



IOP Publishing scientific webinars

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As part of our mission to promote physics worldwide, we are offering these free webinars as a way for you to get closer to the research, and the people doing it. You can register to watch these webinars on-demand, or sign up for the live ones happening in the coming weeks.



3D Bioprinting Utilized towards Human Disease Modeling

Tuesday 7 December 2021, 3.00–4.00 p.m. GMT

3D bioprinting offers great versatility in the fabrication of biomimetic volumetric tissues that are structurally and functionally relevant. It enables accurate control of the composition, spatial distribution, and architecture of bioprinted constructs, facilitating the recapitulation of delicate shapes and structures of target tissues and organs. This webinar provides an overview of our efforts on developing a series of advanced 3D bioprinting strategies, and places a focus on how these technologies may be utilized towards fabrication of human-based disease models for applications in therapeutics screening. This presentation is delivered by the guest editor of an ongoing *Biofabrication* special issue 'Placing 3D bioprinting into the context of human disease modeling' (closing for submissions 31 Dec 2021). The speaker will be Y Shrike Zhang, Assistant Professor, Department of Medicine, Harvard Medical School, and Associate Bioengineer, Division of Engineering in Medicine, Brigham and Women's Hospital. Following the presentation there will be an opportunity for attendees to put their questions to the speaker.

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Focus on Public Participation in Environmental Research

Thursday 2 December 2021, 3.00–4.00 p.m. GMT

Much of today's science involves many collaborators and many involve members of the public. Such 'Citizen' or 'Public Participatory' science projects play an important role in engaging people in science, enabling them to observe and truly experience the natural and human-impacted environments that surround them. Participatory science is on the rise as part of research in ecology, climate change, sustainable development, drought monitoring, land cover, land-use change, pollution monitoring and water research. In fact, virtually any environmental study could benefit from the help of public volunteers and by doing so, provide a teachable moment that is likely to transform the volunteer's environmental awareness and understanding of the scientific process. Join our webinar and a Q&A session with the Guest Editors of *Environmental Research Letters*' Focus issue on Public Participation in Environmental Research to discuss the rise of participatory science, its challenges and future developments as well as explore some recent case studies. This event will be presented by Lauren Carter, Publisher, *Environmental Research Letters*, Steffen Fritz, IIASA, Dan Rubenstein, Princeton University and Taru Sanden, Austrian Agency for Health and Food Safety (AGES).

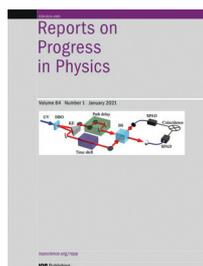
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EST: Spin- and angle-resolved photoemission on topological materials

Join Professor Risto Nieminen (Editor-in-Chief of *Electronic Structure*) and Professor J Hugo Dil (EPFL and Paul Scherrer Institute, Switzerland) in this exciting webinar. They will discuss Prof J Hugo Dil's topical review on Spin- and angle-resolved photoemission on topological materials, iopscience.org/article/10.1088/2516-1075/ab168b, which is published in *Electronic Structure*, iopscience.org/est.

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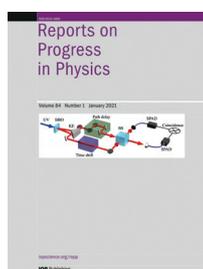
Computational methods for 2D materials modelling

This webinar, presented by Dr Alexandra Ines Sarabando de Carvalho, one of the paper's authors, covers the computational techniques used to simulate and predict the optical, electronic and mechanical properties of two-dimensional (2D) materials, and to interpret experimental observations. In particular, the challenges arising in the simulation of 2D constrained fermions and quasiparticles, and their perspective on the future directions in this field. The event is chaired by the journal's Editor-in-Chief Rebecca Gillan, with presentations from Dr Carvalho, National University of Singapore.

The article discussed is 'Computational methods for 2D materials modelling' by A Carvalho *et al.* recently published in *Reports on Progress in Physics*. It reviews state-of-the-art computational methods used to model 2D materials at different levels of theory, <https://doi.org/10.1088/1361-6633/ac2356>.

You can find out more about Reports on Progress in Physics and browse the articles iopscience.org/ropp.

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Fractional Charge and Fractional Statistics in the Quantum Hall Effects

Join the webinar audience for a talk with our speakers, Professors Dmitri E Feldman and Bertrand I Halperin. They are the authors of Fractional charge and fractional statistics in the quantum Hall effects, a review paper recently published in *Reports on Progress in Physics*, iopscience.org/article/10.1088/1361-6633/ac03aa.

The talk discusses fractional quantum Hall states, which are peculiar states of electron matter that are found to exist in certain two-dimensional electron systems in strong magnetic fields at low temperatures. It has been argued theoretically that these systems support elementary excitations ("quasiparticles") with the charge that is a fraction of the electron charge e , and it has been predicted that if the positions of two such quasiparticles are interchanged, the effect on the quantum mechanical wavefunction differs from what happens when ordinary particles such as electrons or atoms are interchanged. Whereas ordinary particles are said to obey Fermi-Dirac or Bose-Einstein statistics, fractional Hall quasiparticles are said to obey "fractional statistics", or in certain cases "non-Abelian statistics". During the webinar, we focus in detail on the definitions of these concepts and the ways in which their consequences may be observed. In addition to the theoretical foundations, we review the present status of the experiments in the area. Webinar speakers are Dmitri E Feldman, Brown Theoretical Physics Center and Department of Physics, Brown University, Bertrand I Halperin, Department of Physics, Harvard University, with an introduction by Professor Nandini Trivedi, Ohio State University.

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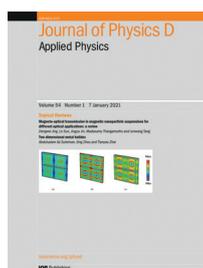


Nano Futures Webinar on Seamless integration of functional nanomaterials and nanoelectronics with biology

Hosted by Professor Bozhi Tian (The University of Chicago), join us for this exciting webinar with Professor Jia Liu (Harvard University), who will be discussing the research around his highly downloaded topical review 'Functional nanomaterial-enabled synthetic biology', iopscience.org/article/10.1088/2399-1984/abfd97. Published in the *Nano Futures* journal from IOP Publishing, iopscience.org/nanof.

More from Professor Jia Liu on the webinar: "In this talk, I discuss 1) "tissue-like" electronics that possess tissue-like properties for long-term stable single-cell electrophysiology in tissues, organs, and behaving animals; 2) "cyborg organoids", where stretchable sensor arrays are embedded in 2D sheets of stem/progenitor cells and reconfigured through 2D-to-3D organogenesis, enabling 3D electrophysiology over the time course of organoid development; and 3) genetically targeted functional assembly in tissue, where living neurons are genetically instructed to guide chemical synthesis of conductive and insulating polymers onto the plasma membrane for the bidirectional remodeling of cellular membrane properties and modulation of the cell-type-specific behaviors in freely-moving animals."

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Applied Physics by Pioneering Women: A Webinar

Women have made significant contributions to applied physics research and development, and their participation is vital to continued progress. Recognizing those contributions is important for encouraging increased involvement and creating an equitable environment in which women can thrive. This webinar includes a presentation by Gillian Butcher (University of Leicester) highlighting the international, multi-disciplinary and teamwork aspects of Space followed by a panel discussion on the contribution made by women scientists to applied physics and the importance of diversity in science.

The webinar is based on *Journal of Physics D: Applied Physics's* next Roadmap, 2022 Applied Physics by Pioneering Women: A Roadmap. The event is chaired by Cathy Foley (*Superconductor Science and Technology* Editor-in-Chief), one of the Roadmap's lead authors, with a presentation from Gillian Butcher (University of Leicester) followed by a panel discussion moderated by Kirstin Alberi (NREL) and featuring Cathy Foley (CSIRO), Youngah Park (Myongji University), Diana Leitao (TU Eindhoven) and Bonna Newman (TNO).

Find out more about *Journal of Physics D: Applied Physics* at iopscience.org/jphysd.

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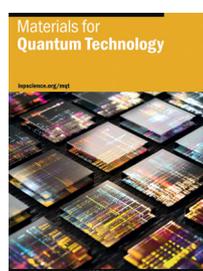


Integrated Quantum Photonics: Grand Challenges, and Future Directions

We are delighted to announce the publication of the 'Integrated Quantum Photonics' Roadmap in *JPhys Photonics* (IOP Publishing), an interdisciplinary, gold open access journal publishing leading work across photonics. Authored by leading voices in the topic of integrated quantum photonics, this Roadmap highlights the current progress in the field, future challenges, and advances in science and technology needed to meet these challenges.

In this webinar we are joined by Guest Editor and *JPhys Photonics* Editorial Board Member, Galan Moody (University of California, Santa Barbara, USA), John Bowers (University of California, Santa Barbara, USA), Eleni Diamanti (CNRS, France), Val Zwiller (KTH Royal Institute of Technology, Sweden). Chair, Volker Sorger (George Washington University, USA). The speakers discuss their latest research and will be looking at some of the grand challenges, and future directions of the exciting and rapidly advancing field of integrated quantum photonics.

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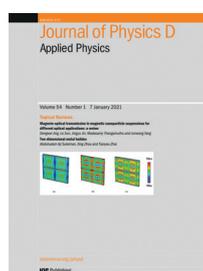


Materials for Quantum Technology

We stand on the brink of a second quantum revolution, and materials science will be key to unlocking novel technologies utilizing and controlling quantum states. This webinar outlines some of the latest developments at the interface of materials and quantum science, with presentations from leading researchers in the field. The webinar showcases work published in the inaugural volume of *Materials for Quantum Technology* (IOP Publishing), an interdisciplinary, gold open access journal publishing cutting-edge research on the development and application of materials for all quantum-enabled technologies and devices. The event is chaired by the journal's Editor-in-Chief Jason Smith (University of Oxford), with presentations from Stefania Castelletto (RMIT), Giordano Scappucci (QuTech) and Michael Flatté (University of Iowa).

You can find out more about *Materials for Quantum Technology* and browse the first volume at iopscience.org/mqt

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Solar Fuels Webinar

Renewable fuel generation is essential for a low carbon footprint economy. Thus, over the last five decades, a significant effort has been dedicated towards increasing the performance of solar fuels generating devices. This webinar outlines some of the scientific and engineering challenges that must be overcome in order to turn solar fuels into a viable technology, with presentations from leading researchers in the field.

The webinar showcases work to be published in *Journal of Physics D: Applied Physics's* next Roadmap, The 2022 Solar Fuels Roadmap. The event is chaired by one of the Roadmap's lead authors, Frances Houle (LBNL) with presentations from Harry Atwater (CALTECH), Daniel Nocera (Harvard) and Paul McIntyre (Stanford). These talks are followed by a panel discussion moderated by Gideon Segev (Tel Aviv University) and featuring Frances Houle and Roel van de Krol (TU Berlin).

You can find out more about *Journal of Physics D: Applied Physics* at iopscience.org/jphysd.

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Next Generation Batteries: Li-ion and Beyond

The growing energy demands of modern society are driving a revolution in battery technology, with researchers working to optimize the performance of current lithium-ion battery technologies and look beyond to the development of new battery chemistries which will power the clean energy transition. This webinar brings together speakers from the Faraday Institution, the UK's independent institute for electrochemical energy storage science and technology, who present their research on battery technologies.

The event is chaired by Professor John Irvine (University of St Andrews), Editor-in-Chief of *JPhys Energy* (IOP Publishing), an interdisciplinary, gold open access journal publishing leading work across materials science, physics, chemistry and engineering that has applications in energy.

Speakers include Professor Laurence Hardwick, University of Liverpool, Dr Nuria Tapia Ruiz, Lancaster University, Professor Paul Shearing, University College London and Dr Alisyn Nedoma, University of Sheffield.

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SUST: Superconductors for Fusion

With the first Tokamak designed for full nuclear operation now well into final assembly (ITER), and a new major research Tokamak starting commissioning (JT60SA), nuclear fusion is becoming a mainstream potential energy source for the future. A critical part of the viability of magnetic confinement for fusion is superconductor technology. The experience gained and lessons learned in application of this technology to ITER and JT60SA, together with new and improved superconducting materials, is opening multiple routes to commercial fusion reactors. The object of this webinar is to outline some of these routes and the materials/technologies that go with them. The webinar is run as a panel session featuring contributing authors to the forthcoming roadmap article 'Superconductors for Fusion: A Roadmap'.

To find out more about, 'Superconductors for Fusion: a Roadmap', view the accepted manuscript at iopscience.org/article/10.1088/1361-6668/ac0992.

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QST: Increasing quantum volume on a superconducting quantum computing system

Watch the webinar for a talk with our guest speaker Petar Jurcevic. Petar is the first author from our recently published open access article in *Quantum Science and Technology* from the IBM Quantum research groups. The talk details how the groups improved the quality of quantum circuits on superconducting quantum computing systems, as measured by the quantum volume, with a combination of dynamical decoupling, compiler optimizations, shorter two-qubit gates, and excited state promoted readout. This result shows that the path to larger quantum volume systems requires the simultaneous increase of coherence, control gate fidelities, measurement fidelities, and smarter software which takes into account hardware details, thereby demonstrating the need to continue to co-design the software and hardware stack for the foreseeable future.

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Quantum Materials: Now and the Future

Quantum materials and related science and technologies have a huge potential to impact on future industries and grand societal challenges. The emerging vast family of emerging quantum materials (including 2D materials, topological insulators, Weyl semimetals, twisted (Moiré) van der Waals heterostructures, etc) offer a revolutionary playground for fundamental science but also already put in perspective novel paradigms and future quantum technologies combining ultralow-power with resilient and practical implementation and processing of quantum information.

This webinar brings together speakers from the Quantum Materials Roadmap (<https://iopscience.iop.org/article/10.1088/2515-7639/abb74e>), who present their quantum materials research.

The event is chaired by Stephan Roche, Editor-in-Chief of *JPhys Materials* (IOP Publishing), an interdisciplinary, gold open access journal publishing leading work across materials science, physics, chemistry and engineering that has applications in energy.

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One-dimensional molecular systems with exotic quantum states

In this presentation, Dr Jelinek explores how recent progress in on-surface chemistry has paved the way for the synthesis of molecular chains with atomic precision. He will connect the two distinct worlds of topological band theory (condensed matter physics) and π -conjugation polymer science (chemistry). He demonstrates unusual mechanical and electronic properties of hydrogen bonded chains formed on a metallic surface driven by quantum nuclear effects within the chain. Finally, he presents the synthesis of organometallic chains and control of their conductivity by light, which opens new alternatives for optoelectronic devices on the molecular level.

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A webinar on Optical Biosensor Technologies with Laura Lechuga

The COVID-19 pandemic has evidenced the urgent need of having portable diagnostic tools that enable rapid testing and screening of the population with sensitivity and specificity levels comparable to laboratory techniques. Photonic biosensor technology is one of the best prepared to tackle the challenging goal of offering fast and user-friendly diagnostics tools that can be employed at the point-of-need.

In this presentation Laura talks through how her group has demonstrated cutting-edge nanophotonic biosensor point-of-care devices (such as the Bimodal Waveguide Interferometer) that enabled ultrasensitive analysis of body fluids in a few minutes and in decentralized settings. Her group has demonstrated sensitivities at the fM-aM level for clinical biomarkers diagnostics, such as for example the direct specific miRNA detection in urine and the whole pathogen detection directly in human samples.

Laura will look at how photonic biosensors can provide sensitive, reliable, and selective analysis, while reducing test and therapeutic turnaround times, decreasing and/or eliminating sample transport, and using low sample volume.

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