International Forum on Microscopy

8-10 August 2021, Guilin, China

IFM 2021

  

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Introduction

The 2nd International Forum on Microscopy (IFM2021) is sponsored by Chinese Academy of Engineering (CAE), and organized by China Instrument and Control Society (CIS), Microscopy Branch of China Instrument and Control Society (MCIS) and Harbin Institute of Technology (HIT). For the purpose of providing a platform for world masterminds in both science and engineering fields to exchange views on general development tendency, major issues, recent processes and appropriate industrial strategy. In addition, round-table talk discussion will be organized for world masterminds, specialists and entrepreneurs and common understanding reached will be basis for strategic planning for future development of microscopy.

Scopes

- Optical Microscopy
- Scanning Probe Microscopy
- Electron Microscopy
- Magnetic Force Microscope
- Acoustic Microscopy
- Radionuclide Imaging
- Big Data Imaging and Artificial Intelligence
- Industrialization and Application

IFM 2021

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Guilin, China

International Forum on Microscopy

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General requirements for papers

Please submit an introduction of the reporter and a structured extended abstract (up to 1 page) before the Abstract Due Date. The structured extended abstract should have figures, and sufficient data. Full manuscript is not needed. The forms of the reports on the conference will include plenary/keynote/invited talk and Poster.

Considering the ongoing pandemic, IFM 2021 will adopt a **hybrid model integrating online and offline**, where overseas scholars will participate in the conference online and domestic participators will join us offline. To avoid the possible problems caused by the network service, we strongly recommend overseas scholars to use "pre-recorded video + online discussion" for conference speeches.

Critical Dates and Location

Abstract Due Date: ~~June 15, 2021~~ **July 5, 2021**
Check-in Time: **August 8, 2021(CST, UTC+8)**
Duration: **August 9-10, 2021(CST, UTC+8)**
Venue: **Grand Bravo Guilin Hotel (Guilin, China) (**In Chinese: 桂林大公馆**)**
Hotel add.: **No.2 Zhongyin Road, Grand Bravo Guilin, Guilin, China**
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Contact Information

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Registration Fee

	Before July 7, 2021	After July 7, 2021
Regular registration fee	**2000 RMB**	**2400 RMB**
Student registration fee	**1000 RMB**	**1400 RMB**

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Hotel Room Reservation

The conference provides the accommodation reservation at the Grand Bravo Guilin Hotel (桂林大公馆) for the delegate with a special discount.

The hotel offers:

Grand Bravo Guilin Hotel (桂林大公馆)

Hotel Add: **No.2 Zhongyin Road, Xiufeng District, Guilin, 541001, Guangxi, China**

Double room (Two single beds) 400 RMB per room per night with two breakfasts

Single Room (One double bed) 400 RMB per room per night with two breakfasts

The room charge could be discounted if reservation is made before July 5, 2021. (Through email **microscopy-cis@outlook.com** with the Subject ‘Room Reservation’ and receipt table)

Speakers

Plenary speakers

Hongjun Gao, Chinese Academy of Sciences, China

Wolfgang Baumeister, Max Planck Institute of Biochemistry, Germany

Paul Weiss, University of California, Los Angeles, USA

Scott Fraser, University of Southern California, USA

Minghui Hong, National University of Singapore, Singapore

Zeev Zalevsky, Bar-Ilan University, Israel

Alain Diebold, SUNY Polytechnic Institute, USA

Changhuei Yang, California Institute of Technology, USA

(To be updated)

Plenary speakers

Prof. Wolfgang Baumeister

Director and Head of Department
Max Planck Institute of Biochemistry, Martinsried
Honorary Professor, TU Munich, Faculty of Chemistry
Honorary Professor, TU Munich, Faculty of Physics
Distinguished Adjunct Professor, ShanghaiTech University
Member of the US National Academy of Sciences

Prof. Wolfgang Baumeister is Director and Head of the Department of Structural Biology at the Max Planck Institute of Biochemistry, Martinsried.

He obtained his PhD from the University of Düsseldorf in 1973. 1981/82 he spent time at the Cavendish Laboratory in Cambridge, England as a Heisenberg Fellow. In 1982 he joined the Max-Planck-Institute of Biochemistry in Martinsried as a group leader (C3). Since 1988 he is a Scientific Member of the MPG and Director of the Department of Structural Biology. 2000 he was a Moore Distinguished Scholar at the California Institute of Technology in Pasadena, California. From 2014 to 2020 he was a Senior Fellow at the Canadian Institute for Advanced Research (CIFAR). Professor Baumeister's main interest is the development of new tools and methods for the structural characterization of molecules and cells. He is particularly interested in the development of electron cryotomography for structural studies of molecular and supramolecular structures in situ, i.e. in their cellular environment. A major focus is the molecular machinery of protein quality control, in particular the proteasome.

His awards and honors include: Ernst-Ruska Prize (1982), EMBO Member (1988), Otto-Warburg-Medal (GBM, 1998), Fellow, Bavarian Academy of Sciences (2000), Max-Planck Research Award (2000), Prize of the Feldberg Foundation (2001), Fellow, American Academy of Microbiology (2001), Fellow, German Academy of Sciences Leopoldina (2001), Karl-Heinz-Beckurts Prize (2001), Foreign Honorary Member, American Academy of Arts & Sciences (2002), Datta Lecture and Medal, FEBS (2002), Louis Jeantet Prize for Medicine (2003), I. and H. Wachter Prize (2003), Stein and Moore Award, Protein Society, USA (2004), Schleiden-Medal, German Academy of Sciences, Leopoldina (2005), Harvey-Prize in Science and Technology, Technion Haifa (2005), Ernst-Schering-Prize, Schering Foundation (2006), Carl Zeiss Lecture and Prize, German Society for Cell Biology (2008), Bijvoet Medal, University of Utrecht, Netherlands (2008), Biochemical Analysis Prize (DGKL, 2008), J.M. Cowley Medal, International Federation of Microscopy Societies (2010), Foreign Associate US National Academy of Sciences (2010), Palladin Medal, Ukrainian Academy of Sciences (2014), Rolf-Sammet Professorship, University of Frankfurt, Aventis Foundation (2015), Doctor honoris causa, Masaryk University, Brno, Czech Republic (2017), Honorary Fellowship of the Royal Microscopical Society (2017), Ernst Jung Medal for Medicine in Gold, Jung-Stiftung (2018), Vallee Foundation Visiting Professorship (2018), Ivano Bertini Award (2019), Scientific Prize of the Stifterverband (2019), van Deenen Medal, University of Utrecht (2019), Doctor honoris causa, Heinrich Heine Universität (2020).

Title: **Structural biology *in situ*: the promise and challenges of cryoelectron tomography**

Traditionally, structural biologists have approached cellular complexity in a reductionist manner by characterizing isolated and purified molecular components. This 'divide and conquer' approach has been highly successful, as evidenced by the impressive number of entries in the PDB.

However, awareness has grown in recent years that only rarely can biological functions be attributed to individual macromolecules. Most cellular functions arise from their acting in concert. Hence there is a need for methods developments enabling studies performed *in situ'* i.e. in unperturbed cellular environments. *Sensu stricto* the term structural biology *in situ*' should apply only to a scenario in which the cellular environment is preserved in its entirety.

Cryo electron tomography has unique potential to study the supramolecular architecture or 'molecular sociology' of cells. It combines the power of three-dimensional imaging with the best structural preservation that is physically possible to achieve. We have used this method to study the 26S proteasome in a number of cellular settings revealing their precise location, assembly and activity status as well as their interactions with other molecular players of the cellular protein quality control machinery.

Prof. Paul S. Weiss

UC Presidential Chair
Distinguished Professor of Chemistry & Biochemistry, Bioengineering, and Materials Science & Engineering
California NanoSystems Institute
University of California, Los Angeles (UCLA)
ACS Nano, Editor-in-Chief

Prof. Paul S. Weiss graduated from MIT with S.B. and S.M. degrees in chemistry in 1980 and from the University of California at Berkeley with a Ph.D. in chemistry in 1986. He is a nanoscientist and holds a UC Presidential Chair and is a distinguished professor of chemistry & biochemistry, bioengineering, and materials science & engineering at UCLA, where he was previously director of the California NanoSystems Institute. He also currently holds visiting appointments at Harvard's Wyss Institute and several universities in Australia, China, and South Korea. He studies the ultimate limits of miniaturization, developing and applying new tools and methods for atomic-resolution and spectroscopic imaging and patterning of chemical functionality. He and his group apply these advances in other areas including neuroscience, microbiome studies, tissue engineering, and high-throughput gene editing. He led, coauthored, and published the technology roadmaps for the BRAIN Initiative and the U.S. Microbiome Initiative. He has won a number of awards in science, engineering, teaching, publishing, and communications. He is a fellow of the American Academy of Arts and Sciences, American Association for the Advancement of Science, American Chemical Society, American Institute for Medical and Biological Engineering, American Physical Society, American Vacuum Society, Canadian Academy of Engineering, IEEE, Materials Research Society, and an honorary fellow of the Chinese Chemical Society and Chemical Research Society of India. He is the founding and current editor-in-chief of *ACS Nano*.

Title: Imaging Atomically Precise Chemical, Physical, Electronic, and Spin Interfaces

Paul S. Weiss*
Departments of Chemistry & Biochemistry, Bioengineering, and Materials Science & Engineering and
California NanoSystems Institute
University of California, Los Angeles, USA, 19104-6083
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It has become possible to fabricate atomically precise structures and interfaces. The key to leveraging this capability is to understand the interfacial properties, such as transport, so as to enable optimization in a targeted and reproducible way.[1] Ultimately, we would like to be able to *predict* the structures formed and their properties. I describe a series of advances in atomic-resolution spectroscopic imaging that have moved us closer to this goal. We are able to measure molecular orbitals across interfaces and the conductance of buried contacts.[2,3] We are also able to measure buried interactions in molecular layers.[4]

This latter property has enabled us to measure the atomically resolved structures of biomolecules without averaging.[5,6] In all of the above experiments, we exploit sparsity to record and to analyze information-rich data sets. With statistically significant data sets, we are able to understand heterogeneity in structure and function of complex assemblies.

References

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Prof. Minghui Hong

Department of Electrical and Computer Engineering
National University of Singapore
Director, Advanced Research and Technology Innovation Centre (ARTIC)
Director, Optical Science and Engineering Centre (OSEC)
Founder, Phaos Technology Pte. Ltd.

Prof. Minghui Hong specializes in laser microprocessing & nanofabrication, optical engineering and laser applications. He has co-authored 15 book chapters, 42 patents granted, ~ 500 scientific papers, and ~ 100 plenary/keynote/invited talks in international conferences. He is a member of organizing committees for Laser Precision Micromachining International Conference (2001~2021), International Symposium of Functional Materials (2005, 2007, and 2014), Chair of International Workshop of Plasmonics and Applications in Nanotechnologies (2006), Chair of Conference on Laser Ablation (2009) and Chair of Asia-Pacific Near-field Optics Conference (2013 and 2019). Prof. Hong is invited to serve as an Editor of *Light: Science and Applications, Engineering, Science China G*, *Physics*, *Laser Micro/nanoengineering*, and Executive Editor-in-chief of *Opto-Electronic Advances*. Prof. Hong is Fellow of *Academy of Engineering, Singapore (SAEng),* Fellow of *The Optical Society (OSA),* Fellow of *International Society for Optics and Photonics (SPIE),* Fellow of *International Academy of Photonics and Laser Engineering (IAPLE),* and Fellow of *Institution of Engineers, Singapore (IES).*

Title: Optical Microsphere Nanoscope: Progress and Outlook

To push imaging capability beyond 100 nm is revolutionary in the field of optical microscope. When a dielectric transparent microsphere at a diameter of 5 ~ 50 µm is located between sample surface and objective lens, this microsphere can image tiny feature sizes down to 50 nm, even 25 nm by coupling it into a confocal microscope. In this talk, both contact and non-contact mode nano-imaging schemes by optical microsphere nanoscope are presented. For the contact mode nano-imaging, a microsphere is in direct touch with sample surfaces, fine features at sub-50 nm can be observed clearly. However, such contact mode operation has the following critical drawbacks: the relative location of microsphere and sample is fixed and cannot be adjusted freely, thus limiting the imaging field and also contaminating sample surfaces. To address these issues, a non-contact nano-imaging mode for the optical microsphere nanoscope is successfully developed via the precise control of sample movement via nano-stages. Our recent research progress on non-contact confocal optical microsphere imaging microscope will also be described. This new approach can achieve enhanced imaging contrast (from 13% to 59%) with a competent resolving power as well as a much faster three-dimensional (3D) scanning speed (9 times faster) compared to a commercial confocal microscope. 3D surface morphology of the sample can also be obtained with fine details in both transverse and axial dimensions. Meanwhile, a new scheme based on microsphere compounded lenses (MCL) is employed to further enhance the FOV and imaging magnification. Due to an enlarged magnification, a high-resolution target with

137 nm line width can be resolved by a 10× objective lens. The field-of-view of MCL is two times that of a single microsphere, which can be further increased through scanning working manner. Technical limitations and further development of optical microsphere microscope, especially engineered microsphere, will be discussed. Our commercialization progress to push OptoNano 200 (in the process to OptoNano 100) products into the market will also be reported.

Prof. Zeev Zalevsky

Professor of Electro-Optics
Dean of Engineering,
Bar-Ilan University, Israel

Zeev Zalevsky received his B.Sc. and direct Ph.D. degrees in electrical engineering from Tel-Aviv University in 1993 and 1996 respectively. Zeev is currently a full Professor and the Dean of the faculty of engineering in Bar-Ilan University, Israel. His major fields of research are optical super resolution, biomedical optics, nano-photonics and fiber-based processing and sensing architectures. Zeev has published more than 530 peer review papers, 330 proceeding papers, 9 books (6 authored and 3 as an editor), 32 book chapters and about 100 patents. Zeev gave 600 conference presentations with more than 200 invited/keynote or plenary talks.

Zeev is a fellow of many large scientific societies such as SPIE, OSA, IEEE, EOS, IOP, IET, IS&T, ASLMS, AIMBE and more. He is also a fellow of the American National Academy of Inventors (NAI). For his work he received many national and international prizes such as the Krill prize, ICO prize and Abbe medal, SAOT prize, Juludan prize, Taubelnblatt prize, young investigator prize in nanotechnology, the International Wearable Technologies (WT) Innovation World Cup 2012 Prize, Image Engineering Innovation Award, NANOSMAT prize, SPIE startup challenge prize, SPIE prism award, IAAM Scientist Medal Award, International Photonic Award, Dr. Horace Furumoto Innovations Professional award, The Asian Advanced Materials Award, Edison Award, IEEE distinguished lecturer award, VEBLEO Scientist Award, Joseph Fraunhofer Award/Robert M. Burley Prize and more.

Besides his academic research activity, Zeev is also very active in commercializing his inventions into start-up companies. Zeev was and is involved in technologically leading of more than 10 startup companies.

Title: Superresolution: Breaking the bounds of imaging in microscopy

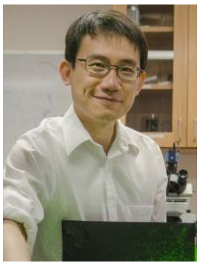
Imaging systems have limited capability for separation of spatial features and this information can also be extracted only from depth limited range. The reasons to the resolution and depth of focus limitations are related to the effect of diffraction i.e. the finite dimensions of the imaging optics as well as the geometry of the sensor.

In this talk I will present novel photonic approaches and means to exceed the above-mentioned resolution and depth of focus limitations and show how those concepts can be adapted to microscopy related configurations. I will present how the resolution limit can go below sub-wavelength bound towards nanoscopic imaging while using label-free configurations involving time multiplexing (time dependent light collection) based upon label-free non-static nano-particles either moving in uncontrolled Brownian motion or being manipulated with light.

Additional super resolution approaches suitable for microscopy which will be discussed include wavelength, field of view and coherence multiplexing. Usage of super-resolved microscopy will be demonstrated not only in order to enhance imaging quality of biological samples but it will also be applied for silicon IC failure analysis. Improved hybrid imaging modalities involving atomic force microscopy integrated with near field scanning optical microscopy will be discussed.

In the last part of the talk, the proposed super-resolved configuration will be combined with extended dept of focus (EDOF) capabilities based upon all-optical concept for EDOF imaging involving “interference” effect (rather than diffraction and refraction based EDOF).

Prof. Changhuei Yang



Thomas G. Myers Professor of Electrical Engineering, Medical Engineering, and Bioengineering
Engineering and Applied Science Division,
California Institute of Technology

Changhuei Yang is the Thomas G. Myers Professor of Electrical Engineering, Bioengineering and Medical Engineering at Caltech. He works in the area of biophotonics and computational imaging. His research team has developed numerous novel biomedical imaging technologies over the past 2 decades – including technologies for focusing light deeply into animals using time-reversal optical methods, lensless microscopy, ePetri, Fourier Ptychography, and non-invasive brain activity monitoring methods.

He has received the NSF Career Award, the Coulter Foundation Early Career Phase I and II Awards, and the NIH Director's New Innovator Award. In 2008 he was named one of Discover Magazine's '20 Best Brains Under 40'. He is a Coulter Fellow, an AIMBE Fellow and an OSA Fellow. He was elected as a Fellow in the National Academy of Inventors in 2020.

Talk title: Improving pathology and life science research by leveraging computational microcopy and machine learning

Abstract: The level of computational power we can currently access, has significantly changed the way we think about, process and interact with information. In this talk, I will discuss some of our recent computational microscopy and deep learning work, that showcase some of these shifts in the context of pathology and life science research. I will talk about Fourier Ptychographic Microscopy – a novel way to collect and process microscopy data, which brings significant workflow advantages to pathology. I will also talking about the use of Deep Learning in image analysis, and point out some of the surprising and impactful ways Deep Learning can improve the way we deal with image data in pathology and life science research.