

MC2021 ended successfully: The limits of the measurable - exciting developments and latest trends in light and electron microscopy

CONFERENCE REPORT

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From dancing atoms to fundamental questions about the limits of the measurable - after five exciting conference days on current developments and latest trends in light and electron microscopy, the Microscopy Conference MC2021 (<https://www.microscopy-conference.de/>) came to a successful close. Microscopy societies from 11 countries - Austria, Croatia, Czech Republic, Germany, Hungary, Italy, Serbia, Slovakia, Slovenia and Switzerland -, organised the digital Joint Meeting of Dreiländertagung and Multinational Congress on Microscopy. Led by the congress presidents Johannes Bernardi, Michael Stöger-Pollach and Stefan Löffler, Vienna University of Technology, MC2021 offered a comprehensive scientific exchange with a diverse program.

New research results were presented in eight thematic sessions on life sciences, materials science, and instrumentation and methods by experts from all fields. As the only major electron microscopy meeting in Europe this year, MC2021 offered especially for the so-called "early-stage researchers" (ESRs) best opportunities for an international scientific exchange to develop, network and gain new insights. A large number of younger researchers took the opportunity to present their work with exciting talks.

Keywords: life sciences; materials science; instrumentation and methods.

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BOOK AND EVENT REVIEW

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INTERDISCIPLINARITY AND EXCELLENT QUALITY OF THE MC2021

Special emphasis was placed on applications and developments of various microscopy techniques in the field of light and electron microscopy, which have made incredible progress in the last 20 years and have become indispensable in countless areas of research. Johannes Bernardi emphasised the high value of the new spectacular improvements and findings in these techniques. "The creativity of science opens new doors to better understand life, but also inorganic matter," said Michael Stöger-Pollach. The combination of the fields of life sciences, materials sciences and methods technology formed the major common focus. Stefan Löffler referred to the broad interdisciplinary set-up of MC2021 with excellent quality in all areas, which could not have been achieved otherwise.

The presentations showed that the trends of breakthrough improvements in electron microscopy in the field of imaging and analytics, as well as progressive automation, continued. It was clear that development of even more efficient and faster detectors and measurement methods also continues, and further advances are taking place in terms of method development in electron beam phase manipulation and the flexibility of available electron energies.

NEW DEVELOPMENTS IN LIFE SCIENCES AND MATERIALS SCIENCE

In the field of life sciences, the focus was on new developments in cryo-microscopy and in correlative techniques that combine different measurement methods on different size scales to better understand living nature with the help of this special technology. A wide range of interesting content was covered - from sample preparation and aspects of basic research to diagnostic and therapeutic applications in medicine and biotechnology.

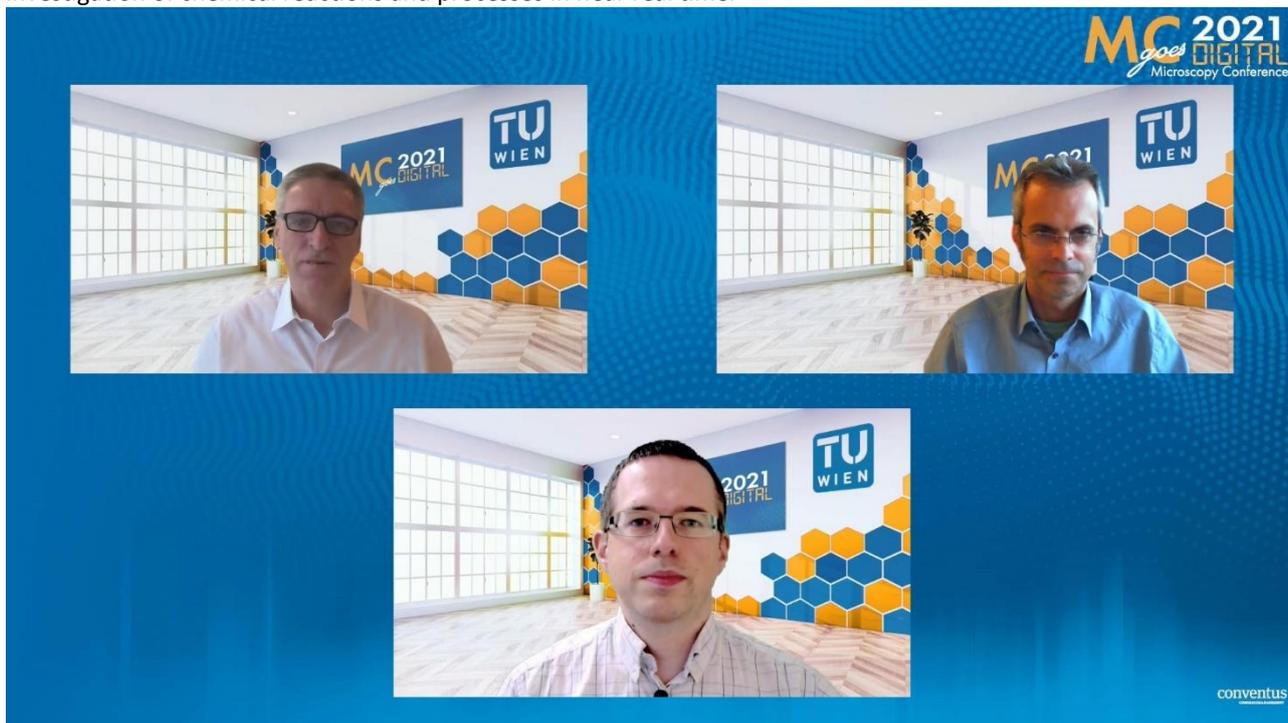
In the field of materials science, the focus was not only on material-related topics but also on a wide variety of analytical methods. In the presentations it became clear how much "in-situ" and "in-operando" applications have gained

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in importance. For example, gas or liquid cell imaging and spectroscopic techniques have been shown to enable the investigation of chemical reactions and processes in near real time.



MC2021 The Congress presidents, Johannes Bernardi, Michael Stöger-Pollach and Stefan Löffler (Foto CONVENTUS)

Another focus was on investigations using a wide variety of analytical techniques, as well as micro- and nano-mechanical methods to study structure-property relationships in new functional materials. Sessions on energy storage, catalysts and semiconductors, and the study of metals and ceramics were well attended.

ELECTRON MICROSCOPY IN MEDICAL RESEARCH

Presentations on cryo-microscopy capabilities and applications of machine learning and automation highlighted the essential role that high-resolution electron microscopy plays in medical research. Fascinating applications of high-resolution light microscopy were also presented in this area by labelling proteins genetically or marking them with dyes and tracking them in the organism. With regard to the fight against the coronavirus, it was fascinating to learn what an essential contribution high-resolution electron microscopy could make to the success of vaccine development. Thereby, understanding the complex structure of the viral envelope was crucial.

New developments in nanoscience were another conference focus. In addition to interesting presentations on the generation and investigation of nanostructures that can be produced by chemical processes or specifically by means of focused ion beams, research on 2D materials with special electrical properties, e.g., anisotropic dielectric properties, was presented.

DISCUSSION ON THE EU PROJECT "HORIZON EUROPE"

A special highlight was the high-level panel discussion on the EU project "Horizon Europe", in which new research infrastructures were presented. Internationally renowned experts shed light on the new opportunities offered by the European Union's planned research framework program to address global challenges for electron microscopy. Based on the analysis of previous projects, the question on how the electron microscopy community in Europe can organise broad access to its know-how was discussed. In this way, it will continue to play a crucial role in issues such as climate change adaptation, healthy oceans, climate-neutral cities, healthy nutrition and the fight against cancer.

HIGH-PROFILE PLENARY SPEAKERS AND AWARD CEREMONIES

Conference highlights were exciting presentations on important current topics. Renowned plenary speakers such as Sandra van Aert (University of Antwerp), Sarah Haigh (University of Manchester), Stefan Raunser (MPI Dortmund), Andreas Rosenauer (University of Bremen), Holger Stark (MPI Göttingen) and Marc Willinger (ETH Zurich) were able to inspire the participants with a broad range of topics in excellent presentations - from dancing atoms to fundamental questions about where the limits of the measurable lies.

A special highlight was the award of the internationally renowned Ernst Ruska Prize, awarded every two years, to Julia Mahamid (EMBL, Heidelberg) and to David A. Muller (Cornell University, USA), honoring the two scientists for their outstanding achievements in the field of electron microscopy. Joachim Mayer (RWTH Aachen and ER-C Jülich) was honored with the "Harald Rose Distinguished Lecture" award.

OUTLOOK 2023

Following the diverse exchange between young colleagues, experienced scientists and companies, the conference leaders were convinced that with MC2021 the successful series of joint conferences could be continued even during the pandemic. The next insights into the exciting properties of the world of atoms and molecules can be expected at the MC2023 Annual Meeting in Darmstadt from February 26 to March 2, 2023.

MC 2021 je uspešno završen: Granice merljivog - uzbudljiv razvoj i najnoviji trendovi u svetlosnoj i elektronskoj mikroskopiji

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Izvod

Nakon pet uzbudljivih konferencijskih dana o razvoju i najnovijim trendovima u svetlosnoj i elektronskoj mikroskopiji, obuhvatajući teme od atoma "koji plešu" do fundamentalnih pitanja o granicama merljivog, konferencija o mikroskopiji MC2021 (<https://www.microscopy-conference.de/>) uspešno je završena. Društva za mikroskopiju iz 11 zemalja - Austrije, Hrvatske, Češke, Nemačke, Mađarske, Italije, Srbije, Slovačke, Slovenije i Švajcarske organizovala su digitalni združeni sastanak: Dreiländertagung (Konferencija tri zemlje) i Multinacionalni kongres o mikroskopiji. Predsednici kongresa bili su Johannes Bernardi, Majkl Stoger-Polak i Stefan Lofler sa Tehnološkog univerziteta u Beču. MC2021 je ponudio sveobuhvatnu razmenu naučnih informacija kroz raznovrsni program. Stručnjaci iz različitih oblasti predstavili su nove rezultate istraživanja u okviru osam tematskih sesija o prirodnim naukama, nauci o materijalima i razvoju opreme i metoda. Kao jedini veliki sastanak na temu elektronske mikroskopije u Evropi ove godine, MC2021 je bio posebno važan za istraživače na početku karijere, takozvane "Early-Stage Researchers (ESRs)", nudeći najbolje mogućnosti za međunarodnu razmenu naučnih informacija u cilju razvoja, umrežavanja i sticanja novih saznanja. Veliki broj mlađih istraživača iskoristio je priliku da predstavi svoja istraživanja kroz usmene prezentacije.

Ključne reči: prirodne nauke; nauka o materijalima; instrumenti i metode

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