(/MandM/2018/)

Microscopy & Microanalysis 2018 Meeting

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(https://www.youtube.com/watch?v=AULinm-8P58&feature=youtu.be)

On behalf of the Microscopy Society of America, the Microanalysis Society, and the Microscopical Society of Canada (Société de Microscopie du Canada) we invite you to join us August 5-9 in Baltimore, Maryland for Microscopy & Microanalysis 2018. Baltimore and its famous Inner Harbor promise to be an exciting venue that provides ample opportunity for all to visit with old friends and meet new colleagues with a common interest in microscope development and applications.

Baltimore provides many unique opportunities for visitors, including the National Aquarium and Maryland Science Center, the historic tall ships and U.S. Navy and Coast Guard museum vessels, the city's rich railroad history at the B&O Railway Museum, the Birthplace of the National Anthem at Fort McHenry, and the many great dining opportunities, both on land and at sea (harbor dinner cruises). We hope that many of you will be able to bring your families along to enjoy all that Charm City and its region have to offer.

Bob Price
President
Microscopy Society of America

Masashi Watanabe
President
Microanalysis Society

Joaquin Ortega
President
Microscopical Society of Canada /
Société de Microscopie du Canada

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All M&M 2018 symposia, workshops and official events will be held at the Baltimore Convention Center.

Full Symposium Descriptions

Analytical Sciences Symposia

A01 - Professor Hatsujiro Hashimoto Memorial Symposium: Foundations in Imaging Crystals, Defects, and Atoms

Satoshi Ichikawa, Osaka University, Japan
Masashi Watanabe, Lehigh University

Professor Hatsujiro Hashimoto is one of the pioneers in imaging crystalline solids by transmission electron microscopy (TEM). His many achievements include the development of TEM instruments and holders, pioneering work in atomic-scale imaging and early contributions in understanding diffraction contrast based on dynamical diffraction theory. In addition, Professor Hashimoto performed *in situ* observations at elevated temperatures as high as 3000°C in the 1960s, fabricated an environmental TEM instrument with a gas reaction chamber and challenged the field to image single atoms using spectrometry techniques in TEM. His tremendous scientific contributions influenced scientists not only in Japan but also across the world. This symposium is dedicated to the memory of Professor Hashimoto and will feature technical aspects spanning a broad range of topics representative of the significant breadth and scope of his work and achievements.

Invited Speakers:

- Makoto Shiojiri, Kyoto Institute of Technology, Japan
- Yoshizo Takai, Osaka University, Japan
- Robert Sinclair, Stanford University
- Yoshio Bando, National Institute for Material Science, Japan
- Colin Humphreys, University of Cambridge, UK

A02 - Atomic-scale Functional Imaging in Aberration-corrected Electron Microscopy

Miaofang Chi, Oak Ridge National Laboratory
Jing Tao, Brookhaven National Laboratory
Marta Rossell, Electron Microscopy Center, Switzerland

S/TEM capabilities of probing structure and chemistry at atomic resolution are routine in microscopy labs owing to the successful invention and implementation of aberration correctors two decades ago. Accompanying the high spatial resolution is the developments of new and revisited imaging and spectroscopy techniques stimulated by the use of aberration correctors along with the emerging new detectors and data analytics. Notably, the recent advancements in differential phase contrast imaging, precise measurements of atomic positions, atomic-scale holography, high resolution tilt-series tomography, depth sectioning with high convergence angles, and 4D data acquisition provides new imaging capabilities for not only structure and chemistry, but also functionalities of materials, bringing about a transformation in the way the materials being understood and designed. This symposium intends to foster discussions on recent and future developments and applications of aberration-corrected S/TEM.

Invited Speakers:

- Wu Zhou, University of Chinese Academy of Sciences, China
- Andrew Yankovich, Chalmers University of Technology, Sweden
- Lena Kourkoutis, Cornell University
- Ryo Ishikawa, University of Tokyo, Japan
- Lin Gu, Chinese Academy of Sciences, China
- Yimei Zhu, Brookhaven National Laboratory
- Juan Carlos Idrobo, Oak Ridge National Laboratory
- Rafal Dunin-Borkowski, Ernst Ruska-Centre, Jülich, Germany

A03 - Four-dimensional Scanning Transmission Electron Microscopy (4D-STEM): From Scanning Nanodiffraction to Ptychography and Beyond

Colin Ophus, Lawrence Berkeley National Laboratory
David Muller, Cornell University

STEM experiments that utilize full reciprocal space images of the diffracted converged electron beam at each probe position are becoming increasingly common, due to the widespread adoption of high speed direct electron detectors. These experiments range from micrometer to atomic scale, including measurements of local physical properties, statistical characterization of atomic distributions, phase retrieval methods, and many others. These experiments can also generate an enormous quantity of data, requiring efficient analysis codes and new data handling methods. In this symposium, we will cover a wide range of 4D-STEM experiments, and studies examining both their promise and their limitations.

Invited Speakers:

- Christopher Allen, University of Oxford, UK
- Ian Johnson, Lawrence Berkeley National Laboratory
- Peter Nellist, University of Oxford, UK
- Joanne Etheridge, Monash University, Australia
- Benjamin McMorran, University of Oregon
- Jian-Min Zuo, University of Illinois
- Ian MacLaren, University of Glasgow, UK
- Paul Midgley, University of Cambridge, UK

A04 - *In situ* Transmission Electron Microscopy in Liquid and Gas Cells

B. Layla Mehdi, University of Liverpool, UK
Damien Alloyeau, CNRS - Paris Diderot University, France
Niels de Jonge, INM - Leibniz Institute for New Materials, Germany
Larry Allard, Oak Ridge National Laboratory

This symposium aims to discuss the multi-disciplinary challenges and opportunities of *in-situ* transmission electron microscopy (TEM) and scanning TEM (STEM) in liquid- and gas cells. These techniques are used in many fields including electrochemistry, catalysis, energy storage, nanomaterial synthesis, geology, soft materials, and structural- and cell biology. This symposium covers the applications of these techniques, new methods to improve imaging and quantitative analyses, spatial resolution, hardware and software methods needed for improved temporal resolution, and the role of electron-beam effects.

Invited Speakers:

- Diana Peckys, Saarland University, Germany
- Deborah Kelly, Virginia Tech
- Nigel Browning, University of Liverpool, UK
- Utkur Mirsaidov, National University of Singapore, Singapore
- Jeo Patterson, Eindhoven University of Technology, Netherlands
- Kristian Molhave, Technical University of Denmark, Denmark
- Heimei Zheng, Lawrence Berkeley National Laboratory
- Stig Helveg, Haldo Topsoe, Denmark
- Eric Stach, University of Pennsylvania
- Grace Burke, Manchester University, UK
- Kinga Unocic, Oak Ridge National Laboratory

A05 - Low-energy Electron and Particle Microscopies in Liquid, Gaseous, and Frozen Conditions

Andrei Kolmakov, National Institute for Standards and Technology
Olga Ovchinnikova, Oak Ridge National Laboratory
Xiao-Ying Yu, Pacific Northwest National Laboratory
Debbie Stokes, Thermo Fisher Scientific, The Netherlands

Scanning as well as wide-field electron microscopy and spectroscopy at (near-) atmospheric pressure and in the liquid or frozen state have recently demonstrated impressive progress in biomedical, environmental, and energy-related research under realistic conditions. In addition to ESEM and cryo-SEM, breakthroughs in the development of electron transparent, molecularly impermeable membranes integrated into microfluidic/gas flow cells and micro-reactors have increased the range of innovative applications of low energy electron and ion microscopies and analytical techniques such as SIMS, XPS, AES, CL, EDX, and EBSD. This symposium will highlight progress, technical developments and application trends of these novel approaches, serving to increase the visibility of new emerging tools and vendors.

Invited Speakers:

- David Muller, Cornell University
- Kristian Molhave, Technical University of Denmark, Denmark
- Sato Chikara, National Institute of Advanced Industrial Science and Technology (AIST), Japan
- Jiro Matsuo, Quantum Science and Engineering Center, Japan

- Marc Willinger, Fritz Haber Institute, Germany
- Alex Belianinov, Oak Ridge National Laboratory
- Harald Plank, Graz University of Technology, Austria

A06 - Mesoscale Correlative Microscopy and Imaging of Physical, Environmental, and Biological Sciences

Xiao-Ying Yu, Pacific Northwest National Laboratory
Si Chen, Argonne National Laboratory
Nestor J. Zaluzec, Argonne National Laboratory

Mesoscale connects the microscopic and macroscopic worlds, encompassing large differences in size, arrangement, complexity, and operating principle. This symposium aims to promote latest scientific findings and emerging techniques for mesoscale observations built upon microanalysis, microscopy, and correlative imaging. Besides electron/optical microscopy and spectroscopy used in various microanalysis, synchrotron-based X-ray microscopy or spectroscopy in conjunction with electron microscopy presents new opportunities to study chemical composition, biology, and material ultrastructure. We invite contributions in biology, catalysis, energy storage, and materials sciences. Presentations noting technical and scientific advancement of correlative spectroscopy and microscopy are encouraged.

Invited Speakers:

- Richard Leapman, National Institute of Health (NIH)/NIBIB
- Hongbo Jiang, University of Western Australia, Australia
- DaeWon Moon, Daegu Gyeongbuk Institute of Science and Technology, South Korea
- Adam Hitchcock, McMaster University, Canada

A07 - New Advances in Electron Energy Loss Spectroscopy and Allied Techniques

Juan Carlos Idrobo, Oak Ridge National Laboratory
Ian MacLaren, University of Glasgow, UK
Maria Varela, Universidad Complutense de Madrid, Spain

Electron Energy Loss Spectroscopy has been a key tool for the analysis of materials in the (scanning) transmission electron microscope since the introduction of suitable spectrometers in the 1970s. The field continues to expand and develop rapidly, both by the efforts of academic researchers and the equipment manufacturers. This symposium will provide a venue for the discussion of the latest advances in the field of EELS in the (S)TEM.

Invited Speakers:

- Alan Craven, University of Glasgow, UK
- Odile Stéphan, Université Paris-Sud, France
- Tracy Lovejoy, NION
- Jordan Hachtel, Oak Ridge National Laboratory
- Javier Aizpurua, State Agency Superior Council of Scientific Investigations (CSIC), Spain
- Robert Klie, University of Illinois, Urbana-Champaign

A08 - Machine Learning & Compressive Sensing for Image Acquisition, Processing, and Reconstruction

Andrew Stevens, Pacific Northwest National Laboratory
Volkan Ortalan, Purdue University
Rowan Leary, Cambridge University, UK

This symposium is concerned with the use of advanced statistical, mathematical, and computational methods for computational/compressive sensing; tomographic, ptychographic, and other reconstructions; and data cleaning/refinement techniques such as denoising and superresolution. Papers will focus on important topics in both machine learning and adaptive/computational sensing — especially their application to the acquisition and refinement of microscope data (e.g. images, spectrographs, ptychographs). The symposium will cover new microscope designs that depend on computational recovery techniques and other novel post facto machine learning and computational techniques to improve data quality or recover a minimum of useful information possibly by leveraging data across multiple sensors. Our target audience is generic microscope users, to introduce new techniques to the community and facilitate communication leading to their adoption.

Invited Speakers:

- Peter Nellist, University of Oxford, UK
- Doga Gursoy, Argonne National Laboratory
- Xin Yuan, Bell Labs
- Lewys Jones, Trinity College Dublin, Ireland

A09 - Data Analytics and Model-based Imaging for Microstructure and Physical Property Interpretations

Lawrence Drummy, Air Force Research Laboratory
Charles Bouman, Purdue University
Vinayak Dravid, Northwestern University
Alex Belianinov, Oak Ridge National Laboratory

This symposium will cover a breadth of topics from emerging multi-modal microscopy techniques, to modern processing methods after the data has been collected. Machine learning methods discussed here will focus on transforming the raw collected signal into physically interpretable results — the data connection to material properties. Specific attention will be paid to selecting and applying models in order to guide optimal strategy for extracting useful, scientifically relevant information. The symposium will also feature new algorithmic and software developments for data denoising, object tracking, correlative analysis, and data management for end use.

Invited Speakers:

- Stephen Jesse, Oak Ridge National Laboratory
- Ichiro Takeuchi, University of Maryland
- David Rowenhorst, U.S. Naval Research Laboratory
- Nicolas Piche, Object Research Systems
- Jeff Simmons, Air Force Research Laboratory
- Mark DeGraef, Carnegie Mellon University
- Jianwei Miao, University of California, Los Angeles

A10 - The Joy of Scanning Electron Microscopy

Raynald Gauvin, McGill University, Canada
Dale Newbury, National Institute of Standards and Technology

First introduced commercially in 1965, the scanning electron microscope (SEM) has evolved into a core microscopy characterization tool for thick (electron-opaque) specimens, capable of imaging nanometer-scale features with a variety of contrast mechanisms: topographic, compositional, crystallographic, magnetic, and electrical potential. Augmented with energy dispersive X-ray spectrometry (EDS) and electron backscatter diffraction (EBSD), SEM can characterize morphology, elemental composition and crystal structure. Recently, amazing capabilities using STEM-in-SEM have been demonstrated making the SEM more valuable than ever for materials characterization. This symposium will present a comprehensive overview of SEM as a problem-solving tool whose capabilities are still being developed and extended.

Invited Speakers:

- Eric Lifshin, SUNY-Polytechnic Institute
- Andras Vladar, National Institute of Standards and Technology
- Yoosuf Picard, Carnegie Mellon University
- Hendrix Demers, McGill University, Canada
- Joseph Michael, Sandia National Laboratories
- Brendan Griffin, University of Western Australia, Australia

A11 - Solid-state X-ray Spectrometry at 50 Years

Paul Carpenter, Washington University
Edward Vicenzi, Smithsonian Institution
Katherine Burgess, Naval Research Laboratory
Nicholas Ritchie, National Institute of Standards and Technology

50 years ago, Fitzgerald, Keil, and Heinrich published the first results obtained from an energy-dispersive x-ray spectrometer (EDS) in Science. From identification of unknown materials, to compositional mapping and quantitative microanalysis, EDS has advanced our understanding of an enormous range of materials and is used worldwide in microanalysis and microscopy laboratories. The symposium will link historical and technical developments of solid state x-ray instrumentation, data processing, applications, and emerging detection systems. Perspectives on the developments in EDS from a technological and educational perspective will be featured, including invited and contributed presentations from the inventor, vendor, and scientific communities.

Invited Speakers:

- Klaus Keil, University of Hawaii
- Karsten Goemann, University of Tasmania, Australia
- Fred Schamber, Retired
- Chris Ryan, CSIRO
- Carolyn Caplan, University of Hawaii
- Rick Mott, PulseTor
- Dale Newbury, National Institute of Standards and Technology
- Julia Schmidt, PNDetector
- Mike Matthews, AWE, EMAS President

A12 - The FIB-SEM Laboratory: Sample Preparation and Beyond

Joshua F. Einsle, University of Cambridge, UK
Marco Cantoni, École Polytechnique Fédérale de Lausanne, Switzerland
Timothy Burnett, University of Manchester, UK

The modern FIB-SEM microscope combines the high-resolution scanning electron microscopy (SEM) analytical techniques and the site-specific nanoscale milling capabilities of a focused ion beam (FIB). In this symposium, we welcome contributions covering novel studies and ongoing developments combining the nanofabrication capabilities of the FIB-SEM with analytical characterization and/or *in situ* testing. Research across a broad range of materials applications is sought with the intent for contributors to share knowledge on optimal utilization of this technology. We wish to highlight that the FIB-SEM is more than a transitory step on the way to other microscopic modalities, but truly, a laboratory space in its own right.

Invited Speakers:

- Annelena Wolff, Queensland University of Technology, Australia
- Miroslava Schaffer, Max Planck Institute of Biochemistry, Germany
- Greg Rohrer, Carnegie Mellon University
- Aleksander Buseth Mosberg, Norwegian University of Science and Technology, Norway
- Gregor Hlawacek, Helmholtz-Zentrum Dresden-Rossendorf, Germany

A13 - Pushing the Limits of Cryo-EM

Mike Marko, Wadsworth Center
Anchi Cheng, New York Structural Biology Center

Cryo-EM provides single-particle maps with resolution in the 3 angstrom range, and sub-tomogram-averaged maps in the 1nm range, all with the sample in a near-native, hydrated state. This symposium will highlight technology and applications, with invited speakers who are key to the latest developments, and will include contributed papers from participants in this exciting field.

Invited Speakers:

- David Mastronarde, University of Colorado
- Abraham (Bram) Koster, Leiden University Medical Center, Netherlands
- Scott Stagg, Florida State University
- Ali Punjani, University of Toronto, Canada
- Alexander Myasnikov, University of California, San Francisco
- Russell King, TTP Labtech Ltd., UK
- Alex Noble, NY Structural Biology
- Katerina Naydenova, Cambridge University, UK

A14 - Quantitative Magnetic Characterization in the TEM

Darius Pohl, IFW Dresden, Germany
Ben McMorran, University of Oregon
Martha McCartney, Arizona State University
Sebastian Schneider, IFW Dresden, Germany

In this symposium, transmission electron microscopy techniques for imaging magnetic fields, such as Lorentz microscopy, differential phase-contrast (DPC), electron holography, and electron energy-loss magnetic chiral dichroism (EMCD), are emphasized. As functional magnetic materials continue to decrease in size, surfaces and interfaces play a growing significance on novel nanoscale magnetic phenomena. Further, skyrmions and topological insulators have recently received widespread interest leading to an increasing demand for high resolution quantitative magnetic measurements in combination with local structural characterization. With

recent advances in mind, the goal of this symposium is to bring together experimentalists involved in applying/developing magnetic techniques and those involved in simulations and/or the development of theory to explain quantitatively magnetic phenomena with TEM.

Invited Speakers:

- Phatak Charudatta, Argonne National Laboratory
- Juan-Carlos Idrobo, Oak Ridge National Laboratory
- Tyler Harvey, University Göttingen, Germany
- Toshiaki Tanigaki, Hitachi High Technologies, Japan
- Daniel Wolf, Leibniz Institute for Solid State and Materials Research (IFW-Dresden), Germany
- Sergio Montaya, University of California, San Diego

A15 - Strain Analysis from Nano- to Micro-length Scales

Brendan Foran, The Aerospace Corporation
Ling Pan, Intel Corporation
Guoda Lian, IBM East Fishkill

This symposium focuses on the application of microscopy and microanalysis techniques to investigate strain across various length scales. For example, transmission EM based methods such as geometric phase analysis, precession nano-beam diffraction and dark field holography are providing significant insights on nanoscale strain in transistor devices. Scanning electron microscopy based methods like high-resolution electron backscatter diffraction (HR-EBSD) and transmission Kikuchi diffraction (TKD) are achieving excellent strain sensitivity and nanometer resolution, respectively. X-ray scattering methods and Raman spectroscopy are bridging the micro and nano length scales. We encourage contributions highlighting developments in strain measurements and mapping approaches from across a wide range of technological applications and materials systems including (but not limited to) semiconductors, ceramics, and metals.

Invited Speakers:

- Mark Vaudin, National Institute of Standards and Technology
- Jian-Min Zuo, University of Illinois, Urbana-Champaign
- Andrew Minor, University of California, Berkeley
- Jiong Zhang, Intel
- Moon Kim, University of Texas, Dallas

A16 - Sterling Newberry Memorial Symposium on X-ray Imaging

Jeffrey Davis, PNDetector
Nikolaus Cordes, Los Alamos National Laboratory
Eric Telfeyan, General Electric
Richard Wuhrer, Western Sydney University, Australia

This symposium is being held in honor of one of the pioneers of X-ray microscopy and founders of the Microscopy Society of America, Sterling Newberry. In honor of his work, the symposium will focus on a wide range of X-ray imaging techniques, including computed tomography, coherent X-ray imaging and X-ray microscopy. We are also soliciting papers on imaging using focused probe techniques such as μXRF and μXRD, correlative imaging techniques and direct applications of X-ray imaging to solving complex problems in materials science and engineering. The symposium will also include contributions on new detectors, software and analytical tools for X-ray imaging.

Invited Speakers:

- Benedikt Günther, Technical University Munich, Germany
- Lothar Strüder, University of Siegen, Germany

A17 - Surface and Subsurface Microscopy and Microanalysis

Vincent S. Smentkowski, General Electric
John A. Chaney, The Aerospace Corporation
Chanmin Su, Bruker-Nano Inc.
Xiao-Ying Yu, Pacific Northwest National Laboratory

Surface properties such as composition, uniformity, thickness, and topography dictate the performance of many systems. The surface analyst is asked to detect and image species present in ever-lower concentrations and within ever-smaller spatial and depth dimensions. This symposium will emphasize state-of-the art surface analysis and interpretation methods encompassing all aspects of surface mass spectrometry; scanning probe microscopy; and nano-scale chemical and physical property analysis via TERS, IR, and other probe based techniques. We will also cover advanced data analysis tools; correlative imaging (e.g., AFM and SEM; AFM and SIMS; etc.); the use of complementary surface analytical instrumentation to perform a complete analysis of complex material systems; and surface analytical challenges. Contributed papers are solicited for both platform and poster presentations.

Invited Speakers:

- Mary Kraft, University of Illinois, Urbana-Champaign
- Rasmus Havelund, National Physical Laboratory, UK
- Greg Fisher, Physical Electronics
- Tim Nunney, Thermo Fisher Scientific, UK
- Nathan Havencroft, IonTof
- Dave Surman, Kratos
- Lara Gamble, University of Washington
- Tom Beebe, University of Delaware
- Igor Sokolov, Tufts University
- Olga Ovchinnikova, Oak Ridge National Laboratory
- Sankar Raman, Evans and Associates

A18 - Vendor Symposium

Luisa Amelia Dempere, University of Florida, Gainesville
Andreas Holzenburg, University of Texas, Rio Grande Valley

This symposium is a forum for vendors to highlight advances in the development and improvement of their products. It covers new methods and technologies that advance the fields of microscopy and microanalysis for both physical and biological sciences, and provides a forum for exchange of ideas and best practices.

Biological Sciences Symposia

B01 - Microscopy and Analysis in Forensic Science

Keana Scott, National Institute for Standards and Technology
Robert Pope, Department of Homeland Security
Eric Steel, National Institute for Standards and Technology

The symposium topics will include the application of various microscopy and spectroscopy techniques in forensic case samples and research. The techniques of interest are, but not limited to, electron and ion microscopy, x-ray microanalysis, confocal microscopy, atomic force microscopy, FT-IR imaging, Raman mapping, neutron scattering, and 3D surface metrology. Topics will include case histories and the type of evidence presented for examination, identification and characterization of trace evidence and sample preparation for microscopic examination. Also included will be the interpretation of case-related microscopic and spectral results, forensic research topics, and preparation and presentation of the results of microscopic analyses of trace evidence for court testimony.

Invited Speakers:

- Andrew Laurence, U.S. Customs and Border Control
- David Glasgow, Oak Ridge National Laboratory
- Jennifer Verkouteren, National Institute of Standards and Technology
- Heather Suebert, Federal Bureau of Investigation
- Stephen Morgan, University of South Carolina

B02 - Microscopy in Food Science: Bridging Biology and Materials Science

Almut Vollmer, Utah State University
Nabil Youssef, Utah State University

Recent advances in instrumentation have promoted the revival of microscopy in food science, an area not traditionally covered at microscopy meetings, yet of broad practical importance. This symposium gives an overview of how various microscopy techniques have been utilized to gain a deeper understanding of complex food systems at the interface of biology and materials science. Scientists from industry, academia and government are encouraged to participate and use this symposium as a platform to exchange ideas and expertise in a research field that heavily depends on interdisciplinary approaches.

Invited Speakers:

- Brian Van Devener, University of Utah
- Marc Auty, Teagasc Food Research Center, Ireland
- Ulrich Kulozik, Technical University Munich, Germany
- Nicolas Piche, Object Research Systems, Canada
- Jinping Dong, Cargill

B03 - 3D Structures: from Macromolecular Assemblies to Whole Cells (3DEM FIG)

Joaquin Ortega, McGill University, Canada
Michael Radermacher, University of Vermont
Teresa Ruiz, University of Vermont

Our understanding of the 3D structure and functional subtleties of complex biological systems has skyrocketed due to recent advances in EM imaging technology and hybrid methodologies. This symposium will highlight structural studies of macromolecules, microorganisms, cells, and tissues using state-of-the-art high-resolution techniques. These techniques include electron crystallography, single particle cryo-EM, helical reconstruction, STEM; AFM, X-ray crystallography, and molecular modeling. Biological topics of interest include: cellular

architecture, metabolism, trafficking, communication, and division; gene regulation, transcription, and translation; host-pathogen interactions and virus structure; *In situ* studies using TEM and SEM, and all aspects of structure-function studies of biological assemblies.

Invited Speakers:

- Montserrat Samso, Virginia Commonwealth University
- Derek Taylor, Case Western Reserve University
- Paula da Fonseca, MRC Laboratory of Molecular Biology, UK
- Michael Cianfrocco, University of Michigan
- Mavis Agbandje-McKenna, University of Florida

B04 - Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals

Greg Ning, Pennsylvania State University
Ru-Ching Hsia, University of Maryland, Baltimore
Trace Christensen, Mayo Clinic

Microscopy is critically important in the ongoing research, detection, diagnosis and treatment of diseases. Advances in microscopy techniques provide us with an improved ability to diagnose and study the origins and development of diseases in human, plant and animal specimens. This symposium is an opportunity to share information on the microscopic investigation of cells, tissues and entire organisms in clinical, diagnostic and research laboratories. Emphasis is placed on using latest or innovative sample processing techniques or instrumentation in both clinical and research laboratories.

Invited Speakers:

- Irene Wacker, Heidelburg University, Germany
- Fengxia (Alice) Liang, New York University School of Medicine
- Shigeki Watanabe, Johns Hopkins University
- Siyang Zheng, Pennsylvania State University
- Steven Bernstein, University of Maryland, Baltimore
- Anastas Popratiloff, George Washington University
- James Adair, Pennsylvania State University

B05 - Focused on Microbes!

Alice Dohnalkova, Pacific Northwest National Laboratory
Xiao-Ying Yu, Pacific Northwest National Laboratory

Microscopy and microanalysis are important in understanding and characterizing all aspects of microbiology and systems biology including bacteria, fungi, and other microbes. We invite presentations on all topics of environmental processes but not limited to: microbial interactions with metals and minerals, with plant root and leaf; symbionts, pathogens and immune reactions, and biofilm formation on various surfaces. Contributions presenting novel optical and electron microscopic tools and method development, educational outreach, and scientific findings in microbial interactions are strongly encouraged.

Invited Speakers:

- Beth Fischer, NIH-National Institute of Allergy and Infectious Diseases
- Wen Yang, Leiden University, Netherlands
- Neerja Zambare, Montana State University

- William Chrisler, Pacific Northwest National Laboratory

B06 - Imaging Life at New Frontiers of Spatiotemporal Resolution and Adaptive Microscopy

Jay Potts, University of South Carolina Medical School
Teng-Leong Chew, Janelia Research Facility (HHS)

This symposium presents three important frontiers that have recently transformed optical imaging, including (i) the various methods in breaking the diffraction limit to achieve super-resolution microscopy, (ii) the renaissance of selective plane illumination (light sheet) microscopy and (iii) the integration of adaptive methods into optical microscopy to correct for the heterogeneity in refractive indices, dynamic changes in sample size during development of living specimens. These technologies have in turn ushered in an era of big data and promises to image life on scales previously thought impossible. In this symposium, we aim to highlight the exciting possibilities and hurdles faced by modern optical microscopy. In addition, the sypmposium will cover new developments and techniques used to image life as never before.

Invited Speakers:

- Robert Gourdie, Virginia Tech
- Harald Hess, Janelia Research Campus
- Hari Shroff, National Institute of Biomedical Imaging and Bioengineering

B07 - Pharmaceuticals: Imaging, Analysis, and Regulation of Medical Products and Devices

Jason Mantei, Baxter
Gianpiero Torraca, Amgen

This symposium will present diverse content related to the research, development, manufacture, and use of pharmaceuticals and medical products/devices. Content will feature the use of advanced techniques to address the unique problems that arise during drug discovery, vaccine research, formulation, biocompatibility, production, product life cycle, and eventual patient use. In-depth technical presentations will describe the development of methods specially optimized for use with these real-world materials and biological systems, including hybrid and correlative techniques. Additionally, given the proximity of the conference to regulatory bodies in the US, there will be a secondary focus on discussing and understanding regulations and data integrity concerns as they specifically apply to the pharmaceutical industry.

Invited Speakers:

- Neal Zupec, Baxter Healthcare
- Jenifer MacLean, Gilead Sciences
- Linda Obenauer-Kutner, Bristol-Myers-Squibb

B08 - 3D Structure of Complex Soft Materials Derived From Electron Tomography

Deborah Kelly, Virginia Tech Carilion Research Institute
Steven Ludtke, Baylor College of Medicine
Elizabeth Wright, Emory University School of Medicine

Electron tomography (ET) is trailblazing the resolution revolution in the EM field. Recent advances in sample preparation, instrumentation and methodology have widened the scope of ET to reveal information at sub-nanometer resolution and target length scales in the micrometers. This symposium will highlight leading scientific and technological developments in structural studies of complex systems in biology and materials science, using the widest possible range of ET imaging approaches and their integration with complementary techniques. Applications and developments covering - but not limited to - aberration-corrected, energy-filtered TEM and STEM, phase plates, diffraction and holography, are invited. Contributions including complementary approaches such as correlative light-electron microscopy, X-ray tomography, serial-block face SEM/AFM, and novel processing tools — including sub-volume alignment, classification and averaging are encouraged.

Invited Speakers:

- Grant Jensen, California Institute of Technology
- Jianwei (John) Miao, University of California, Los Angeles
- Kristin Parent, Michigan State University
- Heiner Friedrich, Eindhoven University of Technology, Netherlands
- Ru-ching Hsia, University of Maryland, Baltimore

Physical Sciences Symposia

P01 - Advances in Electron, X-ray and Neutron Spectro-imaging/Holography of Energy Materials and Devices

Feng Wang, Brookhaven National Laboratory
Chongmin Wang, Pacific Northwest National Laboratory
Kazuo Yamamoto, Japan Fine Ceramics Center, Japan
Michael Toney, Stanford University

In order to address fundamental questions related to energy storage and conversion, there have been significant efforts in developing electron, X-ray and neutron techniques with improved spatial and temporal resolution and chemical sensitivity. These efforts better resolve the dynamic structural and chemical changes within materials, at interfaces and in devices. Developments in sample environment and *in situ* capabilities open new opportunities for probing proton, lithium, oxygen, and other charge/mass carriers, and tracking their transport in liquid, solid and across liquid-solid/solid-solid interfaces. This symposium focuses on recent advances in electron, X-ray and neutron spectro-imaging/holography techniques for characterizing materials, interfaces and devices related to energy and nuclear applications, such as electrochemical energy storage, fuel cells, photocatalysis, photovoltaics, thermoelectrics and nuclear energy systems.

Invited Speakers:

- William Chueh, Stanford University
- Laura Schelhas, Stanford University
- Pratibha Gai, York University, UK
- Peter Crozier, University of Arizona
- Yimei Zhu, Brookhaven National Laboratory
- Hiroyuki Shinada, Hitachi, Japan
- Miaofang Chi, Oak Ridge National Laboratory
- Katherine Jungjohann, Sandia National Laboratories

- Esther Takeuchi, Stony Brook University

P02 - Atomically Thin 2D Materials: Recent Results and Challenges

Raul Arenal, Universidad de Zaragoza, Spain
Quentin Ramasse, SuperSTEM Laboratory, UK

Recently, 2D materials, down to atomically thin crystals, have been a clear point of interest for research. This significant interest comes mainly from the attractive electronic, optical and mechanic properties (among others) that this kind of materials can display; as well as a vast number of potential applications. TEM techniques (structural and analytical modes) have provided major advances in the study of these materials, including, very rich information at the atomic scale. This symposium will focus on the state-of-the-art, current challenges and perspectives of TEM studies in these materials. However, studies employing other characterization techniques, including Raman and infrared spectroscopy, XPS, photoluminescence, cathodoluminescence and scanning probe microscopy are also of interest, alongside contributions calling upon theoretical modeling to predict the properties and structure of these fascinating materials.

Invited Speakers:

- Arkady Krasheninnikov, Aalto University, Finland
- Jannik Meyer, University of Vienna, Austria
- Ryosuke Senga, National Institute of Advanced Industrial Science and Technology (AIST), Japan
- Mauricio Terrones, Pennsylvania State University
- Valeria Nicolosi, Trinity College Dublin, Ireland
- Shiyong Wang, EMPA, Switzerland

P03 - Nanoparticles and 1D Materials: Synthesis, Characteristics and Applications

Zonghoon Lee, Ulsan National Institute of Science and Technology, Korea
Moon Kim, University of Texas, Dallas

With recent advances in synthesizing 0D and 1D materials with various morphology for their specific needs, they are now poised to make disruptive advances in energy, nano-electronics, health, and environment-related areas. These low dimensional materials are also stimulating new applications in many new areas. This symposium will cover various aspects of advanced 0D and 1D materials including synthesis, properties and characterization by TEM, STEM, spectroscopy, diffraction, *in-situ* methods and other surface analytical techniques, theoretical modeling, and technological applications. Presentations are sought from the areas of nanoparticles, nanowires and nanotubes, growth morphology, defects, surfaces, interfaces, and new and emerging applications.

Invited Speakers:

- Haimei Zheng, Lawrence Berkeley National Laboratory
- Litao Sun, Southeast University, China
- Xiaohu Xia, Michigan Technological University
- Hugh Churchill, University of Arkansas
- Jungwon Park, Seoul National University, South Korea

P04 - *In situ* Methods for Probing Properties and Dynamics in Materials

Sanjit Bhowmick, Bruker Nano Surfaces
Chaoying Ni, University of Delaware
Andrew Minor, University of California, Berkeley and Lawrence Berkeley National Laboratory

In situ methods inside electron microscopes provide unique insight into the dynamics of materials in response to external stimuli at the micrometer, nanometer, and atomic scale. Recent advances in microscopy techniques, analytical detectors, high-speed cameras, and computing resources are able to provide unprecedented insights and fundamental understanding of intrinsic behavior of materials, assemblies and devices as they are exposed to mechanical forces, heating, photon irradiation, electromagnetic fields. The focus of this symposium is to bring together those in the microscopy and characterization community that are active in the development and application of *in situ* methods. Contributions are sought regarding key developments in the discoveries, techniques, and experimental methods that aid in the fundamental understanding of properties and mechanisms of small-scale materials, assemblies and devices.

Invited Speakers:

- Daniele Filippetto, Lawrence Berkeley National Laboratory
- Jennifer Dionne, Stanford University
- Aaron Lindenburg, Stanford University
- David Flannigan, University of Minnesota
- Robert Carpick, University of Pennsylvania
- Zhiwei Shan, Xi'an University, China
- Daniel Gianola, University of California, Santa Barbara
- Christoph Gammer, Austrian Academy of Sciences, Austria
- Thierry Epicier, University of Lyon, France
- Nathan Mara, University of Minnesota
- Xiaoqing Pan, University of California, Irvine
- Chongmin Wang, Pacific Northwest National Laboratory
- Chris Regan, University of California, Los Angeles
- Seiji Takeda, Osaka University, Japan
- John Cumings, University of Maryland

P05 - Minimizing Beam-sample Interactions by Modulating Electron Beams in Space and Time

Christian Kisielowski, Lawrence Berkeley National Laboratory
Joerg Jinschek, The Ohio State University
David Flannigan, University of Minnesota
Hector Calderon, Instituto Politécnico Nacional, Mexico

In high resolution electron microscopy objects are actively altered by the intense electron irradiation that is necessary to reach single atom sensitivity. In these circumstances, a control of beam-sample interactions is no longer a commodity but a necessity. It is of outstanding interest to develop new tools and concepts that strive for a stricter control of the probing electron beam in space and time in order to optimize the detection of every scattering event. Further, new insights on the physical mechanisms of beam-matter interaction is critical for atomic scale imaging. This symposium welcomes contributions that exercise improved control of electron beam-induced alterations of soft and hard matter with the goal to reveal its genuine state. Efforts to further our understanding of the fundamental effects of the electron on different environments and at interfaces are also welcome, as well as topics discussed in the 2017 Radiation Damage Pre-Meeting Congress.

Invited Speakers:

- David Yancey, The DOW Chemical Company
- Stig Helveg, Haldor Topsoe, Denmark
- Nigel Browning, University of Liverpool, UK
- Oh-Hoon Kwon, UNIST, South Korea
- Florian Banhart, University of Strasbourg, France
- David McComb, The Ohio State University
- Taylor Woehl, University of Maryland

P06 - Applications of Integrated Electron Probe Microscopy and Microanalysis in Characterizing Natural and Synthetic Materials

Kat Crispin, Pennsylvania State University
Colin MacRae, CSIRO Mineral Resources, Australia
Owen Neill, University of Michigan

Electron beam instruments have been merging with other techniques to extract information such as bonding, valence, and density-of-state, which, combined with elemental analysis, offers new insights into the structure and chemistry of natural and synthetic materials. Researchers now have access to an analytical toolbox enabling characterization in a range of controlled environments (liquid and gas) and conditions (elevated temperatures to liquid helium). This symposium showcases synergies of new and emerging techniques, while highlighting recent advances in areas such as optical analysis using Raman spectroscopy, cathodoluminescence, soft X-ray spectrometry, and others. Contributions covering some or all of these new developments and re-emerging technologies are welcomed.

Invited Speakers:

- Emma Bullock, Carnegie Institution
- Paul Edwards, Strathclyde University, UK
- Reynald Gauvin, McGill University, Canada
- Peter Statham, Oxford Instruments Analytical, Ltd., UK
- Ed Vicenzi, Museum Conservation Institute

P07 - Planetary Building Blocks and the Techniques Needed to Analyze Them

Tom Zega, University of Arizona
Michelle Thompson, NASA Johnson Space Center
Emma Bullock, Carnegie Institution for Science

After successful missions to collect solar wind (NASA Genesis), cometary dust (NASA Stardust), and asteroidal regolith (JAXA Hayabusa) and with the successful launches of the JAXA Hayabusa2 and NASA OSIRIS-REx missions, the planetary-materials community is firmly within the era of sample return. The proposed symposium solicits papers that use microscopy and related techniques to explore the origins of planetary materials. We welcome contributions that discuss a range of topics including but not limited to: current analytical approaches, developments in new characterization strategies, developments in spatial and spectral resolution for pushing spectroscopic detection sensitivity and precision, and new protocols for sample handling.

Invited Speakers:

- Keiko Nakamura-Messenger, NASA Johnson Space Center
- Jessica Barnes, NASA Johnson Space Center
- Pierre Haenecour, University of Arizona
- Hope Ishii, University of Hawaii

- Levke Kööp, University of Chicago

P08 - Spectroscopic and Imaging Studies in Heritage Science

Edward Vicenzi, Smithsonian Institution
John Mansfield, University of Michigan
Thomas Lam, Smithsonian Institution

The application of microscale and nanoscale characterization techniques to the examination of cultural heritage materials has greatly enhanced our understanding of the processes that formed, and subsequently transformed those materials to their present state. Understanding the chemistry and morphology of heritage materials from the macro/mesoscopic scale to the microscale is of critical importance for our increasingly deeper levels of knowledge of the interaction between objects and their environment. This symposium will include invited and contributed presentations from students, conservators, conservation scientists, researchers, and those from other disciplines who have an interest in the preservation of cultural heritage.

Invited Speakers:

- Glenn Gates, The Walters Art Museum
- Tana Villafana, U.S. Library of Congress
- Marc Walton, Northwestern University
- Jennifer Mass, Scientific Analysis of Fine Art
- Admir Masic, Massachusetts Institute of Technology
- Danielle Duggins, Northwestern University

P09 - Microstructure and Mechanics Deformation Symposium

Frank Muecklich, Saarland University, Germany
James Martinez, NASA Johnson Space Center

This symposium will focus on the further development of advanced 2D microstructure analysis as well as the application and development of tomographic techniques and 3D microstructure analysis including sophisticated 3D data evaluation. It is important to consider the measurement of mechanical properties in conjunction with methods for visualizing a material's microstructure and its evolution during processing or deformation. Small-scale mechanical techniques such as *ex situ* and *in situ* compression, tension, bending or indentation generate fundamental insight into deformation processes that can be paired with structural techniques such as atom-probe tomography, electron tomography, synchrotron tomography and related digital image correlation methods.

Invited Speakers:

- Luke Brewer, University of Alabama
- Brad Baker, United States Naval Academy
- Daniel Kiener, University of Leoben, Austria
- Martina Zimmermann, Technical University Dresden, Germany
- Dominik Britz, Saarland University, Germany

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Plenary Session Speakers

Monday, August 6, 2018
Baltimore Convention Center — Baltimore, Maryland

PLENARY SPEAKER #1

Jon Larsen

Project Stardust; Jazz Guitarist, Composer, Surrealist Painter, Author, Citizen Scientist

Using Microscopy to Find Stardust Anywhere

Jon Larsen is author of "In Search of Stardust," the first comprehensive popular science book on micrometeorites. The book also features a photo atlas presenting hundreds of micrometeorites imaged by high-resolution color optical microscopy and by scanning electron microscopy. Historically, cosmic dust was thought to be discoverable only in pristine areas like Antarctica or isolated deserts. Larsen became the first individual to demonstrate how to find micrometeorites in populated areas, allowing any individual to find tiny extraterrestrial stones in their nearest rain gutter. Since 2008, Larsen has collected dust particles and empirically classified various terrestrial contaminants. Suspecting that some of his particles were micrometeorites, Larsen worked with Matthew Genge from the Imperial College of London in 2015 to verify that indeed some of the particles were of extraterrestrial origin. Since then, Larsen has facilitated a community-based network of researchers through a program called "Project Stardust" so that anyone can conduct independent field work and lab analysis to document their own discovery of micrometeorites.

Larsen is also a self-trained and well-regarded guitarist, notably in the style of gypsy jazz inspired by Django Reinhardt, and has produced 450 jazz records with many prominent musicians throughout his musical career. Prior to composing music full-time, Larsen was a surrealist painter heavily influenced by Salvador Dali.

PLENARY SPEAKER #2

Manu Prakash, PhD

Stanford University

Every Child in the World Should Carry a Microscope in Their Pocket

Manu Prakash obtained a Bachelor of Technology degree in Computer Science from the Indian Institute of Technology, Kanpur, India, and a Ph.D. in Applied Physics from Massachusetts Institute of Technology. Since 2011, he has been an Assistant Professor in the Department of Bioengineering at Stanford University. His lab applies cellular- and physical biology-based approaches to problems in organismic biophysics and develops novel tools for measurements in biological systems. A prominent goal in the Prakash lab is inventing novel tools for "frugal science" applied to global health and democratizing access to scientific experience.

Prakash and Jim Cybulski, a Ph.D. student in the Prakash lab, co-invented the "Foldscope." This foldable microscope is made mostly of paper and costs less than one U.S. dollar. Since 2014, 50,000 Foldscopes have been distributed to 135 countries, where they have been used to identify the microscopic eggs of agricultural pests in India, catalog the biodiversity of soil arthropods in the Amazon, detect fake currency and medicine, follow toxic algal blooms, detect bacteria in water samples, and map pollen diversity in a city landscape.

Prakash is a current HHMI-Gates Faculty scholar, a 2016 MacArthur Fellow, one of the "Brilliant 10" featured by Popular Science in 2014, and a 2014 MIT Technology Review top 35 innovator under 35 years of age. He has presented two TED talks featuring the use of origami and paper to create cost-effective diagnostic tools, one in 2014 on the Foldscope and one in 2017 on "Paperfuge," a hand-powered centrifuge costing only 20 cents. Prakash founded Foldscope Instruments in 2015, which handles large-scale production of Foldscopes for distribution to educators and individuals of all ages. Foldscope Instruments facilitates community engagement and sharing of experiences using Foldscopes through their "Microcosmos" online program, where children around the world post their micrographs and their experiences in scientific discovery.

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2018 Pre-Meeting Congresses

- Separate registration fee required; see registration information on website, and form for details (form available March 1, 2018).
- Click on the individual PMC listings below for information on meals and breaks.

X60 - Pre-Meeting Congress for Students, Postdocs, and Early-career Professionals in Microscopy & Microanalysis (congress_X60.cfm)

X61 - Standards and Reference Materials for Microanalysis (congress_X61.cfm)

X62 - Practical Challenges and Opportunities for *in situ/operando* Microscopy in Liquids and Gases (congress_X62.cfm)

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Microscopy Outreach

X90 - Microscopy in the Classroom

Local educators and registered conference attendees are invited to participate in presentations, round table discussions, and demonstrations of effective strategies for microscopy outreach and education from K-12 and post secondary classrooms. This session will show how microscopy in education serves as an important learning tool for inspiring our future STEM professionals. Those involved in microscopy education or educational outreach are encouraged to submit a paper about their successful program or lesson for platform or poster presentation.

- Best practices for incorporating microscopy into K-12 and post secondary classrooms and curricula
- Local and national initiatives emphasizing STEM education and outreach
- Methods to expose students to microscopy in a fun, engaging and impactful manner

X91 - Microscopy Explorations (formerly "Family Affair")

A fun, hands-on session for families and kids of all ages!
Elaine Humphrey, Janet Schwarz, Pat Connelly
The exciting world of microscopy opens up for attendees' family and friends.
This session includes:

- Some new Microscopic Explorations
- A mystery to solve using microscopy
- Materials science and biological science

X92 - A Project MICRO Workshop

Elaine Humphrey, Caroline Schooley, Janet Schwarz, Pat Connelly

- The Project MICRO workshop has its venue in the MegaBooth all week after the Exhibit Hall opens
- Visit the Outreach booth every day to see how to set up different stations in a classroom
- Share your experiences with how you have fun with microscopy outreach
- See different microscope systems for use in a classroom, in action
- Peruse the books suitable for school age children

- Put your name into a draw for the daily door prize

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- All Short Courses are held Sunday, August 5, 2018 from 8:30 am - 5:00 PM.
- Separate registration is required (see registration form for details).
- AM and PM Coffee Breaks are provided. Meals are on your own.

Sunday Short Courses

X10 - Exploring Cryo-Preparation Techniques for Biological Samples

Danielle Jorgens, University of California, Berkeley
Elizabeth Fischer, Rocky Mountain Laboratories/NIAID/NIH

In this short course, a variety of topics covering a spectrum of biological sample preparation needs will be reviewed, with special attention paid to cryo-preservation via high pressure freezing, plunge freezing, and cryosectioning. In addition, the course will focus on how to best prepare samples for the newest imaging tools and approaches in biological EM imaging, including correlative LM-EM, volume EM, cryo-SEM, and cryo-TEM. Tips and tricks on sample screening and sample-preparation artifacts will be covered. Participants will walk through the "ins and outs" of how to prepare samples for their specific experiments. After the course, participants will be provided access to a library of on-line reference material.

X11 - Advanced Focused Ion Beam Methods

Joseph Michael, Sandia National Laboratories
Lucille Giannuzzi, EXpress LO, LLC

The use of FIB instruments in materials- and biological-science laboratories is growing rapidly. The versatility and capabilities of these tools are also rapidly improving. This course will first cover ion/solid interactions, which are very important for a user of FIB instrumentation to understand. We will discuss different ion sources and the various ions that are now commercially available in FIB instruments, and explore their benefits for a range of applications. We will then discuss techniques of sample preparation for SEM and TEM, 3D applications, and micro- and nano-fabrication.

X12 - Practical Considerations for Image Analysis and ImageJ and Clemex Vision

James Grande, General Electric Global Research

This workshop covers a wide range of practical topics in the field of image analysis. Subjects will be covered in an easy-to-understand format so that users with little or no experience can understand how image analysis can provide extensive quantitative measurements that may lead to better understanding of material performance. Topics will range from input devices to image-processing algorithms and how best to extract quantitative data. Treating image analysis as a problem-solving tool along with discerning key metrics within a microstructure is discussed through several real-life examples. Comparisons using ImageJ/Fiji and a commercial image analysis product will be demonstrated.

X13 - SerialEM for EM Data Acquisition

David Mastronarde, University of Colorado, Boulder
Cindi Schwartz, Rocky Mountain Laboratories/NIAID/NIH
Guenter Resch, Nexperion - Solutions for Electron Microscopy

The course is intended to be of interest to both beginners and advanced users of SerialEM in both biological- and materials-science disciplines. Developed by David Mastronarde at the University of Colorado, SerialEM is open-source and widely used in TEM data acquisition. It is unique in its adaptability for many imaging techniques. The instructors will explain installation and calibration of SerialEM, including use of direct-electron detectors and imaging energy filters, and will cover imaging techniques such as tilt-series acquisition, low-dose imaging, single-particle acquisition, montaging, mapping, and STEM. We will discuss advanced programming such as scripts (macros), plugins, and working with the navigator file or image data to extend SerialEM beyond its native capabilities. A demonstration specifically for course attendees will be performed in the exhibit hall.

X14 - Sample Preparation for High-resolution EM of Materials — CANCELED

Donovan Leonard, Oak Ridge National Laboratory

This course is intended for attendees using electron microscopy (e.g. SEM, STEM, TEM) to image samples at high magnification. Topics covered will consider minimization of preparation artifacts in order to achieve representative samples that yield high-quality micrographs. Methods producing consistent high-resolution SEM and atomic-resolution TEM/STEM imaging will be discussed.

X15 - Introduction to SEM with EDS: Imaging and Compositional Analysis

Keana Scott, National Institute of Standards and Technology
Nicholas Ritchie, National Institute of Standards and Technology

This introductory-level course will cover basic SEM instrument operation, imaging modes, and compositional analysis with an energy-dispersive x-ray spectrometer. We will approach the subject from the perspective of taking high-quality data that can be used to answer metrological, materials and compositional questions with a high degree of confidence. We will discuss practical considerations and strategies for different types of applications. The course will conclude with discussions of the latest SEM technologies, x-ray detector options, add-on tools, and image-analysis methods.

X16 - Multivariate Methods and Image-processing for Quantitative Microscopy

Stephen Jesse, Oak Ridge National Laboratory
Alex Belianinov, Oak Ridge National Laboratory
Suhas Somnath, Oak Ridge National Laboratory
Christopher R. Smith, Oak Ridge National Laboratory

Recent advances in microscopy hardware, statistical algorithms, and supporting information technology have made large volumes of high-veracity materials data easy to acquire. However, these hyperspectral data conceal pertinent information that is difficult to extract and interpret when the data size is large, complex, and corrupted by noise. In this tutorial, we will demonstrate a set of open-source Python-based tools that will make image- and spectral-data processing significantly easier for beginners and experts alike. We will showcase implementation, and highlight strengths and weaknesses, of various image-processing and machine-learning methods for a subset of real-world microscopy problems.

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- Physical Sciences Tutorials
- Biological Sciences Tutorials

Physical Sciences Tutorials

Organizer: Donovan N. Leonard, Oak Ridge National Laboratory

X40 - Scanning Nanobeam Diffraction

Presenter: Colin Ophus, Lawrence Berkeley National Laboratory

Traditional scanning transmission electron microscopy (STEM) detectors are large, single pixels that integrate a subset of the transmitted electron beam signal scattered from each electron probe position. These transmitted signals are extremely rich in information, containing localized information on sample structure, composition, phonon spectra, three-dimensional defect crystallography and more. Conventional STEM imaging experiments record only 1-2 values per probe position, throwing away most of the diffracted signal information. With the introduction of extremely high speed direct electron detectors, we can now record a full image of the diffracted electron probe at each position, producing a four-dimensional dataset we refer to as a 4D-STEM experiment. This tutorial will describe the challenges and opportunities created by 4D-STEM.

X41 - Entrepreneurship in the Microscopy Community

Presenter: John Domiano, Protochips

Several entrepreneurs from the microscopy community will be in attendance for a round table Q&A with tutorial attendees on topics including, but not limited to:

- Instrumentation development and commercialization
- Practical steps to take when starting your own microscopy based business
- Panel discussion on business start-up best practices
- Role of local affiliated microscopy societies in bringing microscopists and businesses together

X42 - Ultra-high spatial resolution EBSD: Transmission Kikuchi Diffraction (TKD) in the SEM

Presenter: Scott D. Sitzman, The Aerospace Corporation

- Introduction to TKD: What distinguishes TKD from conventional EBSD, to its benefit and detriment from the standpoint of both the researcher and the practitioner
- Hardware, software and SEM requirements & considerations
- TKD sample preparation
- Advice for high quality data collection

Biological Sciences Tutorials

Organizer: Tommi A. White, University of Missouri

X43 - Cryo-FIB: Overcoming the Hurdle of Sample Preparation for in situ Cryo-Electron Tomography

Presenter: Miroslava Schaffer, Max Planck Institute of Biochemistry, Germany

In recent years, Cryo-Focussed Ion Beam (Cryo-FIB) milling of frozen hydrated specimen has become a key technique for in-situ Cryo-Electron Tomography, immensely broadening the scientific questions which can be tackled. However, the obtainability of results hinges strongly on the quality of the preparation and its reproducibility. In this tutorial, we will present the technique developments at Max Planck in Martinsried and show what is needed for a reliable, high-quality specimen preparation. We will discuss the critical issues of the preparation workflow, including:

- Hardware requirements
- Optimizing freezing conditions
- Different milling strategies
- Protective coatings
- Obtaining homogeneously thin, large field-of-view lamellas
- Avoiding contamination
- Improving sample conductivity
- The influence of different specimen
- Tips and tricks

X44 - Single-particle Cryo-EM: Data Processing Techniques for Obtaining Optimal Results

Presenter: Ali Punjani, University of Toronto

Single-particle cryo-EM is a powerful method for resolving near-atomic resolution of 3D structures of a wide variety of biologically important molecules, including membrane proteins and GPCRs. As data collection and sample preparation mature, and the use of cryo-EM expands, expertise and tools for data processing are critical for achieving state-of-the-art results at high resolutions. In this tutorial, we will present a workflow of data processing methods and advanced algorithms available in the cryoSPARC software package for single particle cryo-EM, guiding the audience through processing stages including:

- Motion correction of microscope movies
- Picking single particles from micrographs
- Cleaning and sorting particle stacks in 2D

- Solving multiple heterogenous structures in 3D
- Refinement of structures and validation
- Advanced refinement techniques to improve resolution
- Tips and tricks

X45 - How to Get Funding for Instrumentation When Budgets Are Tight (Parts I and II)

Presenters - Part I:
Amelia Dempere, University of Florida
James LeBeau, North Carolina State University
Vonnie Shields, Towson University
Frank Macaluso, Albert Einstein College of Medicine
Christine Brantner, George Washington University

Presenters - Part II:
Robert Kokoska, Life Sciences Division, US Army Research Office
Guebre Tessema, National Facilities and Instrumentation Program, National Science Foundation
Malgorzata Klosek, Office of Research Infrastructure Programs, National Institutes of Health
Christine Brantner, George Washington University

Do you have questions about how to land an instrumentation grant for a new high-pressure freezing device or a replacement electron microscope? Then these are the tutorials for you! Decreases in federal and institutional budgets, along with increased competition for those resources, have made it more difficult to obtain funding for equipment. How can you maximize your chances for success? What does a funded grant application look like versus a not-funded one? These two tutorial sessions (Parts I and II) will provide you with advice from two different angles: agency officials and successful grant applicants. Come and hear the tips and tricks that they have to share. Be sure to bring your questions.

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Technologists' Forum

X30 - Technologists' Forum: E. Ann Ellis Memorial Symposium

Andreas Holzenburg, University of Texas, Rio Grande Valley
Janice G. Pennington, University of Wisconsin

"If we don't have a protocol, we are developing one," said Ann Ellis when interviewing for the position of research scientist in the Microscopy & Imaging Center at Texas A&M University. After she joined the team when asked how she liked it, she responded, "Oh, this is my dream job." What did she get so excited about? Helping faculty, staff and students with their specimen preparation and imaging needs; teaching theory (never without a strong hands-on component); developing new protocols to improve specimen preparation methodology to enable data acquisition to those who otherwise could afford it; imparting knowledge on ultrastructural pathology; and engaging in outreach efforts. And she did it with a passion second to none. Ann dedicated her life to electron microscopy and specimen preparation, and to the Microscopy Society of America and local affiliate societies alike, such as her all-time favorite SEEMS.

This symposium celebrates the life of Ann Ellis with talks covering research studies that benefited and still benefit from Ann's input and approach, or simply echo her passion for it.

X31 - Technologists' Forum Special Topic Session: Specimen Preparation for Correlative FIB-SEM and XRM

Caroline Miller, Indiana University School of Medicine

3D characterization and modeling of microstructures at levels of light and electron microscopy has had a surge in interest and activity across a variety of scientific fields. Correlative work using FIB-SEM and XRM microscopes are being used to gain the necessary data and understanding of different types of microstructures from the materials to the biological world. A thorough knowledge of specimen preparation is required to achieve the maximum amount of correct information from these microscopes, while avoiding artifacts. It is important to examine surface features that represent structures not modified due to specimen preparation. The purpose of this special session will look at the specimen preparation needed for this type of correlative microscopy.

X32 - Technologists' Forum Roundtable Session: Sample Preparation Strategies for Super-Resolution Correlative Electron Microscopy

Janice G. Pennington, University of Wisconsin

This roundtable session will cover basic steps needed to correlate super-resolution fluorescence microscopy and electron microscopy with emphasis on PALM, iPALM and STORM. Proper balance of fixatives as well as specific infiltration and embedding protocols are necessary to preserve the fluorophore as well the ultrastructural integrity of the sample. Choosing the correct fluorescent label will be discussed as well as alignment of the fluorescent and EM data sets. This discussion will be good for attendees who are new to these techniques.

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(https://www.2spi.com/)

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(/MandM/2018/)

2018 MSA Award Winners (https://www.microscopy.org/awards/society.cfm)

MAS Award Winners (http://www.microanalysissociety.org/)

Apply for a Meeting Award

M&M Meeting award applications are made **during paper submission**. The submission deadline of February 20 has now passed. All M&M 2018 Meeting Awards have been determined.

No additional scholarships or travel awards are available for M&M 2018. Several **onsite awards** will be given during the meeting, which do not require advance application.

MSA Micrograph Competition

This competition rewards the innovative blending of art and science. Winning micrographs will be selected on the basis of artistic merit and general audience appeal. The winner of the 2018 Micrograph Competition is featured on the cover of the 2019 Call for Papers brochure. A maximum of three (3) awards will be presented; First Prize: $200; Two Second Prizes: $50 each.

Enter the Contest!

Click on the link below to fill out a short Google form and upload a low-resolution image of your micrograph. You may enter as many micrographs as you like, but please submit one form per entry. **Micrographs must also be posted onsite in Baltimore**. (See **RULES** below.)

https://goo.gl/forms/MMUv4iAWv10GBK7i1 (https://goo.gl/forms/MMUv4iAWv10GBK7i1)

Criteria

- Entries must be scientifically significant
- Entries must contain novel information useful in resolving a scientific issue, and/or
- Present established information in a way that dramatically enhances its comprehension or interpretation.

Rules

1. An individual may submit a maximum of two (2) entries (one award per entrant).

2. Entries must have overall dimensions of 11" x 14" (horizontal or vertical), and be affixed to a stiff lightweight support (e.g. "foam board"). Micrographs may be mounted so that they have borders.

3. Each entry must have a separate text sheet with the title and a 200-word (max) description of the image, including the technique and its scientific significance. Text is recommended to be printed in 14-pt Times New Roman font on a separate 8½" x 11" sheet. Entrant's name, address, employer/institution, email address, and image title shall be posted on the back of the mounted entry(ies).

4. **NEW! An *Intent to Submit Form* must be completed and emailed by 5 PM on Friday, August 3 for each entry.**

5. ***Entries must be brought to the meeting in Baltimore and mounted on the display boards by 12:00 noon on Monday, August 6, 2018.***

6. Non-winning entries must be removed Thursday afternoon by 3:00 PM. Micrographs remaining after that time will be discarded.

7. Winners will be announced at the meeting during the Wednesday afternoon poster awards. Submitted micrographs remain the property of the entrants subject to the conditions above.

The winning image of the 2017 MSA Micrograph Competition is featured in the M&M 2018 Call for Papers brochure.

Onsite Awards

The M&M meeting's co-sponsoring societies confer competitively judged awards **at the meeting**.

MSA Student Poster Awards

We believe poster presentations are an excellent format for all participants to engage in intensive discussion with other researchers in the field. To especially encourage students to take advantage of this opportunity and submit papers for poster presentation, MSA provides cash awards to the most outstanding student posters (first author) each day (up to one in each of three categories).

Diatome Poster Awards

All posters illustrating the use of diamond-knife ultramicrotomy are eligible. Prizes include cash and Swiss watches.

MAS Best Paper Awards

MAS annually confers awards for papers presented at the M&M meeting deemed to be best in four categories. Each comes with a cash award generously provided by MAS Sustaining Members.

M&M Meeting Awards

The Microscopy Society of America (MSA) and the Microanalysis Society (MAS) annually sponsor awards for outstanding papers contributed to the Microscopy & Microanalysis (M&M) meeting, which are competitively judged based upon the quality of the submitted paper. These awards are provided to students, postdoctoral researchers, and professional technical staff members to help defray travel, lodging and other costs of attending the meeting. All awardees must fit the award criteria, as described below, at the time of the M&M meeting.

General Considerations

Award applicants will automatically be considered for memorial scholarships, conferred by MSA based on the generous support of society sponsors.

Applicants who have previously received an M&M Meeting Award will not be considered for a second award in the same category.

Students

All full-time students enrolled at accredited academic institutions are eligible for student awards. High school, undergraduate, and graduate students are encouraged to apply. Applicants are not required to be members of the sponsoring society.

Postdoctoral Researchers

All full-time postdoctoral researchers are eligible for post-doc awards. Applicants are not required to be members of the sponsoring society.

Professional Technical Staff Members

Full-time technologists are eligible for staff awards. In addition, **the applicant must be a member of the sponsoring society**, current in his or her dues for the year of the meeting.

Amount of Award

M&M Meeting Awards and memorial awards consist of full meeting registration and up to $1,000 for travel-related expenses. Original receipts must be provided to receive travel reimbursement. All award winners also receive an invitation to the Presidents' Reception, held on the Tuesday evening of the meeting.

Notification of Award

All award applicants will be notified by email of their award status approximately eight weeks after the Call for Papers deadline. Unsuccessful applicants will be permitted to withdraw their papers, should their ability to attend the meeting be contingent on the award, within one week following notification.

Requirements of Award

All award winners must present their paper in person at the M&M meeting in order to receive their award. Awardees are expected to attend and participate in the entire meeting, which runs from Sunday evening's opening reception through late Thursday afternoon.

Awardees are required to attend the Monday morning plenary session, at which their award will be conferred.

How to Apply For an M&M Meeting Award

1. As part of the on-line paper submission process, an applicant must flag his or her paper for award consideration. Only **one paper** may be designated and considered per applicant.

2. **The applicant must appear as *first author and presenter* of the paper submitted for award.**

3. Within the paper submission form, the applicant must provide the name, title, institution, and e-mail address of his or her supervisor, who will be contacted in March to provide a supporting letter and confirmation of applicability for the indicated award category (e.g. student, post-doc, or technical staff).

(https://www.microscopy.org/)

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Vendor Tutorials

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Bruker Corp.	514	**Crystal Orientation Mapping and Imaging at Nanometer Scale Using On-Axis TKD**	Monday, Aug 6th, 2018	Introduced just a few years ago, TKD in SEM, a.k.a. t-EBSD, has already become an established technique due to its much better spatial resolution as compared to standard EBSD and to the ever increasing need of analytical tools for characterizing nanomaterials. The original sample-detector configuration using the standard EBSD detector a.k.a off-axis TKD had certain limitations resulting in a drop in data quality and/or measurement efficiency. The two most important drawbacks of off-axis TKD were the strong gnomonic projection distortions in the patterns and the fact that the patterns were produced by high angle scattering electrons, i.e. very weak signal. We are going to demonstrate the unique capability of on-axis TKD which does not have these limitations. The most important factors influencing the spatial resolution of TKD in SEM will also be discussed as well as its integration with other techniques like Energy Dispersive X-Ray Spectroscopy (EDS).

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
EXpressLO LLC	538	Theory and Applications of ex situ Lift Out	Monday, Aug 6th, 2018	The EXLO theory and methods will be discussed and applications in specimen lift out and manipulation will be demonstrated.
Gatan	824	Advances in EELS and EFTEM Analysis	Monday, Aug 6th, 2018	Please join Gatan to learn about the latest results from our EELS systems focusing on high-speed acquisition, fine structure analysis and sensitivity improvements. We will highlight the tools and methodology used to acquire these results.
Gatan	824	Correlating Physical and Optical Properties Down to the Nanoscale Using Cathodoluminescence	Monday, Aug 6th, 2018	Characterization of the optical properties of materials with spatial resolution better than the diffraction limit of light is required to further our understanding of nanostructured materials and devices, and light-matter interactions. The technique of cathodoluminescence (CL) performed in the scanning- and transmission- electron microscopes has gained great interest to study optical properties at the nanoscale due to the ability to excite optical processes with a sub-nanometer probe of electrons. Light emission is defined by its distribution in energy (wavelength), momentum (angular), and polarization and in this tutorial, we will review how the latest tools are being used to understand all three distributions, delivering the most complete understanding to date of optical properties at the nanoscale and the most accurate correlation with physical properties.
IDES, Inc.	437	Compressively Sensed Video in Transmission Electron Microscopy	Monday, Aug 6th, 2018	

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
JEOL USA, INC	812	Various Acquisition Options with serialEM	Monday, Aug 6th, 2018	The workshop focuses on using SerialEM on the JEOL JEM-1400Flash for montaging, tomography and setting up for unattended image for a single particle acquisition.
MEO Engineering / PBS&T	330	Gas Injection, Etching, and Deposition in FIB/SEM	Monday, Aug 6th, 2018	Principles of Gas-Assisted Etching (GAE) and beam-induced deposition in Focused Ion Beam (FIB) and Electron Beam (SEM) systems, covering gas injection into vacuum apparatus, types of GAE reactions and precursors, influence of gas flux and raster parameters on dynamics of GAE and deposition processes, and highlights of GALEX(TM) Gas-Injection System (GIS) features.
point electronic GmbH	908	New Generation of Detectors and Electronics for Quantitative BSE	Monday, Aug 6th, 2018	The workshop covers new developments in detector and image acquisition technology for BackScatter Electron (BSE) techniques. The new high-speed detector technology developed by PNDetector will be described, as well as the new high-temperature detector developed by Point Electronic. Calibrated signal amplification and acquisition is also detailed, including software for acquisition and analysis. Workflows for quantitative analysis (qBSE) and height measurements (SEM topography) are described. Applications illustrated include measurement of density, roughness and step height, as well as measurement of FIB milling and deposition rates.
Protochips	1238	Latest Advancements in the Protochips in situ Product Suite	Monday, Aug 6th, 2018	

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
SEMTech Solutions, Inc.	531	Upgrading SEMs with Win10 Software	Monday, Aug 6th, 2018	Hands on review of the new SEMView 8000 package, with Universal Electronics Control, on a refurbished FEI XL-30 ESEM and AMRAY 1830 SEM. The SEMView 8000 is now capable of upgrading most SEMs with 64 MegaPixel image capture, along with full control of the column, stage, and vacuum running under a Win10 software platform.
TESCAN USA Inc.	413	Automation of SEM Experiments and Calibration using SharkSEM and Python	Monday, Aug 6th, 2018	SharkSEM has enabled simple and robust control of Tescan's SEMs through Python, allowing for automated control of experiments. Examples will be provided for how automation tasks have been integrated into serial sectioning experiments. The impact of automated microscopy will be explained in the context of developing an autonomous material-to-information pipeline.
TESCAN USA Inc.	413	Exploring Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS) Integrated with FIB-SEM	Monday, Aug 6th, 2018	TOF-SIMS provides another powerful capability to analyze materials within the FIB-SEM. The fundamentals of TOF-SIMS analysis and its application to materials characterization in the FIB-SEM environment will be presented.
Vitatech Electromagnetics LLC	1418	Passive Shielding, Revealed!	Monday, Aug 6th, 2018	Live hands-on demonstration of the superiority of passive shielding compared to ACS only EMI solutions.
Digital Surf	425	3D Photogrammetry for SEM	Monday, Aug 6th, 2018	How to reconstruct a 3D model from your SEM data in just a few seconds
Vitatech Electromagnetics LLC	1418	Retrofitting Existing Imaging Tools with Active Compensation Systems	Monday, Aug 6th, 2018	Existing facilities for Electron Microscope present certain challenges for traditional electromagnetic mitigation which can be successfully abated with an Active Compensation System (ACS).

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Angstrom Scientific, Inc.	1138	Demonstration of NANOPSIS M - The World's First Microsphere Objective Lens Microscope to Surpass the Optical Diffraction Limit	Tuesday, Aug 7th, 2018	The NANOPSIS M is a bright-field microscope tuned to work with SMAL, the world's most powerful water-immersed objective lens with a 4 - 6 x performance increase over a regular 100 x lens. Semiconductor sample live scanning will be demonstrated.
Bruker Corp.	514	High-Speed Elemental Mapping with Micro-XRF/SEM	Tuesday, Aug 7th, 2018	Introduced just a few years ago, micro-XRF has become a widely used analytical technique in SEM. One major application is element distribution measurements. However, the X-ray beam cannot be scanned as the electron beam in the SEM. Thus, the change of the measurement position has to be performed by SEM stage movement. In most SEMs, moving the stage from point to point is time consuming which results in long acquisition times. We are going to demonstrate our new piezo sub-stage which will be mounted directly on the existing SEM stage. This new stage enables distribution analysis "on the fly" meaning the stage never stops during acquisition with a maximum speed of up to 20 mm/s. Useful information on element distribution can already be obtained with an acquisition time of 1 ms per pixel. Seamlessly integrated in the ESPRIT software suite, it even allows the use of EDS and micro-XRF mapping simultaneously.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Bruker Corp.	514	Quantitative Element Mapping and Analysis of (Mainly) Electron Transparent Samples Using EDS	Tuesday, Aug 7th, 2018	With the advent of SDD technology Energy Dispersive X-Ray Spectroscopy (EDS) for STEM is growing into a wide spread well-established serious analysis technique. Just identifying elements is not good enough, it becomes more and more relevant to know how many atoms there are of which element. How well can this be measured without a few assumptions and how does the composition develop during e.g. in-situ experiments? The tutorial introduces possibilities for quantitative EDS in STEM compared to SEM and in relation to some other STEM analysis techniques. Quantitative EDS using Bruker ESPRIT SW for off-line data analysis is demonstrated. Advantages of version 2 vs version 1.9 are shown and analysis approaches tailored to specific challenges, such as nanoparticles, interfaces and composition changes during in situ experiments, are discussed.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Carl Zeiss Microscopy, LLC	624	Connecting Modern Microscopy and Classical Metallography to Train the Next Generation of Scientists	Tuesday, Aug 7th, 2018	Our imaginations continue to drive the development of taller towers, stronger ships, and improved manufacturing. Despite exploding research and development in new materials, the value and importance of metals to the modern world remains clear. ASM International is a world leader in metallography education and training, offering classroom and laboratory coursework for a wide audience from career metallurgists to aspiring materials scientists in high school. In particular, metallographic preparation, microstructure interpretation, and failure analysis training programs at ASM International covers macroscopic preparation to microscopic evaluation of samples. Through a strategic partnership with ZEISS, light and electron microscopes enhance this coursework. Elemental mapping and semi-quantitative analysis of phases and constituents broaden the tools available to students. Correlative microscopy enables a convenient workflow for direct comparison of light and electron microscope contrast methods of a single area. This approach provides a complete toolbox for answering demanding industrial problems and teaching metallurgical concepts.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Carl Zeiss Microscopy, LLC	624	REFINE Your View, Imaging Tales from a Multi-Modal Lab	Tuesday, Aug 7th, 2018	Multi-modal characterization workflows require a suite of tools that interact in such a way that details typically omitted or overlooked by singular techniques are elucidated in an easy to obtain and well correlated fashion. Whether spanning traditional throughput, length scale, or sample interaction limitations, imaging tools are increasingly capable of utilizing data from one instrument to guide the efforts undertaken by additional downstream methods. Examples of multi-modal investigations on advanced coatings will be used to illustrate the impact of complementary information from various forms of microscopy including both non-destructive (XRM) and destructive (FIBSEM) forms of 3-dimensional analysis
Digital Surf	425	Apply Color to SEM Images Quickly and Easily	Tuesday, Aug 7th, 2018	How to colorize your black & white SEM image
Direct Electron	738	Recent Developments for Cryo-EM	Tuesday, Aug 7th, 2018	We'll share our recent developments related to biological cryo-EM, including improvements to hardware and algorithms for better electron counting, high-throughput data collection, large-area tomography, etc.
E.A. Fischione Instruments, Inc.	424	Versatile and Reliable Sample Preparation for SEM: Model 1061 SEM Mill	Tuesday, Aug 7th, 2018	Fischione Instruments Model 1061 SEM Mill is a fast and precise ion mill for cross-section and plan view sample preparation. The SEM Mill offers stage cooling for beam-sensitive materials and vacuum transfer capability for atmosphere-sensitive materials.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Gatan	824	Application of High Speed Cameras for 4D Data Collection in STEM	Tuesday, Aug 7th, 2018	Diffraction patterns directly provide crystallographic information about the specimen, which can be used to determine material structures, atomic displacements and structural modulations in crystals. This tutorial gives a quick introduction on different electron diffraction methods in transmission electron microscopy and discusses how 4D STEM diffraction-imaging experiments can benefit from high speed cameras. This will include live demonstrations of Digital Micrograph application used to collect, visualize and analyze 4D STEM diffraction datasets.
Gatan	824	Latest Developments in Gatan Microscopy Suite	Tuesday, Aug 7th, 2018	We will highlight the latest new developments in Gatan Microscopy Suite (GMS), including new image analysis routines, a whole new paradigm in data presentation, new STEM and EELS features and more.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Hitachi High Technologies America, Inc.	1125	Advanced Software Image Processing for Hitachi EM/IM Systems	Tuesday, Aug 7th, 2018	Image analysis software enhances data collection for those who wish to increase accuracy and automate research, development and quality processes. Site-specific surface analysis via SEM with Hitachi Map3D software can quickly acquire micron and nano-specific 3-dimensional model surfaces using either by stereo pairs or simultaneous acquisition using integrated image detectors. Automated image processing such as particle size analysis and 3-dimensional volumetric rendering reveals information beyond traditional microscopy techniques for applications in numerous sciences. Image-Pro and Hitachi delivers an integrated solution with macro driven customizability for automated routines on the latest Hitachi EM/IM platforms. In this tutorial we will present multiple image processing applications including a Show-and-Learn session live with data generated from the latest microscope platforms for 2D and 3D applications. Join us to learn more about automated microscopy!
HREM	906	SmartAlign Plug-In	Tuesday, Aug 7th, 2018	SmartAlign plug-in with Template matching module will be presented by the original developer.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Hummingbird Scientific	605	Exploring Heating and Heating/Biasing Experiments with in situ Electron Microscopy	Tuesday, Aug 7th, 2018	In this tutorial we will present our newest in-situ electron microscopy platforms to perform heating and heating/biasing experiments with MEMS-based chips. We will cover the platforms capabilities and present different examples, such as the crystallization of titanium oxide amorphous thin films and the melting of Au particles (melting temperature: 1064° Celsius). Practical considerations such as sample drift, power consumption, and how samples are prepared will be discussed -- the chips where samples are mounted for characterization are contacted to the sample holder via a robust mechanism that guarantees good electrical contacts and easy sample preparation.
JEOL USA, Inc	812	Atomic Resolution TEM with Cs Correction/Cold FEG and Molecular Microscopy with Mass Spec Imaging	Tuesday, Aug 7th, 2018	Two ends of the microscopy spectrum, from atomic resolution imaging to mass spec imaging, will be presented by Eric Stach, University of Pennsylvania and Robert Cody, JEOL USA
MEO Engineering / PBS&T	330	Cost of Maintaining and Useful Lifetime of FIB/SEM Equipment	Tuesday, Aug 7th, 2018	Overview of pros, cons, and cost/benefit considerations for support models of FIB/SEM instrumentation and other capital equipment: extended warranty, OEM and third-party service contracts, Time and Materials (T&M) service calls, service insurance, and self-service with diversified support. Considerations for reducing cost of ownership and extending useful lifetime beyond the forced obsolescence, avenues for procurement of spare parts, consumable components, maintenance training, and support.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Microscopy Innovations	718	Walk-Away Specimen Preparation of Biological Tissue for TEM and Immunogold Labeling using ThemPrepâ„¢ ASP-1000 Automated Specimen Processor	Tuesday, Aug 7th, 2018	Learn about rapid robotic parallel processing of multiple kidney, muscle and liver tissue specimens plus fullyautomated on-grid immunogold labeling using innovative mPrep capsules and the mPrep ASP-1000 Automated Specimen Processor. Kidney is processed from fixative rinse through infiltration in about an hour and other tissues typically in about 2 hours. See the ASP-1000's new fume containment system and control software with three-tiered user access and text alert signaling to operators.
Olympus America, Inc.	612	Surface Roughness 101 using Laser Scanning Confocal Microscopy	Tuesday, Aug 7th, 2018	Surface metrology, measurement of solid surfaces topography, has become an important topic for many material scientists and engineers. Laser Scanning Confocal Microscopy (LSCM) is non-contact and non-destructive to samples, requires minimal sample preparation, and provides single nanometer-level resolution. In this session we will review these capabilities using Olympus' LEXT OLS5000 3D Laser Scanning Confocal Microscope.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Ted Pella, Inc.	1012	BioWave Assisted Processing for Serial Block-Face SEM (SBEM)	Tuesday, Aug 7th, 2018	Serial Block-Face SEM dictates the need for an extended sample processing protocol involving several metal stains in order to increase the signal and the conductivity of the sample. Unfortunately the routine SBEM protocol now used in most labs takes 5 days to perform. However, using the PELCO Biowave Pro+ to assist in the processing gives a substantial saving in time and the entire process can now be completed in under a day and samples processed in this way give identical results in the SBEM to those processed by the standard long protocol. Presented by Rick Webb, Sr. Research Officer, University of Queensland
TVIPS	809	CMOS based TEM camera for fast image acquisition combined with high sensitivity and high dynamic range	Tuesday, Aug 7th, 2018	CMOS based TEM camera and its unique properties that makes it an ideal choice for various application including in-situ experiments and MicroED.
Vitatech Electromagnetics LLC	1418	Passive Shielding, Revealed!	Tuesday, Aug 7th, 2018	Live hands-on demonstration of the superiority of passive shielding compared to ACS only EMI solutions.
Vitatech Electromagnetics LLC	1418	Retrofitting existing Imaging Tools with Active Compensation Systems	Tuesday, Aug 7th, 2018	Existing facilities for Electron Microscope present certain challenges for traditional electromagnetic mitigation which can be successfully abated with an Active Compensation System (ACS).

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
point electronic GmbH	908	New Generation of Detectors and Electronics for Quantitative BSE	Tuesday, Aug 7th, 2018	The workshop covers new developments in detector and image acquisition technology for BackScatter Electron (BSE) techniques. The new high-speed detector technology developed by PNDetector will be described, as well as the new high-temperature detector developed by Point Electronic. Calibrated signal amplification and acquisition is also detailed, including software for acquisition and analysis. Workflows for quantitative analysis (qBSE) and height measurements (SEM topography) are described. Applications illustrated include measurement of density, roughness and step height, as well as measurement of FIB milling and deposition rates.
SEMTech Solutions, Inc.	531	Upgrading SEMs with Win10 Software	Tuesday, Aug 7th, 2018	Hands on review of the new SEMView 8000 package, with Universal Electronics Control, on a refurbished FEI XL-30 ESEM and AMRAY 1830 SEM. The SEMView 8000 is now capable of upgrading most SEMs with 64 MegaPixel image capture, along with full control of the column, stage, and vacuum running under a Win10 software platform.
Agilent Technologies	537	Simplifying Core Facility and Shared Resource Management	Wednesday, Aug 8th, 2018	Agilent's iLab Operations Software is the global leader in web-based facility management tools. Learn why more than 175 institutions use iLab to schedule, manage projects, track usage, report, and bill.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Angstrom Scientific, Inc.	1138	Demonstration of NANOPSIS M - The World's First Microsphere Objective Lens Microscope to Surpass the Optical Diffraction Limit	Wednesday, Aug 8th, 2018	The NANOPSIS M is a bright-field microscope tuned to work with SMAL, the world's most powerful water-immersed objective lens with a 4 - 6 x performance increase over a regular 100 x lens. Semiconductor sample live scanning will be demonstrated.
Bruker Corp.	514	Bruker XFlash FlatQUAD EDS Detector - Gaining Analytical Advantages using an Annular Four-Channel Silicon Drift Detector	Wednesday, Aug 8th, 2018	As Silicon Drift Detectors (SDDs) have become the standard detectors for energy dispersive x-ray detection in the last years, special detector designs and concepts can bring the performance to the next level. During this tutorial, you will learn more about the special multi-element concept of the XFlash® FlatQUAD, an annular detector that can be placed between the pole piece and the sample in a standard SEM using a BSE detector like setup. This setup leads to an extremely large solid angle of more than 1 sr which is typically 100 times larger than standard 10mm detectors in a conventional inclined setup as well as to a high take-off angle. Therefore extremely high count rates can be achieved easily even with low probe currents, and can be processed with four separate electronic channels in parallel, leading to maximum output count rate of more than 2,400,000 cps. These properties make the detector an ideal device for high speed mapping applications or beam sensitive sample at low accelerating voltages and beam currents and samples with an extreme topography.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Coxem Co. Ltd.	614	Automated Particle Analysis with the New SELPA and CX-200plus using Oxford AZtecEnergy	Wednesday, Aug 8th, 2018	This is the first introduction for NEW capabilities in Automated Particle / Feature Analysis using the new CX-200plus SEM with Oxford AZtecEnergy. Applications include ISO Cleanliness, ASTM Steel Analysis, wear particles, Gun Shot Residue, Mineralogy, Geology and more.
Digital Surf	425	3D Photogrammetry for SEM	Wednesday, Aug 8th, 2018	How to reconstruct a 3D model from your SEM data in just a few seconds
Direct Electron	738	Innovations for Materials Science TEM	Wednesday, Aug 8th, 2018	We'll share our recent developments related to materials science TEM/STEM, including high-speed 4D-STEM/ptychography, high-speed in situ TEM, low-dose imaging, compressive sensing, etc.
E.A. Fischione Instruments, Inc.	424	Cryo-Transfer Tomography Holder for Advanced Cryo-Electron Microscopy	Wednesday, Aug 8th, 2018	Learn more about Fischione Instruments' Model 2550 Cryo Transfer Tomography Holder; an easy to use holder for cryo transfer and tomography of thin-film frozen-hydrated/vitrified specimens for low-dose imaging and analysis.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
Gatan	824	Capturing in situ EELS Video Datasets	Wednesday, Aug 8th, 2018	For many in-situ experiments, dynamic behavior is irreversible, and thus, only one in-situ experiment can be performed on a single TEM sample. This makes it essential to gather as much time-resolved data simultaneously as possible, since the material may be very different during subsequent acquisitions, and the dynamics of interest may no longer be observable. Acquiring chemical information from EELS can often be an important part of interpreting the dynamics from Â¬in-situ experiments. In this tutorial, workflows for in-situ EELS acquisition in GMS 3 will be explained and example datasets will be shown. Examples include core-loss, low-loss excitations, EFTEM and STEM-EELS.
Hitachi High Technologies America, Inc.	1125	Advanced MEMS In-Situ Technology for SEM & TEM - HTC Blaze Heating Holders	Wednesday, Aug 8th, 2018	Advanced MEMS heaters combined with precise feedback temperature control enable high-performance in-situ capabilities of Hitachi SEM and TEM microscopes. The Blaze heating holder allows for ultra-high resolution studies at elevated temperatures due to its highly stable configuration and features easy-to-use software to provide an effective solution for all your heating needs. In this tutorial we will present you results of selected heating studies as well as showcase the Blaze heating holders during live demonstrations on the SU7000 FE-SEM as well as HT7800 TEM. Join us to experience microscopy at the Xtreme Performance level!

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
HREM	906	qDPC Plug-In	Wednesday, Aug 8th, 2018	The plug-in for quantitative DPC (differential phase contrast) will be presented by the original developer.
Hummingbird Scientific	605	Replicating Bulk-Level Electrochemistry in Liquid Cell TEM	Wednesday, Aug 8th, 2018	In this tutorial we will present our newest in-situ electrochemical liquid cell TEM sample holder, which allows to acquire time-dependent electrochemistry data comparable to bulk samples. We will show the integration of the electrochemical liquid cell with an advanced hardware system and optimized MEMS-based chips, which have special electrodes configurations that allow true quantitative measurements of electrochemical processes in the TEM. This new in-situ TEM platform will enable and impact several areas of research, including electrochemistry, photocatalysis, and other energy related applications.
Microscopy Innovations	718	The mPrepâ„¢ System for Specimen Prep - What Has it Done Lately in Labs Like Yours?	Wednesday, Aug 8th, 2018	As more users adopt the innovative mPrep® System, documented applications have grown to include biological sample prep for TEM (including ultra-rapid tissue and organism embedding), rapid prep for serial block-face SEM, virus TEM in demanding BSL3/4 labs, immuno-gold labeling, cryo-facing SEM, pharmaceutical and medical device applications, nanoparticles, and more. The tutorial will discuss applications requested by attendees.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
point electronic GmbH	908	New Generation of Detectors and Electronics for Quantitative BSE	Wednesday, Aug 8th, 2018	The workshop covers new developments in detector and image acquisition technology for BackScatter Electron (BSE) techniques. The new high-speed detector technology developed by PNDetector will be described, as well as the new high-temperature detector developed by Point Electronic. Calibrated signal amplification and acquisition is also detailed, including software for acquisition and analysis. Workflows for quantitative analysis (qBSE) and height measurements (SEM topography) are described. Applications illustrated include measurement of density, roughness and step height, as well as measurement of FIB milling and deposition rates.
Protochips	1238	Edge Engineering of 2D Materials Using in situ Heating	Wednesday, Aug 8th, 2018	
RMC Boeckeler	1031	3D Reconstruction: Beyond Connectomics	Wednesday, Aug 8th, 2018	Various applications of 3D nano-technology presented by Naomi Kamasa and Connon Thomas from Max Planck Florida Institute for Neuroscience.
SEMTech Solutions, Inc.	531	Upgrading SEMs with Win10 Software	Wednesday, Aug 8th, 2018	Hands on review of the new SEMView 8000 package, with Universal Electronics Control, on a refurbished FEI XL-30 ESEM and AMRAY 1830 SEM. The SEMView 8000 is now capable of upgrading most SEMs with 64 MegaPixel image capture, along with full control of the column, stage, and vacuum running under a Win10 software platform.

Exhibitor	Booth #	Title of Tutorial	Date	Brief Description
TESCAN USA Inc.	413	RISE, the Confocal Raman Mapping in SEM: A Very Promising Approach for Geo-Materials and Mineralogy	Wednesday, Aug 8th, 2018	The application of RISE to geosciences will be illustrated by various practical examples in the field of geo-materials and mineralogy. The Use of a SEM-EDS coupled to confocal Raman-in-SEM imaging (RISE) is a new and efficient method for identifying the mineral nature of natural materials.

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