waveguide Experient (Page 217)

Craig Ross Donaldson (University of Strathclyde), Wenlong He (University of Strathclyde), Liang Zhang (University of Strathclyde), Adrian W. Cross (University of Strathclyde), Fengping Li (University of Strathclyde), Alan D.R. Phelps (University of Strathclyde), Kevin Ronald (University of Strathclyde), Craig W. Robertson (University of Strathclyde), Colin G. Whyte (University of Strathclyde), Paul McElhinny (University of Strathclyde)

Klaus-Jochen Boller (University of Twente)

P2.30: Power Scalability of a low-current multi-beam Photonic Free-Electron Laser (Page 219) Joan H. H. Lee (University of Twente), Mark van Dijk (University of Twente), Thomas Denis (University of Twente), Peter J. M. van der Slot (University of Twente),

P2.31: Study of Beam Focusing Techniques for a Power- and Frequency Scalable Photonic Free-Electron Laser (Page 221) Joan H. H. Lee (University of Twente), Mark van Dijk (University of Twente), Thomas Denis (University of Twente), Peter J. M. van der Slot (University of Twente), Klaus J. Boller (University of Twente)

P2.32: Single-mode Power Scaling in a Multi-beam Photonic Free-Electron Laser (Page 223) Thomas Denis (University of Twente), Mare W. van Dijk (University of Twente), Joan H. H. Lee (University of Twente), Peter J. M. van der Slot (University of Twente), Klaus-Jochen Boller (University of Twente)

Session 10: TWTs II

Session Chair: Yehuda Goren (Teledyne Microwave Solutions)

10.1: Wide Band Ka-Band Coupled-Cavity Traveling Wave Tube (CCTWT) Development (Page 225) Michael Cusick (Communications and Power Industries LLC), Rasheda Begum (Communications and Power Industries LLC), Deepika Gajaria (Communications and Power Industries LLC), Tom Grant (Communications and Power Industries LLC), Peter Kolda (Communications and Power Industries LLC), Jim Legarra (Communications and Power Industries (contract)), Brad Stockwell (Communications and Power Industries LLC), David K. Abe (U.S. Naval Research Laboratory), Igor A. Chernyavskiy (U.S. Naval Research Laboratory), Mike Daniell (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), John Pasour (U.S. Naval Research Laboratory), Alexander N. Vlasov (U.S. Naval Research Laboratory), Alexander T. Burke (Science Applications International Corporation), David P. Chernin (Science Applications International Corporation), John J. Petillo (Science Applications International Corporation) 10.2: 700 W Ka-Band Coupled-Cavity Traveling Wave Tubes (CCTWT) for Communication (Page 227) Michael A. Cusick (Communications and Power Industries LLC), Rasheda Begum (Communications and Power Industries LLC), Deepika Gajaria (Communications and Power Industries LLC), Tom Grant (Communications and Power Industries LLC), Peter Kolda (Communications and Power Industries LLC) Jim Legarra (Communications and Power Industries (contract)), Chris Meyer (Communications and Power Industries LLC), Jose-Luis Ramirez-Aldana (Communications and Power Industries LLC), Dennis San Pedro (Communications and Power Industries LLC), Brad Stockwell (Communications and Power Industries LLC),

George Yamane (Communications and Power Industries LLC)

10.3: Comparison Between One and Two Dimensional Models of Coupled Cavity TWT Performance (Page 229)

Alexander N. Vlasov (U.S. Naval Research Laboratory), Igor A. Chernyavskiy (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), David Chernin (Science Applications International Corporation), Thomas M. Antonsen, Jr. (Science Applications International Corporation)

10.4: Harmonic Reduction for Broadband Helix TWTs with Negative Dispersion (Page 231)

YuLu Hu (University of Electronic Science and Technology of China), YanMei Wang (Beijing Vacuum Electronics Research Institute), ZhongHai Yang (University of Electronic Science and Technology of China), JianQing Li (University of Electronic Science and Technology of China), Bin Li (University of Electronic Science and Technology of China)

10.5: Electromagnetic Band Gap Substrate for Planar Microstrip Meander Line Travelling Wave Tube (Page 233)

Ningfeng Bai (Southeast University), Hehong Fan (Southeast University), Xingqun Zhao (Southeast University), Jinjun Feng (Beijing Vacuum Electronics Research Institute), Fujiang Liao (Beijing Vacuum Electronics Research Institute), Xiaohan Sun (Southeast University)

Session 11: THz II

Session Chair: Colin Joye (U.S. Naval Research Laboratory)

11.1: Design Procedure for THz Cascade Backward Wave Amplifiers (Page 235)

Mauro Mineo (University of Rome Tor Vergata), Claudio Paoloni (University of Rome Tor Vergata), Alain J. Durand (Thales Electron Devices)

11.2: 1-THz Cascade Backward Wave Amplifier (Page 237)

Claudio Paoloni (University of Rome Tor Vergata), Mauro Mineo (University of Rome Tor Vergata), Aldo Di Carlo (University of Rome Tor Vergata), Alain J. Durand (Thales Electron Devices), Viktor Krozer (Goethe-Universität Frankfurt am Main), Mikko Kotiranta (Goethe-Universität Frankfurt am Main), Fayçal Bouamrane (UMR137 CNRS/Thales), Thomas Bouvet (UMR137 CNRS/Thales), Stephan Megtert (UMR137 CNRS/Thales)

11.3: Study of the Effect of Surface Roughness and Skin Depth on the Conductivity of Metals at 650 GHz (Page 239)

Matt P. Kirley (University of Wisconsin-Madison), Nils Carlsson (University of Wisconsin-Madison), Benjamin B. Yang (University of Wisconsin-Madison), John H. Booske (University of Wisconsin-Madison)

11.4:

Electromagnetic Attenuation due to Water Vapor Measured at 400 GHz (Page 241)

Marcus J. Weber (University of Wisconsin-Madison), Benjamin B. Yang (University of Wisconsin-Madison), Matk Kirley (University of Wisconsin-Madison), Mark S. Kulie (University of Wisconsin-Madison), Ralf Bennartz (University of Wisconsin-Madison), John H. Booske (University of Wisconsin-Madison)

11.5: Quasi-optical Resonant System for Extended Interaction Devices (Page 243)

Yong Yin (University of Electronic Science and Technology of China), Bin Wang (University of Electronic Science and Technology of China), Lin Meng (University of Electronic Science and Technology of China)

Session 12: Basic Emission Physics I

Session Chair: Joan Yater (U.S. Naval Research Laboratory)

12.1: The Work Function of the Crystal Faces of Metals (Page 245) Ivor Brodie (University of California)

Poster Session III

P3.1: Quadrupole Strong Focusing Transport for a Ka-band Coupled Cavity Traveling Wave Tube Amplifier (Page 255) Kimberley Eden Leslie Nichols (University of New Mexico),

Edl Schamiloglu (University of New Mexico), John Petillo (Science Applications International Corporation)

- **P3.2:** The Program Package of Simulation of TWT Attenuator (Page 257) Elena Moiseevna II'ina (*The Federal State Unitary Enterprise NPP*)
- **P3.3:** Cold Simulation on Overmoded Traveling-wave Tube at W-band (Page 259) Zhaojun Zhu (University of Electronic Science and Technology of China), Baofu Jia (University of Electronic Science and Technology of China), Chaolei Wei (University of Electronic Science and Technology of China)
- P3.4: Research on Dielectric-Loaded Rectangular Cerenkov Maser (Page 261) Ye Chen (Chinese Academy of Sciences),

Ding Zhao (Chinese Academy of Sciences), Yong Wang (Chinese Academy of Sciences)

- P3.5: A Study of the Discrete Electron-wave Interaction for the Passbands and Stopbands of TWT Slow-wave Systems (Page 263) Victor Anatolievich Solntsev (Moscow State Institute of Electronics & Mathematics), Roman Pavlovich Koltunov (Moscow State Institute of Electronics & Mathematics), Dmitry Sergeevich Shabanov (Moscow State Institute of Electronics & Mathematics) P3.6: Electrodynamics Method of Calculation Irregular Folded TWT in the Range of Frequencies 40-3000 GHz (Page 265) Anatoli Vladimirovich Aksenchyk (Belarusian State University of Information and Radioelectronics), Irina Fedorovna Kirinovich (Belarusian State University of Information and Radioelectronics) P3.7: Electron Beam Interaction with the Wave Excited in a Dielectric Plate (Page 267) Yuriy Nikitich Pchelnikov (Consultant) P3.8: Comparison of Different Methods of Suppression of Self-Excitation Broadband TWT on a Backward Wave in View of a Beam Expansion (Page 269) Andrey Borisovich Danilov (The Federal State Unitary Enterprise NPP "Almaz"), Elena Moiseevna Il'ina (The Federal State Unitary Enterprise NPP "Almaz") Alexander Daidovich Rafalovich (The Federal State Unitary Enterprise NPP "Almaz") P3.9: Interaction Study on Overmoded Traveling-wave Tube at W-band (Page 271) Zhaojun Zhu (University of Electronic Science and Technology of China), Baofu Jia (University of Electronic Science and Technology of China), Chaolei Wei (University of Electronic Science and Technology of China) P3.10: Novel Slow-Wave Structure for High Voltage TWTs (Page 273) Yuriy N. Pchelnikov (Consultant), Alexander N. Vlasov (U.S. Naval Research Laboratory) P3.11: Asymmetric Slow-Wave Structures for the Sheet Electron Beam TWT (Page 275) Yuriy N. Pchelnikov (Consultant), Alexander N. Vlasov (Naval Research Laboratory) P3.12: Cylindrical, Periodic Surface-Lattice Cherenkov Source (Page 277) Amy J. MacLachlan (University of Strathclyde), Ivan V. Konoplev (University of Oxford), Craig W. Robertson (University of Strathclyde), Adrian W. Cross (University of Strathclyde), Alan D. R. Phelps (University of Strathclyde) A Novel Serpentine Waveguide Slow-wave Structure with caps and Posts (Page 279) P3.13: Peng Diao (University of Electronic Science and Technology of China), Zhaoyun Duan (University of Electronic Science and Technology of China), Xiong Xu (University of Electronic Science and Technology of China), Yang Liu (University of Electronic Science and Technology of China), Jiangiang Lai (University of Electronic Science and Technology of China), Xin Guo (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) P3.14: Capped Waveguide Slow-Wave Structure for Millimeter Wave Travelling Wave Tube (Page NA) Alan Fang (Consultant) Stability Analysis of 2π Mode Operation in the Beam-wave Interaction Process for a P3.15: Three-gap Hughes-type Coupled Cavity Chain (Page 281) Jirun Luo (Chinese Academy of Sciences), Jian Cui (Chinese Academy of Sciences), Min Zhu (Chinese Academy of Sciences), Wei Guo (Chinese Academy of Sciences) Effect of Manufacturing Tolerances of Helix Diameter on TWT Performances (Page 283) P3.16: Abhishek Jain (CSIR-Central Electronics Engineering Research Institute), Dheeraj Kumar (CSIR-Central Electronics Engineering Research Institute), N. Purshotaman (CSIR-Central Electronics Engineering Research Institute), Rajendra Kumar Sharma (CSIR-Central Electronics Engineering Research Institute), Vishnu Srivastava (CSIR-Central Electronics Engineering Research Institute), Sanjay Kumar Ghosh (CSIR-Central Electronics Engineering Research Institute) Flexible Manufacturing of Helix TWT's and Automation Justification (Page 285) P3.17: Reed Collins (Communications and Power Industries LLC), Mel Wijangco (Communications and Power Industries LLC) An Analysis on Physical Properties of Refractory Metals and Alloys Used as Materials P3.18: for TWT Helix (Page 287) Shike Zhao (Chinese Academy of Sciences), Changyou Xu (Chinese Academy of Sciences), Lixin Wang (Chinese Academy of Sciences), Yanchun Yu (Chinese Academy of Sciences), Xin Wang (Chinese Academy of Sciences) P3.19: Heat Dissipation from Helical Periodic Structure in Vacuum (Page 289) Vishant Gahlaut (CSIR-Central Electronics Engineering Research Institute), Parvez Alvi (Banasthali University), Rajendra Kumar Sharma (CSIR-Central Electronics Engineering Research Institute), Vishnu Srivastava (CSIR-Central Electronics Engineering Research Institute), Sanjay Kumar Ghosh (CSIR-Central Electronics Engineering Research Institute)
- P3.20:

The Radial Klinoorotron (Page 291)

Alexandr Alexandrovich Kurayev (Belarusian State University of Information and Radioelectronics), Anatoli Konstantinovich Sinitsyn (Belarusian State University of Information and Radioelectronics)

- **P3.21:** Design and Simulation of a Q-Band Helix TWT (Page 293) Minghui Liu (Beijing Vacuum Electronics Research Institute), Shaolun Cai (Beijing Vacuum Electronics Research Institute), Jinjun Feng (Beijing Vacuum Electronics Research Institute)
- **P3.22:** Development of W-band CW TWT Amplifier (Page 295) Yinfu Hu (Beijing Vacuum Electronics Research Institute), Jinjun Feng (Beijing Vacuum Electronics Research Institute), Jun Cai (Beijing Vacuum Electronics Research Institute), Yinhua Du (Beijing Vacuum Electronics Research Institute), Ye Tang (Beijing Vacuum Electronics Research Institute), Xianping Wu (Beijing Vacuum Electronics Research Institute), Yinxing Chen (Beijing Vacuum Electronics Research Institute), Wenlei Gao (Beijing Vacuum Electronics Research Institute)

P3.23: Millimeter-Wave Gain Experiments with a Wide-Band Omniguide Traveling-Wave Tube (Page 297) Dmitry Shchegolkov (Los Alamos National Laboratory), William Brian Haunes (Los Alamos National Laboratory)

William Brian Haynes (Los Alamos National Laboratory), Richard M. Renneke (Los Alamos National Laboratory), Evgenya Ivanovna Simakov (Los Alamos National Laboratory)

P3.24: Development of the K-band 100W TWT with Radiation Cooling Collector (Page 299) Bo Qu (Beijing Vacuum Electronics Research Institute), JinJun Feng (Beijing Vacuum Electronics Research Institute), MingHui Liu (Beijing Vacuum Electronics Research Institute), Yanhua Shang (Beijing Vacuum Electronics Research Institute)

P3.25: Design and Preliminary Experiment of a V-band Helix TWT (Page NA) Li Li (Beijing Vacuum Electronics Research Institute), Jinjun Feng (Beijing Vacuum Electronics Research Institute), Bo Qu (Beijing Vacuum Electronics Research Institute), Yanhua Shang (Beijing Vacuum Electronics Research Institute)

P3.26: Simulation of a Ka-band Chebyshev" Traveling Wave Tube on Coupled Cavity Chain" (Page 301) Dutitive A loward cavies Kompton (Endowed State United State United State United State United States)

Dmitriy Alexandrovich Komarov (Federal State Unitary Enterprise Research and Production Corporation),

Sergey Pavlovich Morev (Federal State Unitary Enterprise Research and Production Corporation)

P3.31: Stratified Carbon Film for Large Current Emission Synthesized by a Local Heating CVD Method and Its Growth Mechanism (Page 311) Yunsong Di (Nanjing Normal University & Southeast University),

Yunsong Di (Nahing Normal University) & Southeast University) Xiaobing Zhang (Southeast University), Mei Xiao (Southeast University), Feng Gao (Southeast University), Wei Lei (Southeast University), Yunkang Cui (Southeast University)

Session 13: Klystrons II

Session Chair: Craig Wilsen (L-3 Communications EDD)

13.1: Design and Operation of a 100 kW CW X-Band Klystron for Spacecraft

Communications (Page 315) Adam Balkcum (Communications and Power Industries LLC), Albert Mizuhara (Communications and Power Industries LLC), Brad Stockwell (Communications and Power Industries LLC) Rasheda Begum (Communications and Power Industries LLC), Lydia Cox (Communications and Power Industries LLC), Scott Forrest (Communications and Power Industries LLC), Mark Perrin (Communications and Power Industries LLC), Louis Zitelli (Communications and Power Industries LLC), Daniel Hoppe (California Institute of Technology), Michael Britcliffe (California Institute of Technology), Yakov Vodonos (California Institute of Technology), Ronglin Liou (California Institute of Technology), Daniel Kelley (California Institute of Technology), Ernest Stone (California Institute of Technology) A High Gain 25 MW Ten-Cavity Output Circuit TW Klystron for Testing High Gradient 13.2: Linac Structures in a 64 MW 17 GHz Resonant Ring (Page 317) Jacob Haimson (Haimson Research Corporation), Beverly Mecklenburg (Haimson Research Corporation) Large-Signal Modeling of the 13 kW L-Band Klystron for the CEBAF 12 GeV Upgrade

13.3: Large-Signal Modeling of the 13 kW L-Band Klystron for the CEBAF 12 GeV Upgrade (Page 319) Christopher R. Walz (L-3 Communications Electron Devices), Michael A. Boyle (L-3 Communications Electron Devices),

Holger Schult (L-3 Communications Electron Devices), Richard B. True (L-3 Communications Electron Devices)

13.4: Optimized Design of a 10 MW, L-Band, Annular Beam Klystron (Page 321) Michael Read (Calabazas Creek Research, Inc), Robert Jackson (Calabazas Creek Research, Inc), Patrick Ferguson (Calabazas Creek Research, Inc), Gregory Nusinovich (Calabazas Creek Research, Inc),

R. Lawrence Ives (Calabazas Creek Research, Inc)

 13.5: 2.8 MWp 352 MHz long pulse klystron for proton linac (Page 323) Armel Beunas (*Thales Electron Devices*), Rodolphe Marchesin (*Thales Electron Devices*), Emmanuel Rampnoux (*Université Paris Sud*), Jean Lesrel (*Université Paris Sud*)

13.6: Development of a 10 kW CW High Efficiency S-Band PPM Klystron (Page 325) Patrick Ferguson (Calabazas Creek Research, Inc.), Michael Read (Calabazas Creek Research, Inc.),

R. Lawrence Ives (Calabazas Creek Research, Inc.),

Session 14: Gyrotron Applications

Session Chair: Richard Temkin (Massachusetts Institute of Technology)

14.1: High-Frequency CW Gyrotrons for NMR/DNP Applications (Page 327)

Monica Blank (Communications and Power Industries LLC), Philipp Borchard (Communications and Power Industries LLC), Stephen Cauffman (Communications and Power Industries LLC), Kevin Felch (Communications and Power Industries LLC), Melanie Rosay (Bruker Biospin), Leo Tometich (Bruker Biospin)

14.2: A Novel High Power 3 GHz Tunable 250 GHz Gyrotron for Dynamic Nuclear Polarization (Page 329)

Alexander B. Barnes (Massachusetts Institute of Technology), Emilio A. Nanni (Massachusetts Institute of Technology), Sudheer Jawla (Massachusetts Institute of Technology), Qing Z. Ni (Massachusetts Institute of Technology), Judith Herzfeld (Brandeis University), Robert G. Griffin (Massachusetts Institute of Technology), Richard J. Temkin (Massachusetts Institute of Technology)

14.3: Design of a 10kW/28GHz Gyrotron with a Segmented Emitter using Controlled-Porosity Reservoir Cathodes (Page 331)

Anton Malygin (Karlsruhe Institute of Technology, Association EURATOM-KIT), Stefan IIIy (Karlsruhe Institute of Technology, Association EURATOM-KIT), Ioannis Pagonakis (Karlsruhe Institute of Technology, Association EURATOM-KIT), Bernhard Piosczyk (Karlsruhe Institute of Technology, Association EURATOM-KIT), Stefan Kern (Karlsruhe Institute of Technology, Association EURATOM-KIT), Joerg Weggen (Karlsruhe Institute of Technology, Association EURATOM-KIT), Manfred Thumm (Karlsruhe Institute of Technology, Association EURATOM-KIT), Kostas Avramides (SECE, National Technical University of Athens), R. Lawrence Ives (Calabazas Creek Research, Inc.), David Marsden (Calabazas Creek Research, Inc.)

14.4: Compact Gyrotron Systems for Dynamic Nuclear Polarization NMR Spectroscopy (Page 333)

Jagadishwar Rao Sirigiri (*Bridge12 Technologies, Inc.*), Thorsten Maly (*Bridge12 Technologies, Inc.*), Louis Tarricone (*Bridge12 Technologies, Inc.*)

14.5: 1.5 MW, 110 GHz Gyrotron Breakdown in Air (Page 335) Jason Samuel Hummelt (Massachusetts Institute of Technology),

Alan M. Cook (Massachusetts Institute of Technology), Michael A. Shapiro (Massachusetts Institute of Technology), Rick J. Temkin (Massachusetts Institute of Technology)

14.6: Design and Experiment Demonstration of a W-band Second-harmonic Gyrotron with Complex Cavity (Page 337)

Liu Ying-hui (University of Electronic Science and Technology of China), Niu Xinjian (University of Electronic Science and Technology of China), Li Hongfu (University of Electronic Science and Technology of China), Yao Jun (University of Electronic Science and Technology of China), Jun Zhou (University of Electronic Science and Technology of China), Lei Chaojun (University of Electronic Science and Technology of China), Jiang Hong (University of Electronic Science and Technology of China), Yang Yi (University of Electronic Science and Technology of China), Sun Yu (University of Electronic Science and Technology of China),

Session 15: Cathode Simulation

Session Chair: Kevin Jensen (U.S. Naval Research Laboratory)

15.2: Electrostatic Time-Domain PIC Simulations of RF Density-Modulated Electron Sources with MICHELLE (Page 341)

John J. Petillo (Science Applications International Corporation), Chris Kostas (Science Applications International Corporation), Dimitrios Panagos (Science Applications International Corporation), Serguei Ovtchinnikov (Science Applications International Corporation), Alex Burke (Science Applications International Corporation), Thomas M. Antonsen, Jr. (University of Maryland), Edward L. Wright (Beam-Wave Research, Inc.), Khanh T. Nguyen (Beam-Wave Research, Inc.), Eric Nelson (Nelson Variational Electrodynamics, LLC), Ben L. Held (Simulation Technology and Applied Research, Inc.), John F. DeFord (Simulation Technology and Applied Research, Inc.), Kevin L. Jensen (U.S. Naval Research Laboratory), John A. Pasour (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), Lars Ludeking (ATK Mission Systems Group)

15.6: On 2D Simulation of Particles Motion in Axially Symmetric Field (Page 347) Anatoly Vasilievich Galdetskiy (FSUE Istok)

Session 16: Space TWTs/Systems

Session Chair: Russell Martin (L-3 Communications ETI)

16.1: Space Qualified, 75-Watt V-band Helix TWTA (Page 349)

Neal R. Robbins (L-3 Communications Electron Technologies, Inc.), Daniel R. Dibb (L-3 Communications Electron Technologies, Inc.), William L. Menninger (L-3 Communications Electron Technologies, Inc.), Xiaoling Zhai (L-3 Communications Electron Technologies, Inc.), David E. Lewis (L-3 Communications Electron Technologies, Inc.)

16.2: Exploitation of Q/V-band for Future Broadband Telecommunication Satellites (Page 351) Marinella Aloisio (European Space Agency ESA-ESTEC), Piero Angeletti (European Space Agency ESA-ESTEC), Francesc Coromina (European Space Agency ESA-ESTEC), Riccardo De Gaudenzi (European Space Agency ESA-ESTEC)

16.3: The Mini-RF Microwave Power Module for the Lunar Reconnaissance Orbiter: Status Update (Page 353)

Mark A. Basten (Northrop Grumman Electronic Systems), Joe Duthie (Northrop Grumman Electronic Systems), Al Ferek (Northrop Grumman Electronic Systems), Diane LaFortune (Northrop Grumman Electronic Systems), Jeff Perkins (Northrop Grumman Electronic Systems), John Rein (Northrop Grumman Electronic Systems)

 16.4: Space Qualified 140 Watt Linearized L-band Helix TWTA (Page 355) Jon R. Feicht (L-3 Communications Electron Technologies, Inc.), Keith N. Loi (L-3 Communications Electron Technologies, Inc.), William L. Menninger (L-3 Communications Electron Technologies, Inc.), Jon G. Nicolello (L-3 Communications Electron Technologies, Inc.), Xiaoling Zhai (L-3 Communications Electron Technologies, Inc.)

16.5: High Power L-band TWTs for New Navigations System Based (Page NA) Peter Ehret (*Thales Electron Devices*)

Session 17: Guns

Session Chair: Dan Goebel (Jet Propulsion Laboratory)

- 17.1: Rare Earth Elements and Permanent Magnets A Supply Chain and Technology Overview (Page 357) Peter C. Dent (Electron Energy Corporation)
- 17.2: Dual-Element Switching in Pierce Guns (Page 359) Richard B. TRUE (L-3 Communications Electron Devices Division)

17.3: Intense Electron Beams with Centrifugal Electrostatic Focusing (Page 361) Vadim Jabotinski (Beam-Wave Research), Khanh T. Nguyen (Beam-Wave Research), Yuriy N. Pchelnikov (SloWaveS, Inc.), Baruch Levush (U.S. Naval Research Laboratory),

- John Pasour (U.S. Naval Research Laboratory), David Abe (U.S. Naval Research Laboratory),
- John Petillo (Scientific Applications International Corporation),
- David Chernin (Scientific Applications International Corporation)

17.4: High Power E-Gun for Broad Bandwidth UHF Applications (Page NA) Kenneth Elkane Williams (*Applied Science and Engineering, LLC*), James Matthew Stamm (*North Star Scientific Corp*), Kim Martin Gunther (*HeatWave Labs, Inc*), Marc Raphael Curtis (*HeatWave Labs, Inc*)

Session 18: Basic Emission Physics II

Session Chair: Ivor Brodie (University of California)

- 18.2: Influence of Ion Effects on a Space Charge Limited Field Emission Flow: From Non-relativistic to Ultra-relativistic Regimes (Page 365) M. C. Lin (Fu Jen Catholic University),
 - P. S. Lu (Fu Jen Catholic University),
 - P. C. Chang (Fu Jen Catholic University),
 - J. P. Verboncoeur (University of California, Berkeley)
- 18.3: Exact Formulas for Space Charge Limited Flow in a Planar Diode: New Relativistic Child-Langmuir Law (Page 367)
 M. C. Lin (Fu Jen Catholic University)
- 18.4: Effect of Surface Roughness of High Current Density Nano-Particle Cathode for Terahertz Vacuum Devices Application (Page 369) Ranjan Kumer Barik (Seoul National University), Anil Kumar Tanwar (Seoul National University), In Keun Baek (Seoul National University), Kihoon Eom (Seoul National University),
 - Anirban Bera (Seoul National University),

Matlabjon Abdurakhimovich Sattorov (Seoul National University), Sun Hong Min (Seoul National University), Ohjoon J. Kwon (Seoul National University), Gunsik Park (Seoul National University)

Poster Session IV

P4.1: Microwave Tube Electron Gun Simulators: A Cost-benefit Analysis (Page 373) Cesar C. Xavier (Instituto de Pesquisas Energéticas e Nucleares IPEN/CNEN-SP), Claudio C. Motta (University of São Paulo) A Self-consistent General Thermal Field Emission Model (Page 375) P4.2: M. C. Lin (Tech-X Corporation) P4.4: Simulation of the Field Emission Diode Oscillator with Photonic Crystal Resonator (Page 379) Andrej I. Benedik (Saratov State University), Nikita M. Ryskin (Saratov State University), Seong-Tae Han (Korean Electrotechnology Research Institute) P4.5: Computing the Effects of Discrete Coulomb Interaction in Triode Gun with Magnetic Lens (Page 381) Eric Munro (Munro's Electron Beam Software Ltd.), John Rouse (Munro's Electron Beam Software Ltd.), Haoning Liu (Munro's Electron Beam Software Ltd.), Victor Katsap (NuFlare Technology) P4.8: Sheet Beam Wideband Terahertz Extended Interaction Oscillator using Phase shifted Coupling with Staggered Periodicity (Page NA) Ohjoon Kwon (Seoul National University) P4.9: Ellipse-Shaped Electron Gun for W-Band Sheet Beam Devices (Page 385) Xianfeng Tang (University of Electronic Science and Technology of China), Zhaoyun Duan (University of Electronic Science and Technology of China), Xin Guo (University of Electronic Science and Technology of China), Yanshuai Wang (University of Electronic Science and Technology of China), Bo Dang (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), Yanyu Wei (University of Electronic Science and Technology of China), Yubin Gong (University of Electronic Science and Technology of China) P4.10: Microfabrication of W band Folded Waveguide Slow Wave Structure using Two-step UV-LIGA Technology (Page 387) Li Han Yan (Beijing Vacuum Electronics Research Institute) RF Structure Design for W-Band Folded Waveguide TWT (Page NA) P4.11: Isha Rathi (CSIR-Central Electronics Engineering Research Institute), Rajendra Kumar Sharma (CSIR-Central Electronics Engineering Research Institute), Vimal Vvas (Banasthali University) Vishnu Srivastava (CSIR-Central Electronics Engineering Research Institute), Andre Grede (Technical University), H Henke (Technical University) P4.12: Rhombus-shaped Microstrip Meander-line Slow-wave structure for 140 GHz Travelingwave Tube (Page 389) Fei Shen (University of Electronic Science and Technology of China), Yanyu Wei (University of Electronic Science and Technology of China), Xiong Xu (University of Electronic Science and Technology of China), Jianqiang Lai (University of Electronic Science and Technology of China), Minzhi Huang (University of Electronic Science and Technology of China), Guoqing Zhao (University of Electronic Science and Technology of China), Yubin Gong (University of Electronic Science and Technology of China) P4.13: Design For 0.14 THz Watt Level Folded Waveguide Traveling Wave Tube (Page 391) Zhang Chen (China Academy of Engineering Physics), Yajun Wang (China Academy of Engineering Physics) Simulation Analysis of Nano-CNC fabricated 220 GHz Ultra Wide Band TWTA (Page 393) P4.14: Anisullah Baig (University of California, Davis), Diana Gamzina (University of California), Larry R. Barnett (University of California), Neville C. Luhmann, Jr. (University of California) The Analytical Design of a Folded Waveguide Slow-wave Structure for THz TWT (Page P4.15: 395) Yajun Wang (Chinese Academy of Sciences), Zhang Chen (Chinese Academy of Sciences) P4.16: Design and Microfabrication of 220GHz Clinotron HF Structure (Page 397) Hanyan Li (Beijing Vacuum Electronics Research Institute), Dapeng Ren (Beijing Vacuum Electronics Research Institute), Jinjun Feng (Beijing Vacuum Electronics Research Institute) ICEPIC Simulations of a Folded Waveguide THz TWT (Page NA) P4.17: Paul Gensheimer (U.S. Air Force Research Laboratory/RDHE), Richard Ziolkowski (University of Arizona), Christopher Walker (Steward Observatory), Christian d'Aubigny (TeraVision, Inc.) X-ray Safety Calculations near HPM Sources using ICEPIC and GEANT4/ParRT (Page NA) P4.18: Peter Mardahl (U.S. Air Force Research Laboratory)

P4.19:	Studies on High Power THz Radiation using Nanosecond Pulse in Oversized Relativistic Backward Wave Oscillator (Page NA) Sun-Hong Min (Seoul National University)
P4.21:	Sine Waveguide with a Grating Reflector for 1-THz Backward Wave Oscillator (Page 399) Xiong Xu (University of Electronic Science and Technology of China), Yanyu Wei (University of Electronic Science and Technology of China), Fei Shen (University of Electronic Science and Technology of China), Tao Tang (University of Electronic Science and Technology of China), Huarong Gong (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),
P4.23:	Three Dimensional Magnetic Field Simulator (Page 401) Tao Huang (University of Electronic Science and Technology of China), Quan Hu (University of Electronic Science and Technology of China), JianQing 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), Yuriy Nikitich Pchelnikov (Consultant)
P4.24:	Solution of the TWT Characteristic Equation in the Presence of Loss (Page 403) Yuriy Nikitich Pchelnikov (<i>Consultant</i>),
P4.25:	Simulation of Inter-modulation Components using SUNRAY Code for Large-signal Analysis of a TWT (Page 405) Vishnu Srivastava (CSIR-Central Electronics Engineering Research Institute), Dheeraj Kumar (CSIR-Central Electronics Engineering Research Institute), Abhishek Jain (CSIR-Central Electronics Engineering Research Institute), Vishal Kesari (Defence Research & Development Organization)
P4.26:	Nonlinear Study of Beam-Wave Interaction by Considering the Higher Harmonics (Page 407) Zhaojun Zhu (University of Electronic Science and Technology of China), Baofu Jia (University of Electronic Science and Technology of China), Chaolei Wei (University of Electronic Science and Technology of China)
P4.27:	Analytical and Computational Modeling of Two Relativistic Magnetrons Sharing a Cathode with Combined Power Extraction (Page NA) Michael Lambrecht (U.S. Air Force Research Laboratory), Wilkin Tang (U.S. Air Force Research Laboratory)
P4.28:	On the Reality of "Zero Magnetic" Oscillations of Potential (Page 409) Alexander V. Gritsunov (National Academy of Municipal Economy)
P4.29:	Simulation of the Cathode Rejector for Three-mode Superpower Cherenkov Oscillator (Page 411) Alexander Alexandrovich Kurayev (Belarusian State University of Informatics and Radioelectronics), Alexey Olegovich Rak (Belarusian State University of Informatics and Radioelectronics), Anatoly Konstantinovich Sinitsyn (Belarusian State University of Informatics and Radioelectronics)
	Chair: Gyro-Amplifiers Chair: Monica Blank (Communications and Power Industries) A 250 GHz Photonic Band Gap Gyrotron Traveling Wave Amplifier (Page 413) Emilio Alessandro Nanni (Massachusetts Institute of Technology), Michael A. Shapiro (Massachusetts Institute of Technology), Dichael I. Trachie (Massachusetts Institute of Technology),
19.2:	Richard J. Temkin (Massachusetts Institute of Technology) Operation of a 140 GHz Gyro-amplifier Using a Confocal Waveguide (Page 415) Alexander V. Soane (Massachusetts Institute of Technology), Emilio A. Nanni (Massachusetts Institute of Technology), Michael A. Shapiro (Massachusetts Institute of Technology), Richard J. Temkin (Massachusetts Institute of Technology), Haejin Kim (National Fusion Research Institute)
19.3:	W-Band Gyro-TWA Experiment using a Helically Corrugated Waveguide (Page 417) Wenlong He (University of Strathclyde), Craig R Donaldson (University of Strathclyde), Liang Zhang (University of Strathclyde), Paul McElhinney (University of Strathclyde), Kevin Ronald (University of Strathclyde), Alan D. R. Phelps (University of Strathclyde), Colin Whyte (University of Strathclyde), Adrian W. Cross (University of Strathclyde)
19.4:	New Algorithm for Field Calculation in Tapered Gyrotron Launchers with Adaptive Surface Perturbation (Page 419) Jens Flamm (Karlsruhe Institute of Technology), Jianbo Jin (Karlsruhe Institute of Technology),
19.5:	Manfred Thumm (Karlsruhe Institute of Technology) Research Progress of Ka band Gyro-TWTs in IECAS (Page 421) Qian-Zhong Xue (Chinese Academy of Sciences), Chi-Hai Du (Chinese Academy of Sciences), Pu-Kun Liu (Chinese Academy of Sciences), SHI-Chang Zhang (Chinese Academy of Sciences), Wei Gu (Chinese Academy of Sciences), Yi-Long Su (Chinese Academy of Sciences), Shou-Xi Xu (Chinese Academy of Sciences),

Zhi-Hui Geng (Chinese Academy of Sciences), Shu-jian Wang (Chinese Academy of Sciences)

Jean-Louis Cazaux (Thales Alenia Space),

19.6: Ka-band Gyro-TWA Simulations and Comparison with Experiment (Page 423) Colin G. Whyte (University of Strathclyde), Craig W. Robertson (University of Strathclyde), Kevin Ronald (University of Strathclyde), Alan R. Young (University of Strathclyde), Wenlong He (University of Strathclyde), Adrian W. Cross (University of Strathclyde), Philip MacInnes (University of Strathclyde), Alan D.R. Phelps (University of Strathclyde) Session 20: Components Session Chair: Claudio Paoloni (University of Roma Tor Vergata) 1GHz Instantaneous Wide-Band Analog Predistortion Linearizer for New Telecom 20.1: Satellite Transmit Section (Page 425) Jean-Francois Villemazet (Thales Alenia Space), Hissa Yahi (Thales Alenia Space), Jean-Claude Azzara (Thales Alenia Space), Gregory Mouchon (Thales Alenia Space), Annaick Carlier (Thales Alenia Space), Jean Maynard (Thales Alenia Space),

Geoffroy Soubercaze-Pun (Centre National d'Etudes Spatiales),

Francis Gizard (Centre National d'Etudes Spatiales)
20.2: New Concepts for Pulsed Power Modulators: Implementing a High Voltage Solid-State Marx Modulator (Page 427)
Floyd Arntz (Diversified Technologies, Inc.), Kevin Ostlund (Diversified Technologies, Inc.), Michael Kempkes (Diversified Technologies, Inc.), Jeffrey Casey (Rockfield Research Inc)

20.3: A System Study to Investigate the Feasibility of Terabit/s Satellites (Page 429) Marinella Aloisio (European Space Agency-European Space and Technology Centre), Piero Angeletti (European Space Agency-European Space and Technology Centre), Francesc Coromina (European Space Agency-European Space and Technology Centre), Domenico Mignolo (European Space Agency-European Space and Technology Centre), Daniele Petrolati (European Space Agency-European Space and Technology Centre), Emiliano Re (European Space Agency-European Space and Technology Centre),

- 20.4: Multi-Stage Depressed Collector Design Using MICHELLE in ANALYST (Page 431) Deepika Gajaria (Communications and Power Industries LLC), Michael Cusick (Communications and Power Industries LLC), Jose Luis Ramirez (Communications and Power Industries LLC), Brad Stockwell (Communications and Power Industries LLC), John DeFord (AWR Corp/STAAR), Ben Held (AWR Corp/STAAR), John J Petillo (Science Applications International Corporation), Alexander Burke (Science Applications International Corporation)
- 20.5: On the Isolation Performance of MPAs in Satellite Transponders (Page 433) Salvatore D'addio (European Space Agency-European Space and Technology Centre), Marinella Aloisio (European Space Agency-European Space and Technology Centre), Piero Angeletti (European Space Agency-European Space and Technology Centre)
- 20.6: An Improved Method for Studying the High-Power Miter Bend (Page 435) Wu Zewei (University of Electronic Science and Technology of China), Li Hao (University of Electronic Science and Technology of China), Hu Xiaojun (University of Electronic Science and Technology of China), Xu Jianhua (University of Electronic Science and Technology of China)

Session 21: Photo/Secondary Emission

Session Chair: Martin Kordesch (Ohio University)

21.1: Photomodulated Carbon Nanotubes Cold Cathode (Page 437) Laurent Gangloff (Thales Research and Technology), Stéphane Xavier (Thales Research and Technology), Christophe Bourat (Thales Electron Devices), Nicolas Martinez (Thales Electron Devices), Jean-Paul Mazellier (Thales Research and Technology), Jean-Philippe Schnell (Thales Research and Technology), Kenneth Teo (Aixtron Ltd.), Pascal Ponard (Thales Electron Devices), Pierre Legagneux (Thales Research and Technology) 21.2: Operation and Analysis of a Sintered-Wire Cesium Dispenser Photocathode (Page NA) Eric J. Montgomery (University of Maryland), Blake C. Riddick (University of Maryland), Patrick G. O'Shea (University of Maryland), Donald W. Feldman (University of Maryland),

 R. Lawrence Ives (Calabazas Creek Research, Inc.)
 21.5: Electron Bunching From a DC-biased Single Surface Multipactor (Page 443) Min Sup Hur (UNIST), Dongwon Shin (UNIST), Seok-Gy Jeon (KERI), Jung-Il Kim (KERI), Geun-Ju Kim (KERI)

Session 22: TWTs III

Session Chair: Neal Robbins (L-3 Communications Electron Technologies, Inc.)

- 22.1: The More Things Change the More They Stay the Same: A Retrospective and Prospective Look at TWTs (Page 445)
- Malcolm J. Carruthers (Comtech Xicom Technology)
 22.2: Space qualified low / high power RADAR TWTs (Page NA) Ernst Bosh (Thales Electron Devices)
- 22.3: A Study of Waveguide Loaded with Periodical Dielectrics (Page 447) Yong Han (University of Maryland), Gregory S. Nusinovich (University of Maryland), Thomas M. Antonsen, Jr. (University of Maryland), John Rodgers (University of Maryland), Oleksandr Sinitsyn (University of Maryland)
- **22.4:** Novel Multi Helix Structure for High Frequency Application (Page 449) Vemula Bhanu Naidu (*Defence Research & Development Organization*), Subrata Kumar Datta (*Defence Research & Development Organization*), Lalit Kumar (*Defence Research & Development Organization*)

22.5: Multi Stage Depressed Collector with reduced Size and Weight for Space Applications (Page 451) Nitin Ji Shrivastav (Central Electronics Engineering Research Institute),

Seema Yadav (Banasthali University), A Mercy Latha (Central Electronics Engineering Research Institute), Dheeraj Kumar (Central Electronics Engineering Research Institute), Sanjay Kumar Ghosh (Central Electronics Engineering Research Institute), Vishnu Srivastava (Central Electronics Engineering Research Institute), Rajendra Kumar Sharma (Central Electronics Engineering Research Institute)

Session 23: W-Band TWTs

Session Chair: John Pasour (U.S. Naval Research Laboratory) 23.1: Experimental Study on 0.1 THz Clinotron (Page 453)

Matlabjon Abdurakhimovich Sattorov (Seoul National University, Seoul-Teracom, Co. Ltd),
Eduard Khutoryan (A. Usikov Institute for Radio Physics and Electronics),
Konstantin Alexandrovich Lukin (A. Usikov Institute for Radio Physics and Electronics),
Gun-Sik Park (Seoul Natinal University, Center for THz-Bio Application Systems, Seoul-Teracom, Co, Ltd.),
Anirban Bera (Seoul National University),
Ranjan Barik (Seoul National University),
Ohjoon Kwon (Seoul National University),
Seoul National University),

Sun-Hong Min (Seoul National University), Ashok Sharma (Seoul National University), Anil Tanwar (Seoul National University)

23.2: Development of W-band Backward-Wave Oscillator (Page 455) Chan-Wook Baik (Samsung Advanced Institute of Technology), Ho Young Ahn (Samsung Advanced Institute of Technology), Yongsung Kim (Samsung Advanced Institute of Technology), Jooho Lee (Samsung Advanced Institute of Technology), Seogwoo Hong (Samsung Advanced Institute of Technology), Junhee Choi (Samsung Advanced Institute of Technology),

Sunite Cin (Samsung Advanced Institute of Technology), Sunit Kim (Samsung Advanced Institute of Technology), George A. Collins (Calabazas Creek Research, Inc.), R. Lawrence Ives (Calabazas Creek Research, Inc.), Jongmin Kim (Samsung Advanced Institute of Technology)

 23.3: Over-moded W-Band Traveling Wave Tube Design (Page 457) Elizabeth J. Kowalski (Massachusetts Institute of Technology), Michael A. Shapiro (Massachusetts Institute of Technology), Richard J. Temkin (Massachusetts Institute of Technology)
 22.4.

23.4: PIC Simulation for W-Band Planar Helix with Straight-Edge Connections (Page 459) Ciersiang Chua (Nanyang Technological University), Sheel Aditya (Nanyang Technological University), Julius Ming Lin Tsai (Institute of Microelectronics, Agency for Science, Technology and Research), Zhongxiang Shen (Nanyang Technological University)

23.5:

Analysis of a W-band Meander-line Slow-wave Structure for Millimeter-wave Travelingwave Tubes (Page 461)

M. Sumathy (*Microwave Tube Research and Development Centre*), Latha Christie (*Microwave Tube Research and Development Centre*), Subratha Kumar Datta (*Microwave Tube Research and Development Centre*), Lalit Kumar (*Microwave Tube Research and Development Centre*)

Poster Session V

P5.2: An Investigation of Sustainable Machining Performance for Controlled Surface Quality Requirements in High Temperature and Refractory Alloys, Setting a New Direction for Machining Research and Development Cryogenics (LIN) (Page 475) Michael Effgen *(Semicon Associates)*, Ibrahim S. Jawahir *(University of Kentucl*

Ibrahim S. Jawahir (University of Kentucky) Alternative Ceramic Potting Materials for Dispenser Cathodes (Page 483) P5.6: Phillip Swartzentruber (University of Kentucky), Michael Collier (University of Kentucky). Rachel DeWees (University of Kentucky), Whitney Epperson (University of Kentucky), Christina Poole (University of Kentucky), Ben Rupp (University of Kentucky), David Bowling (University of Kentucky), Elizabeth Fadde (University of Kentucky), Adam Floyd (University of Kentucky), Paul Rottmann (University of Kentucky), Rachel Wilson (University of Kentucky), T. John Balk (University of Kentucky), Scott Roberts (Semicon Associates), Jim Tarter (Semicon Associates), Michael Effgen (Semicon Associates) P5.9: Design and Simulation of a Megawatt Class Conventional Magnetron (Page 489) Timothy Paul Fleming (U.S. Air Force Research Laboratory), Michael Lambrecht (U.S. Air Force Research Laboratory), Peter Mardahl (U.S. Air Force Research Laboratory, Compact A6 Magnetron with Permanent Magnet (Page 491) P5.10: Christopher Leach (University of New Mexico), Sarita Prasad (University of New Mexico), Mikhail Fuks (University of New Mexico), Edl Schamiloglu (University of New Mexico), Brad W. Hoff (U.S. Air Force Research Laboratory), Matthew Franzi (University of Michigan), David M. French (U.S. Air Force Research Laboratory). Geoffrey Greening (University of Michigan), Ronald M. Gilgenbach (University of Michigan) A Pi-Mode Extraction Scheme for the Axial B-Field Recirculating Planar Magnetron P5.11: (Page 493) Brad. W. Hoff (Air Force Research Laboratory), Matthew Franzi (Plasma, Pulsed Power, and Microwave Laboratory), David M. French (Air Force Research Laboratory), Geoffrey Greening (Plasma, Pulsed Power, and Microwave Laboratory), Ronald M. Gilgenbach (Plasma, Pulsed Power, and Microwave Laboratory), Matthew Franzi (University of Michigan), Experimental Demonstration of the Output Characteristics of the A6 Magnetron on P5.12: Pulserad 110a, a Very Short Risetime Accelerator at UNM (Page 495) Sarita Prasad (University of New Mexico), Christopher Leach (University of New Mexico), Ken Prestwich (Kenneth Prestwich Consulting), C. Jerald Buchenauer (University of New Mexico), Mikhail Fuks (University of New Mexico), Edl Schamiloglu (University of New Mexico) P5.13: Design of Single Disc RF Window for 120 GHz, 1MW Gyrotron (Page 497) Mukesh Kumar Alaria (CSIR Central Electronics Engineering Research Institute), Vikas Bhomia (CSIR Central Electronics Engineering Research Institute), Y. Choyal (Devi Ahilyq Vishwavidyalaya), Ashok Kumar Sinha (CSIR Central Electronics Engineering Research Institute) P5.14: Study and Design of a Single-Anode Magnetron Injection Gun for W band Gyrotron (Page 499) Jiang Hong (University of Electronic Science and Technology of China), Liu Ying Hui (University of Electronic Science and Technology of China), Niu Xin Jian (University of Electronic Science and Technology of China) Output System Design for 170GHz, 0.5 MW Gyrotron for ECRH Application (Page 501) P5.15: Parth Chandulal Kalaria (Indian Institute of Technology), Kartikeyan V. Machavaram (Indian Institute of Technology), Manfred Thumm (Karlsruhe Institute of Technology) P5.16: A Design of Inner Quasi-optical Mode Converter for 95GHz Whispering Gallery Mode Gyrotron (Page 503) Hu Wang (Chinese Academy of Sciences), Zhi-Hui Geng (Chinese Academy of Sciences), Shou-Xi Xu (Chinese Academy of Sciences), Pu-Kun Liu (Chinese Academy of Sciences) P5.17: Design and Experiment of the Conventional Collector for W-band Gyrotron Oscillator (Page 505) Zhi-Hui Geng (Chinese Academy of Science), Yi-Nong Su (Chinese Academy of Science), Pu-Kun Liu (Chinese Academy of Science), Shi-Chang Zhang (Chinese Academy of Science), Shou-Xi Xu (Chinese Academy of Science), Qian-Zhong Xue (Chinese Academy of Science), Wei Gu (Chinese Academy of Science),

Niu Xinjian (University of Electronics Science and Technology),

Gu Ling (Southwest University for Nationalities) P5 19 Analysis of 94GHz Low Voltage Second-Harmonic Gyrotron (Page 509) Zhiliang Li (Beijing Vacuum Electronics Research Institute), Jinjun Feng (Beijing Vacuum Electronics Research Institute), Efeng Wang (Beijing Vacuum Electronics Research Institute), Bentian Liu (Beijing Vacuum Electronics Research Institute), Xu Zeng (Beijing Vacuum Electronics Research Institute), Tiechang Yan (Beijing Vacuum Electronics Research Institute) Design of interaction Cavity for 94GHz TE03-mode gyrotron (Page 511) P5.20: Bentian Liu (Beijing Vacuum Electronics Research Institute), Zhiliang Li (Beijing Vacuum Electronics Research Institute), Efeng Wang (Beijing Vacuum Electronics Research Institute), Xu Zeng (Beijing Vacuum Electronics Research Institute), Jinjun Feng (Beijing Vacuum Electronics Research Institute), Tiechang Yan (Beijing Vacuum Electronics Research Institute) Design and Simulation of 94GHz Magnetron Injection Gun (Page 513) P5.21: Chaojun Lei (The Chinese People's Armed Police Force Academy)< Sheng Yu (University of Electronics Science and Technology of China), Xinjian Niu (University of Electronics Science and Technology of China), Yinghui Liu (University of Electronics Science and Technology of China), Jianhua Guo (University of Electronics Science and Technology of China), Shenyong Hou (University of Electronics Science and Technology of China), Yusheng Zhao (University of Electronics Science and Technology of China) P5.22: A Broadband Corrugated Horn for a W-band Gyro-TWA (Page 515) Paul McElhinney (University of Strathclyde) Craig R. Donaldson (University of Strathclyde), Wenlong He (University of Strathclyde), Liang Zhang (University of Strathclyde), Kevin Ronald (University of Strathclyde), Alan D.R. Phelps (University of Strathclyde), Adrian Cross (University of Strathclyde) P5.23: Analysis of Rflections of the Output Port on Saturated Power in TE01 Gyrotron Traveling Wave Amplifier (Page 517) Sun Haiyan (North China University of Technology), Jiang Yanfeng (North China University of Technology), Cai Xingquan (North China University of Technology) P5.24: Wideband TE₀₁-HE₁₁ Mode Converter for Gyro-TWT Applications (Page 519) Niu Xinjian (University of Electronics Science and Technology), Gu Ling (Southwest University for Nationalities) Design of a Q-band gyro-TWT (Page 521) P5.25: Bentian Liu (Beijing Vacuum Electronics Research Institute), Zhiliang Li (Beijing Vacuum Electronics Research Institute), Efeng Wang (Beijing Vacuum Electronics Research Institute), Xu Zeng (Beijing Vacuum Electronics Research Institute), Jinjun Feng (Beijing Vacuum Electronics Research Institute), Tiechang Yan (Beijing Vacuum Electronics Research Institute) P5.26: Girotron at slowed E_{0i}-modes of corrugated waveguide (Page 523) Alexandr Alexandrovich Kurayev (Belarusian State University of Informatics and Radioelectronics), Vladimir Vladimirovich Matveyenko (Belarusian State University of Informatics and Radioelectronics), Anatoli Konstantinovich Sinitsyn (Belarusian State University of Informatics and Radioelectronics) PIC Simulation of a W-band gyroklystron amplifier (Page 525) P5.27: Shou-xi Xu (Chinese Academy of Science), Pu-kun Liu (Chinese Academy of Science), Qian-zhong Xue (Chinese Academy of Science), Zhi-hui Geng (Chinese Academy of Science), Yi-nong Su (, Chinese Academy of Science), Chao-hai Du (Chinese Academy of Science), Gao-feng Liu (, Chinese Academy of Science) P5.28: Calculation of Characteristics of Giroton-multiplier (Page 527) Alexandr Alexandrovich Kurayev (Belarusian State University of Informatics and Radioelectronics), Vladimir Vladimirovich Matveyenko (Belarusian State University of Informatics and Radioelectronics). Anatoli Konstantinovich Sinitsyn (Belarusian State University of Informatics and Radioelectronics) P5.29: Numerical Investigation of Gyro-Multiplier Schemes (Page 529) David A. Constable (University of Strathclyde), Ilya V. Bandurkin (Russian Academy of Sciences), Wenlong He (University of Strathclyde), Adrian W. Cross (University of Strathclyde). Andrey V. Savilov (Russian Academy of Sciences), Alan D.R. Phelps (University of Strathclyde), Vladimir L. Bratman (Russian Academy of Sciences), Kevin Ronald (University of Strathclyde) P5.30: Two-mode gyrotron (Page) 31)

Stanislav Vasilevich Kolosov (Belarus State University of Informatics and Radioelectronics), Alexander Alexanderovich Kurayev (Belarus State University of Informatics and Radioelectronics), Alexander Vasilevich Senko (Belarus State University of Informatics and Radioelectronics)

Session 25: Modeling II

Session Chair: Thuc Bui (Calabazas Creek Research, Inc.)

25.1: Current Status of the Large-signal Code TESLA: Recent Development and New Applications (Page 533) Igor A. Chernyavskiy (U.S. Naval Research Laboratory), Alexander N. Vlasov (U.S. Naval Research Laboratory), Simon J. Cooke (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), Thomas M. Antonsen, Jr. (University of Marvland), Khanh T. Nguyen (Beam-Wave Research, Inc.), Edward L. Wright (Beam-Wave Research, Inc.) Validation Study for the Large-signal Code TESLA-CC Based on Experimental Ka-25.2: Band Coupled-Cavity TWT (Page 535) Igor A. Chernyavskiy (U.S. Naval Research Laboratory), Alexander N. Vlasov (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), Thomas M. Antonsen, Jr. (University of Maryland), David P. Chernin (Science Applications International Corporation), James R. Legarra (Communications and Power Industries LLC) 25.3: Effects of Multiple Internal Reflections on the Small Signal Gain and Phase of a TWT (Page 537) David Chernin (Science Applications International Corporation), Yue Ying Lau (University of Michigan), Ian Rittersdorf (University of Michigan), Thomas Antonsen, Jr. (University of Maryland), Baruch Levush (U.S. Naval Research Laboratory) 25.4: Advances in Fabrication Error Analysis for a mm-wave Ring-Bar TWT Circuit (Page 539) Sean Sengele (University of Wisconsin - Madison), Marc Barsanti (L-3 Communications Electron Devices Division), Tom Hargreaves (L-3 Communications Electron Devices Division), Carter Armstrong (L-3 Communications Electron Devices Division), John H. Booske (University of Wisconsin - Madison), Y.Y. Lau (University of Michigan), M. C. Lin (Tech-X Corporation), D. N. Smithe (Tech-X Corporation) 25.6: Modeling of Drive Induced Oscillations in a Coupled Cavity TWT (Page 543) Alexander N. Vlasov (U.S. Naval Research Laboratory) Igor A. Chernyavskiy (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory), James R. Legarra (Communications and Power Industries LLC (contract)). David Chernin (Science Applications International Corporation), Thomas M. Antonsen, Jr. (Science Applications International Corporation) Session 26: 220 GHz Session Chair: John Booske (University of Wisconsin-Madison, Madison) Embedded Monofilament UV-LIGA Techniques for Microfabrication of Beam Tunnels 26.1: in a 220 GHz Wideband Serpentine Waveguide Amplifier (Page 545) Colin D. Joye (U.S. Naval Research Laboratory), Jeffrey P. Calame (U.S. Naval Research Laboratory), Alan M. Cook (U.S. Naval Research Laboratory), Khanh T. Nguyen (Beam-Wave Research, Inc.), Edward L. Wright (Beam-Wave Research, Inc.), Dean E. Pershing (Beam-Wave Research, Inc.), Baruch Levush (U.S. Naval Research Laboratory) 26.2: Serpentine Waveguide 220 GHz Millimeter Wave Amplifier Cold Test (Page 547) Alan M. Cook (U.S. Naval Research Laboratory), Colin D. Joye (U.S. Naval Research Laboratory), Jeffrey P. Calame (U.S. Naval Research Laboratory), Khanh T. Nguyen (Beam-Wave Research, Inc.), Alexander Vlasov (U.S. Naval Research Laboratory), Edward L. Wright (Beam-Wave Research, Inc.), David K. Abe (U.S. Naval Research Laboratory), Baruch Levush (U.S. Naval Research Laboratory) 26.3: Development of a 220 GHz 50 W Sheet Beam Travelling Wave Tube Amplifier (Page NA) Mark Field (Teledyne Scientific and Imaging LLC), Robert Borwick (Teledyne Scientific and Imaging LLC), Berinder Brar (Teledyne Scientific and Imaging LLC), Jinfeng Zhao (University of California), Diana Gamzina (University of California), Robert Barchfield (University of California), Alexander Spear (University of California), Anisullah Baig (University of California), Larry Barnett (University of California), Neville Luhmann, Jr. (University of California), Takuji Kimura (Communications and Power Industries LLC), John Atkinson (Communications and Power Industries LLC),

Thomas Grant (Communications and Power Industries LLC), Yehuda Goren (Teledyne MEC Vacuum Electronics)

Nano CNC Milling of Two Different Designs of 0.22 THz TWT Circuits (Page 549) 26.4: Robert Barchfeld (University of California), Diana Gamzina (University of California), Anisullah Baig (University of California), Larry R. Barnett (University of California), Neville C. Luhmann, Jr. (University of California) 26.5: A Simple Hybrid Circuit Model for Folded Waveguide Structures (Page551) Thomas M. Antonsen, Jr. (University of Maryland), David Chernin (Science Applications International Corporation), Alexander Vlasov (U.S. Naval Research Laboratory), Igor Chernyavskiy (U.S. Naval Research Laboratory), Khanh Nguyen (Beam-Wave Research, Inc.), Baruch Levush (U.S. Naval Research Laboratory) 26.6: 220 GHz Power Amplifier Development at Northrop Grumman (Page 553) John C. Tucek (Northrop Grumman Electronic Systems), Mark A. Basten (Northrop Grumman Electronic Systems), David A. Gallagher (Northrop Grumman Electronic Systems), Kenneth E. Kreischer (Northrop Grumman Electronic Systems) Session 27: Cold Cathodes II Session Chair: William Mackie (Applied Physics Technologies, Inc.) 27.2: 1.3: Single Walled Nano-Tube Fiber Cathode Emission Property Modification and Evaluation (Page 557) Nathaniel Paul Lockwood (U.S. Air Force Research Laboratory), Steven B. Fairchild (U.S. Air Force Research Laboratory), Wilkin Tang (U.S. Air Force Research Laboratory) 27.3: Multibeam Electron Gun With Gated Carbon Nanotube Cathode (Page 559) Nicolai Bushuev (Federal State Unitary Enterprise, NPP Almaz) Yuri Grigoriev (Institute of Radio Engineering and Electronic of RAS), Anton Bourtsev (Federal State Unitary Enterprise, NPP Almaz), Pavel Schalaev (Federal State Unitary Enterprise, NPP Almaz), Evgeny Tarasov (Federal State Unitary Enterprise, NPP Almaz)

CFF KVKQP CN'RCRGTU

Experiment of 94 GHz, CW, Low-Voltage Gyrotron	507
Xin-jian Niu, Ling Gu	
3D CFDTD PIC Simulation Study on Low-Frequency Oscillations in a Gyrotron	541
M. C. Lin, D. N. Smithe	