QUANTUM SCIENCE CENTER

4th Annual Quantum Summer School

APRIL 30TH – MAY 3RD, 2024

Hosted by Purdue University

A special thanks to our sponsors!!:

PURDUE UNIVERSITY
College of Engineering

PURDUE UNIVERSITY
College of Science

PURDUE UNIVERSITY
Purdue Quantum Science and Engineering Institute

PURDUE UNIVERSITY
Department of Physics and Astronomy

PURDUE UNIVERSITY
Elmore Family School of Electrical and Computer Engineering

PURDUE UNIVERSITY
Department of Chemistry

PURDUE UNIVERSITY
Elmore Family School of Electrical and Computer Engineering

EMERGING FRONTIERS CENTER
CROSSROADS OF QUANTUM AND AI

OAK RIDGE National Laboratory

MONDAY, APRIL 29, 2024 **PURDUE MEMORIAL UNION COMMONS**	
5:00 p.m. – 7:00 p.m.	***Welcome Gathering*** with special concert ***"Making Love with Chopin"*** by **Dr. Orit Wolf,** *Concert Pianist and Lecturer at The Technion – Israel Institute of Technology*
TUESDAY, APRIL 30, 2024 **STEW 218** **Chair: Morris Yang (morning), Peigang Chen (afternoon)**	
7:45 a.m. – 8:45 a.m.	***Registration & Breakfast***
8:45 a.m. – 9:00 a.m.	***Opening Remarks*** **Karen Plaut**, *Executive Vice President for Research, Purdue University* **Vivien Zapf**, *Los Alamos National Laboratory; Deputy Director, Quantum Science Center* **Alexandra Boltasseva**, *The Ron and Dotty Garvin Tonjes Professor of Electrical and Computer Engineering, Purdue University; Workforce Development Lead, Quantum Science Center*
9:00 a.m. – 9:40 a.m.	***Topological materials in the Quantum Science Center*** **Vivien Zapf**, *Los Alamos National Laboratory; Deputy Director, Quantum Science Center*
9:40 a.m. – 10:20 a.m.	***How to measure and use spintronic quantum materials: from topological insulators to quantum magnets*** **Yong Chen,** *Karl Lark-Horovitz Professor of Physics and Astronomy, Professor of Electrical and Computer Engineering, Director of Purdue Quantum Science and Engineering Institute, Purdue University*
10:20 a.m. – 10:35 a.m.	***Break***
10:35 a.m. – 11:15 a.m.	***Nanoscale circuits probe topology: new results in quasiparticle interferometry*** **Michael Manfra,** *Bill and Dee O'Brien Distinguished Professor of Physics and Astronomy, Professor of Materials Engineering, Professor of Electrical and Computer Engineering, Purdue University; Scientific Director, Microsoft Quantum Lab West Lafayette*
11:15 a.m. – 11:55 a.m.	***Extreme Space-Time Optics & Quantum Meta-Photonics*** **Vlad Shalaev**, *The Robert and Anne Burnett Distinguished Professor of Electrical and Computer Engineering, Purdue University*
11:55 a.m. – 1:00 p.m.	***Lunch***
1:00 p.m. – 1:40 p.m.	***A lesson on atomtronic sensing and signal processing*** **Dana Anderson,** *Co-Founder and Chief Strategy Officer, Infleqtion; Fellow, JILA; Professor of Physics and of Electrical & Computer Engineering, University of Colorado Boulder*
1:40 p.m. – 3:00 p.m.	***Infleqtion's Oqtant project; making quantum matter for everyone*** **Noah Fitch**, *Quantum Matter Portfolio Technical Lead, Infleqtion*
3:15 p.m. – 3:30 p.m.	***Break***
3:15 p.m. – 4:30 p.m.	***Postdoc Lightning Talks*** **Andres Allcca**, *Purdue*; **Amandeep Bhatia**, *Purdue*; **Vahagn Mkhitaryan**, *Purdue*; **Mandeep Saggi**; *Purdue*; **Alex Senichev**, *Purdue*; **Mikhail Shalaev**; *Duke*; **Demid Sychev**, *Purdue*
4:30 p.m. – 6:00 p.m.	***Poster Session (STEW 206)***
6:30 p.m. – 8:30 p.m.	***Welcome Dinner - Lafayette Brewing Company (622 Main St, Lafayette, IN 47901)***

WEDNESDAY, MAY 1, 2024 STEW 218 Chair: Alex Senichev (morning), Morris Yang (afternoon)	
8:00 a.m. – 9:00 a.m.	***Registration/Breakfast***
9:00 a.m. – 9:40 a.m.	***Quantum Chemistry on a Quantum Computer*** **Susanne Yelin,** *Professor of Physics in Residence, Harvard University*
9:40 a.m. – 10:20 a.m.	***Quantum Computing from Research to Product*** **Chris Monroe,** *Gilhuly Family Presidential Distinguished Professor of Physics and of Electrical and Computer Engineering, Duke University; Director, Duke Quantum Center*
10:20 a.m. – 10:35 a.m.	***Break***
10:35 a.m. – 11:15 a.m.	***Revolutionizing the Financial Industry with Quantum Technologies*** **Shouvanik Chakrabarti**, *Quantum Algorithms Researcher, JPMorgan Chase*
11:15 a.m. – 11:55 p.m.	***Global Translational Impact on Research and Education (nanoHUB=>Chipshub=>QuantumHUB)*** **Gerhard Klimeck**, *Elmore Professor of Electrical and Computer Engineering, Director of the Network for Computational Nanotechnology, Reilly Director of the Center for Predictive Materials and Devices, Purdue University*
11:55 a.m. – 1:00 p.m.	***Lunch***
1:00 p.m. – 1:40 p.m.	***Complex quantum matter and the boundaries between classical and quantum computers*** **Joel Moore**, *Chern-Simons Professor of Physics, UC Berkeley; Chief Scientist, Quantum Science Center*
1:40 p.m. – 2:20 p.m.	***Exploring quantum computing frontier with programmable atom arrays*** **Misha Lukin,** *The George Vasmer Leverett Professor of Physics, Harvard University*
2:20 p.m. – 3:00 p.m.	***Panel Discussion***
3:00 p.m. – 3:15 p.m.	***Break***
3:15 p.m. – 4:15 p.m.	***PennyLane: a full-stack software ecosystem for quantum computing research*** **Nathan Killoran,** *CTO of software, Xanadu*
4:15 p.m. – 5:30 p.m.	***QuEra Hands-On Training*** **Pedro Lopes**, *Business Developer, QuEra*
6:00 p.m. – 8:00 p.m.	***Student/postdoc social/dinner - Walk Ons (Purdue Memorial Union Commons)***
	Invited speaker dinner - The Bryant (1820 Sagamore Pkwy W, West Lafayette)

THURSDAY, MAY 2, 2024 STEW 218 Chair: Colton Fruhling (morning), Jeffrey Simon (afternoon)	
8:00 a.m. – 9:00 a.m.	***Registration/Breakfast***
9:00 a.m. – 9:40 a.m.	***Learnable and Unlearnable in Quantum Machine Learning*** **Andrew Sornborger**, *Quantum Algorithms and Simulation Lead, Quantum Science Center, Los Alamos National Laboratory*
9:40 a.m. – 10:20 a.m.	***Simulation of Chemical Reactions on a Quantum Computer*** **Sabre Kais**, *Distinguished Professor of Chemistry and of Electrical and Computer Engineering, Purdue University*
10:20 a.m. – 10:35 a.m.	***Break***
10:35 a.m. – 11:15 a.m.	***Quantum sensing for fundamental science*** **Rakshya Khatiwada,** *Assistant Professor of Physics, Illinois Institute of Technology*
11:15 a.m. - 11:35 a.m.	***Analog Hamiltonian Simulation on Amazon Braket*** **Mao Lin**, *Scientist, Amazon Braket*
11:35 a.m. – 12:15 p.m.	***Panel Discussion***
12:15 p.m. – 1:20 p.m.	***Lunch***
1:20 p.m. – 2:00 p.m.	***Unraveling puzzles of light induced superconductivity*** **Eugene Demler**, *Professor of Physics, ETH Zürich, Switzerland*
2:00 p.m. – 2:40 p.m.	***Entangled Sensors for Biomedical Applications*** **Eugene Polzik**, *Professor of Physics, Niels Bohr Institute at the University of Copenhagen*
2:40 p.m. – 3:20 p.m.	***Light-Matter Interactions in Photonic Time-Crystals*** **Mordechai Segev**, *Robert J. Shillman Distinguished Professor of Physics and Electrical Engineering, the Technion, Israel*
3:20 p.m. – 3:35 p.m.	***Break***
3:35 p.m. – 4:15 p.m.	***Leaving a Mark in a Disruptive World*** **Orit Wolf,** *Artist in Residence, The Technion – Israel Institute of Technology*
4:15 p.m. – 5:30 p.m.	***Classiq Hands-on Training*** **Erik Garcell**, *Technical Marketing Manager, Classiq*
6:00 p.m. – 8:00 p.m.	***Closing Dinner – Ripple and Company (1007 Main St, Lafayette, IN 47901)***

FRIDAY, MAY 3, 2024 STEW 218 Chair: Yuheng Chen	
8:00 a.m. – 9:00 a.m.	***Registration/Breakfast***
9:00 a.m. – 9:40 a.m.	***Machine Learning meets Communication Systems: From Theory to Algorithms*** **Chris Brinton,** *Elmore Assistant Professor of Electrical and Computer Engineering, Purdue University*
9:40 a.m. – 10:20 a.m.	***Cognitive Computing: Robustness & Security Challenges*** **Kaushik Roy,** *Edward G. Tiedemann Jr. Distinguished Professor of Electrical and Computer Engineering, Purdue University*
10:20 a.m. – 10:35 a.m.	***Break***
10:35 a.m. – 11:15 a.m.	***Universal Features of Emergent Electronic Fractals in Quantum Materials*** **Erica Carlson,** *150th Anniversary Professor of Physics and Astronomy, Purdue University*
11:15 a.m. – 11:45 p.m.	***Quantum Workforce Development Ecosystem Outlook*** **Jake Douglass**, *Technical Business Development Specialist, Sandia National Laboratory; Chair, Workforce Technical Advisory Committee, Quantum Economic Development Consortium (QED-C)*
11:45 a.m. – 12:25 p.m.	***Workforce Development Panel Discussion***
12:25 p.m. – 12:30 p.m.	***Closing Remarks***
12:30 p.m. – 1:30 p.m.	***Lunch (boxed lunches)***
2:00 p.m. - 3:00 p.m.	**BONUS LECTURE (Note: Location change to FRNY B124)** ***Braiding the Future: Unveiling the Fault-tolerant Power of Topological Quantum Computing*** **Taha Rouabah**, *Associate Professor of Physics, Frères Mentouri Constantine 1 University, Algeria*

Quantum Science Center Leadership

Travis Humble, *QSC Director*

As director of the QSC, Humble leads the Center and serves as the primary contact for DOE, as well as leads the co-design/scientific integration and Industry Council coordination. Humble is a distinguished scientist at ORNL, director of the lab's Quantum Computing Institute, an associate professor with the Bredesen Center for Interdisciplinary Research and Graduate Education at the University of Tennessee, and an associate editor for the Quantum Information Processing journal. He received his doctorate in theoretical chemistry from the University of Oregon before coming to ORNL in 2005.

Vivien Zapf, *QSC Deputy Director*

As deputy director of the QSC, Zapf serves as the secondary contact for DOE and helps oversee QSC research efforts. A scientist at the National High Magnetic Field Laboratory's Pulsed Field Facility located at Los Alamos National Laboratory, her research focuses on using high magnetic fields as tools to induce, probe, and understand potential quantum spin liquid states. Zapf is a fellow of the American Physical Society and currently serves as the chair of APS's Division of Materials Physics, as well as leads the magneto-electric couplings in quantum materials thrust for the Center for Molecular Magnetic Quantum Materials, a DOE Energy Frontier Research Center. She received her Ph.D. in physics from the University of California, San Diego, was a postdoctoral fellow at Caltech, and joined LANL in 2004.

Joel Moore, *QSC's Chief Scientist*

Joel Moore received his Ph.D. from MIT in 2001 and joined UC Berkeley and LBNL in 2002 after a postdoc at Bell Labs Lucent Technologies. He was promoted to tenure in 2007 and is currently the Chern-Simons Professor of Mathematical Physics. His work is primarily on the theory of correlated and topological states of electrons in solids, with applications to their transport, optical, and quantum coherent properties. Areas of his scientific contributions include the theory of topological phases and their electromagnetic responses, the role of quantum entanglement in understanding quantum matter analytically and computationally, and the nature of coherent quantum dynamics in many-body systems. He has been an NSF CAREER and Fulbright grantee and is an elected Member of the NAS, a Fellow of the APS, and a Simons Investigator. He has more than 150 scientific publications with a total of more than 20,000 citations, including a recent book on topological phases of matter co-authored with Roderich Moessner. He is former chair of the science advisory board for the Kavli Institute for Theoretical Physics and has chaired or co-chaired reports for the Department of Energy and National Science Foundation.

Joe Lake, *QSC's Chief Operations Officer*

Lake is the chief operations officer for the QSC. In this role, he leads several key focus areas related to operational support, including project management, procurement, intellectual property, communications, and environment, safety, health, and quality. Prior to being named COO, Lake was a member of the National Center for Computational Sciences (NCCS) division at ORNL, where he managed strategic programs supporting collaborations between NCCS and the National Cancer Institute of the National Institutes of Health. Lake holds a B.S. degree in biomedical engineering from the University of Tennessee and a M.S. degree in project management from Boston University. He is also a certified project management professional through the Project Management Institute.

Alexandra (Sasha) Boltasseva, *QSC's Workforce Development Lead*
Boltasseva serves as the QSC's workforce development lead. Boltasseva received her PhD from the Technical University of Denmark and is currently the Ron and Dotty Garvin Tonjes Distinguished Professor of Electrical and Computer Engineering at Purdue University where she specializes in nanophotonics, optical metamaterials and quantum photonics. As Purdue's Discovery Park fellow, Boltasseva leads the university-wide multidisciplinary Big Idea Challenge program in quantum information science and technology/security/health. She is editor-in-chief of the Optical Society of America's Optical Materials Express journal.

Teresa Hurt, *QSC's Senior Administrative Assistant*
Hurt is the senior administrative assistant to the director of the QSC. In this position, she works closely with the director, deputy director, and numerous principal investigators providing administrative support. Hurt joined ORNL in 2012. Before the QSC, she provided support to the Climate Change Science Institute and the Computer Science and Mathematics Division.

Summer School Speakers

Dana Anderson, *Infleqtion, University of Colorado Boulder*
Professor Dana Z. Anderson is a professor in the department of Physics, and Electrical and Computer Engineering at the University of Colorado. He is a co-founder and former CEO of Infleqtion (formerly ColdQuanta) and serves as Chief Strategy Officer of the company. A JILA fellow, Professor Anderson's research interests span a spectrum of topics including atom-based precision sensors, atomtronics (atom analogs of electronics), RF sensing with Rydberg atoms, quantum signal processing and machine learning in optical and atomic systems.

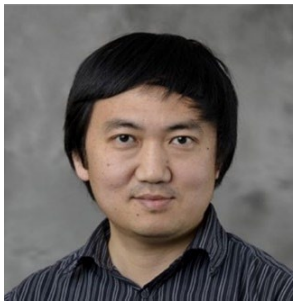
Christopher Brinton, *Purdue University*
Christopher G. Brinton is the Elmore Rising Star Assistant Professor of Electrical and Computer Engineering (ECE) at Purdue University. His research interest is at the intersection of networking, communications, and machine learning, specifically in fog/edge network intelligence, distributed machine learning, and AI/ML-inspired wireless network optimization. Dr. Brinton is a recipient of the National Science Foundation (NSF) CAREER Award, Office of Naval Research (ONR) Young Investigator Program (YIP) Award, Defense Advanced Research Projects Agency (DARPA) Young Faculty Award (YFA), Air Force Office of Scientific Research (AFOSR) YIP Award, Intel Rising Star Faculty Award, and roughly $16M in sponsored research projects as a PI or co-PI. He has also been awarded Purdue College of Engineering Faculty Excellence Awards in Early Career Research, Early Career Teaching, and Online Learning. He currently serves as an Associate Editor for IEEE/ACM Transactions on Networking, and previously was an Associate Editor for IEEE Transactions on Wireless Communications.

Erica Carlson, ***Purdue University***

Erica W. Carlson, Ph.D., is Professor of Physics at Purdue University. Prof. Carlson holds a BS in Physics from the California Institute of Technology (1994), as well as a Ph.D. in Physics from UCLA (2000). Prof. Carlson researches electronic phase transitions in quantum materials. In 2015, she was elected a Fellow of the American Physical Society "for theoretical insights into the critical role of electron nematicity, disorder, and noise in novel phases of strongly correlated electron systems and predicting unique characteristics." Prof. Carlson has been on the faculty at Purdue University since 2003, where she was recently named a "150th Anniversary Professor" in recognition of teaching excellence. She is a founding member of Innovation in Quantum Pedagogy and its Relation to Culture (IQ-PARC). Her latest work popularizing science can be found at youtube.com/@TheQuantumAge.

Shouvanik Chakrabarti, *JPMorgan Chase*

Shouvanik Chakrabarti is a quantum algorithms researcher at the Global Technology Applied Research center at JPMorgan Chase. His primary research interest is the theory of quantum algorithms and the characterization of quantum speedups for problems of classical interest, with a focus on optimization, numerical analysis, machine learning, and stochastic modeling. Prior to joining JPMorgan Chase in 2022, he obtained his PhD in Computer Science at the Joint Center for Quantum Information and Computer Science at the University of Maryland - College Park, where he worked on various aspects of quantum algorithms for optimization and machine learning.



Yong Chen, *Purdue University*

Professor Yong Chen is the Karl Lark-Horvitz Professor of Physics and Astronomy and also a professor of electrical and computer engineering. His lab exploits quantum physics to manipulate electrons, atoms, spins and photons in various materials and artificial systems, with the aim to uncover novel quantum phenomena and new states of matter, and to explore applications in quantum devices (such as quantum information and quantum computation devices), nanotechnology (such as nanoelectronics and nanosensors) and energy. Prof. Chen is also the Director of the Purdue Quantum Science and Engineering Institute and on the Governance Advisory Board of Quantum Science Center.

Eugene Demler, *ETH Zurich*

Eugene Demler received PhD in theoretical physics at Stanford University in 1998. He was a Junior Fellow in the Harvard Society of Fellows, became an assistant professor at Harvard in 2001 and a full professor there in 2005. In the Fall of 2021, he moved to ETH Zurich, Switzerland, as a full professor. Demler was a recipient of the 2006 Johannes Gutenberg lecture award from the University of Mainz. In 2015, he was the winner of a Humboldt Research Award, was elected as a fellow of the American Physical Society and became a Distinguished Scholar at the Max Planck Institute for Quantum Optics in Munich, Germany. In 2021 he received Hamburg Prize in the Theoretical Physics. His research focuses on understanding strongly correlated quantum systems, from electrons in solids to dilute atomic gases to photons. His recent work addressed questions of unconventional mechanisms of magnetism and superconductivity, light induced states of matter, many-body physics with ultracold atoms in optical lattices, nonlinear quantum optics, quantum sensing and simulations.

Jake Douglass, *Sandia National Laboratories*

Mr. Jake S. Douglass is a Technical Business Development Specialist at Sandia National Labs, where he leads Quantum Business Development efforts for Sandia's Quantum Information Science (QIS) portfolio. Jake has a B.S. in Chemistry from New Mexico Tech and an MBA from NM Highlands University, the combination of which allows him to both follow his passion for business and pursue his technical curiosity through QIS. Jake works closely with Sandia's QIS leadership to develop game changing new programs at the Laboratories in support of Sandia's national security mission. Jake works on a continuum of business development functions at Sandia, including program development, strategic planning, workforce development, and partnerships. Additionally, Jake is engaged in the broader national quantum ecosystem through his role as Workforce Development Lead and Operations Deputy for the Quantum Systems Accelerator, one of five DOE-SC NQISRCs, through his engagement with the Quantum Economic Development Consortium (QED-C) where he serves as the Chair for the Quantum Workforce TAC, as well as several other regional partnerships such as Quantum New Mexico. When not engulfed in the world of QIS, Jake enjoys challenging new board games, playing various sports, home renovation projects, and spending time with friends, family and his 4 awesome pets.

Noah Fitch, *Infleqtion*

Dr. Noah Fitch is the quantum matter portfolio technical lead at Infleqtion. He is a former Royal Society University Research Fellow at Imperial College London and expert in low-energy precision measurements for testing fundamental physics, atom and molecular laser cooling, and molecular beam deceleration techniques. His PhD work at CU Boulder focused on decelerating and trapping molecules for studying cold collisions and chemistry near absolute zero temperature. His postdoc and fellowship work involved developing techniques for generating ultracold molecules and using those molecules to execute precise tests of physics beyond the standard model, specifically CP-violating physics as evidenced by a non-zero electric dipole moment of the electron. At Infleqtion, his work includes leading the Oqtant program, which provides remotely controllable quantum matter as a product/service, as well as acting as principal investigator for numerous government research and development projects targeting inertial and gravitational sensing and other applications of ultracold quantum matter.

Erik Garcell, *Classiq*

Dr. Erik Garcell is technical marketing manager at Classiq, which is revolutionizing the process of developing quantum computing software by taking quantum software to a higher level. Dr. Garcell was previously innovation product manager for IP.com and an innovation research scientist at Kodak Alaris. He has a doctorate in physics from the University of Rochester and a Master of Science in Technical Entrepreneurship & Management from the University of Rochester's Simon School of Business

Sabre Kais, *Purdue University*

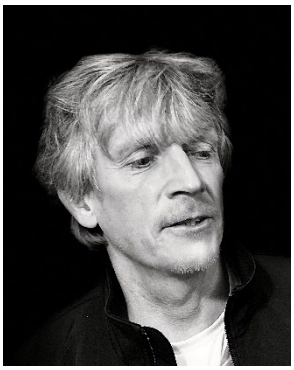
Professor Sabre Kais received the BSc, MSc and Ph.D. degrees at Hebrew University of Jerusalem in 1983, 1984, and 1989. From 1989 to 1994, he was a research associate at Harvard University, Department of Chemistry. Currently, he is a Distinguished Professor of Chemical Physics and of Electrical and Computer Engineering at Purdue University, and also serves as the Director of the Center for Quantum Technologies, an NSF-funded Industry/University Cooperative Research Center (IUCRC). He has published over 260 papers in peer-reviewed journals.

Rakshya Khatiwada, *Illinois Institute of Technology*

Professor Rakshya Khatiwada is an assistant professor at Illinois institute of technology and an associate scientist at Fermilab. Khatiwada earned her bachelor's degrees in physics and mathematics from Linfield University, followed by a Ph.D. in physics from Purdue University. She completed postdocs at the University of Washington in Seattle and Fermilab. Khatiwada is engaged in quantum information science research, with special focus on applications to fundamental science.

Nathan Killoran, *Xanadu*

Nathan Killoran is co-CTO of Xanadu, responsible for the company's Software division. He has the good fortune to work with many talented researchers, developers, and community builders to create the foundations of the present and future quantum computing software stack.



Gerhard Klimeck, *Purdue University*

Gerhard Klimeck is the Elmore Chaired Professor of Electrical and Computer Engineering at Purdue University and leads two research centers in Purdue's Discovery Park. He is also Vice President for Academic Information Technology and Deputy CIO. Previously he worked at the central research Laboratory of Texas Instruments and NASA/JPL/Caltech. His research interest is in computational nanoelectronics, high performance computing, and data analytics. Since 2002 he helped to expand nanoHUB.org to a national and global service of over 2 million visitors today. In 2005 his nanoHUB team released the first end-to-end scientific computing cloud and simple-to-use Apps wrapped around complex simulation tools. These simple to use apps have been rapidly adopted by faculty who taught over 4,000 courses with over 100,000 students in total. nanoHUB serves 43% of all US technical Universities and 56% of all technical MSIs. NEMO, the nanoelectronic modeling software built in his research groups at TI, JPL, and Purdue established the state-of-the-art in atomistic quantum transport modeling. NEMO5 is general enough for 1D, 2D, and 3D devices for quantum transport and electronic structure calculations. NEMO5 is now being used at Intel for advanced transistor designs and commercialized by Silvaco. Gerhard published over 525 printed scientific articles that resulted in over 24,000 citations and an h-index of 75 in Google Scholar. He is a fellow of the Institute of Physics (IOP), the American Physical Society (APS), of IEEE, of AAAS and the Alexander von Humboldt Stiftung (Germany). The Oct. 2020 AAAS Fellow citation reads ”For the quantum mechanical modeling theory and simulation tools to design today's nanotransistors and for leadership of the global nanotechnology community as Director of nanoHUB.

Mao Lin, *Amazon Braket*

Mao Lin is a Scientist at Amazon Braket. His past research focused on theoretical condensed matter physics, particularly topological phases of matter. He studied at University of Illinois where he received his PhD in Physics, and at National University of Singapore where he received his BS in Physics.

Pedro Lopes, *QuEra*

Pedro Lopes is a business developer at QuEra Computing Inc. With a PhD in theoretical physics, his research career - through Brazil, USA, and Canada - explored topics in quantum matter and topological physics. He is passionate about communicating quantum computing at all levels and helping customers and developers understand ideal entry points in this technology.

Mikhail (Misha) Lukin, *Harvard University*

Professor Mikhail (Misha) Lukin’s group at Harvard University focuses on both the theoretical and experimental studies in quantum optics, atomic physics, and quantum information science. The emphasis is on studies of quantum systems consisting of strongly interacting photons, atoms, molecules and electrons. They are developing new techniques for controlling quantum dynamics and studying the relevant fundamental physics phenomena.

Michael Manfra, *Purdue University, Microsoft Quantum Lab West Lafayette*

Michael Manfra is the Bill and Dee O'Brien Distinguished Professor of Physics and Astronomy, Professor of Materials Engineering, and Professor of Electrical and Computer Engineering at Purdue University. He serves as Scientific Director of Microsoft Quantum Lab West Lafayette. Mike received his A.B. from Harvard in 1992 and PhD from Boston University in 1999. Mike spent 2 years from 1998 to 2000 as a Postdoctoral Member of the Technical Staff at Bell Laboratories, Lucent Technologies and in 2001 he was promoted to Member of Technical Staff at Bell Laboratories where he conducted research in low-dimensional semiconductor systems. After 10 years at Bell Labs, Manfra joined Purdue in 2009. Mike was a Keck Foundation awardee in 2013, was elected a Fellow of the American Physical Society in 2015, and in 2016 became the Scientific Director of Microsoft Quantum Lab West Lafayette. Manfra and his team develop new nanoscale electronic devices to explore fundamental aspects of topology and strong electronic correlations. In 2020, his group reported interferometric measurement of anyon braiding, giving experimental evidence for a theoretical prediction made 40 years earlier. Working with Microsoft Quantum he works to develop scalable quantum hardware leveraging the novel properties of anyons.

Chris Monroe, *Duke University*

Christopher Monroe is the Gilhuly Family Presidential Distinguished Professor of Electrical and Computer Engineering and Physics at Duke University. He is also the Co-Founder and former CEO and Chief Scientist of IonQ, Inc., the first pure-play public quantum computing company. Monroe has pioneered nearly all aspects of trapped ion quantum computers and simulators, from demonstrations of the first quantum gate, monolithic semiconductor-chip ion trap, and photonic interconnects between physically separated qubits; to the design, fabrication, and use of full-stack ion trap quantum computer systems in both university and industrial settings. He is a key architect of the US National Quantum Initiative, a Fellow of the American Physical Society, Optical Society of America, the UK Institute of Physics, the American Association for the Advancement of Science, and is a member of the National Academy of Sciences.

Eugene Polzik, *Niels Bohr Institute at the University of Copenhagen*

Eugene Polzik is Professor of Physics at the Niels Bohr Institute at the University of Copenhagen. He is the Leader of the Quantum Optics Center QUANTOP and the Director of the NovoNordisk Center for Biomedical Quantum Sensing. His research interests are within quantum physics of matter and light, quantum communication, and quantum sensing. Among his notable results are the demonstration of the quantum teleportation between material objects, a quantum memory for light, generation of entanglement between distant material objects, a quantum optical interface with ultracold atoms, and measurements of motion and fields not restricted by the Heisenberg uncertainty. Eugene Polzik has published more than 180 papers in refereed journals including a number of papers in Science and Nature journals. He is a member of the Royal Danish Academy of Sciences, Fellow of the American Physical Society and Fellow of the Optical Society of America. Eugene Polzik is the Knight of the Order of Dannebrog, a recipient the Herbert Walther Award of Optical Society of America and German Physical Society, the Gordon Moore Distinguished Scholar award, the Scientific American Research Leadership award, and the Danish Association of Academics award.

Taha Rouabah, *University of Constantine 1, Algeria*

Dr. Mohamed Taha Rouabah is an Associate Professor of Physics at University of Constantine 1 in Algeria. He received a Ph.D. in Physics from a joint program between University of Constantine 1 and Université Nice Côte d'Azur in France, where his doctoral research focused on quantum entanglement and quantum optics. Dr. Rouabah was awarded an Erasmus-Averroes fellowship and a prestigious African Research Initiative for Scientific Excellence grant. He was recently recognized with an Arab-American Frontiers Fellowship by the US National Academies of Sciences, Engineering and Medicine for a research visit to Purdue University. Dr. Rouabah is fascinated by the quantum world and its potential applications to enhance computational abilities and investigate previously unattainable states of matter. In his role of founder and principal investigator of Constantine Quantum Technologies (CQTech), he leads a brilliant team of young physicists whose research efforts are currently focused on topological quantum computing, quantum programming, quantum algorithms, quantum machine learning and quantum simulation.

Kaushik Roy, *Purdue University*

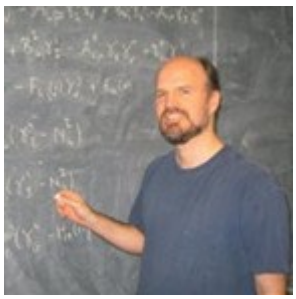
Kaushik Roy is the Edward G. Tiedemann, Jr., Distinguished Professor of Electrical and Computer Engineering at Purdue University. He received his BTech from Indian Institute of Technology, Kharagpur, PhD from University of Illinois at Urbana-Champaign in 1990. His current research focuses on cognitive algorithms, circuits and architecture for energy-efficient neuromorphic computing/ machine learning, and neuro-mimetic devices.

Mordechai Segev, *The Technion – Israel Institute of Technology*

Professor Mordechai (Moti) Segev is the Robert J. Shillman Distinguished Professor of Physics, at the Technion, Israel. Moti's interests are mainly in nonlinear optics, photonics, solitons, sub-wavelength imaging, lasers, quantum simulators and quantum electronics. He has won several major awards, including the 2007 Quantum Electronics Prize of the European Physical Society, the 2009 Max Born Award of the Optical Society of America, the 2014 Arthur Schawlow Award of the American Physical Society, and the 2014 Israel Prize (highest honor in Israel). Moti is a member of the National Academy of Science (NAS), of the AAAS and of the Israel Academy of Sciences. He is currently the Neil Armstrong Distinguished Visiting Professor at Purdue. However, beyond the numerous awards throughout his career, he takes pride in the success of his graduate students and postdocs, among them are currently 21 professors in the USA, Germany, Taiwan, Croatia, Italy, India and Israel.

Vladimir Shalaev, *Purdue University*

Vladimir M. Shalaev, Scientific Director for Nanophotonics at Birck Nanotechnology Center and Distinguished Professor of Electrical and Computer Engineering at Purdue University, specializes in nanophotonics, plasmonics, optical metamaterials and quantum photonics. Prof. Shalaev has received several awards for his research, including the APS Frank Isakson Prize for Optical Effects in Solids, the Max Born Award of the Optical Society of America for his pioneering contributions to the field of optical metamaterials, the Willis E. Lamb Award for Laser Science and Quantum Optics, IEEE Photonics Society William Streifer Scientific Achievement Award, Rolf Landauer medal of the ETOPIM (Electrical, Transport and Optical Properties of Inhomogeneous Media) International Association, the UNESCO Medal for the development of nanosciences and nanotechnologies, and the OSA and SPIE Goodman Book Writing Award. Prof. Shalaev is recognized as a Highly Cited Researcher in Physics by the Web of Science Group for 6 consecutive years, in 2017-2023. He is a Fellow of the IEEE, APS, SPIE, MRS and Optica.



Andrew Sornborger, *Los Alamos National Laboratory*

A multifaceted research scientist and thought leader in the areas of neuroscience, statistical data analysis, and quantum computing with a passion for helping organizations move beyond what is present, obvious, and known, Dr. Andrew Sornborger is the Quantum Algorithms and Simulation Lead at the Quantum Science Center in Los Alamos National Lab.

Orit Wolf, *The Technion – Israel Institute of Technology*

Dr Orit Wolf is an internationally renowned concert pianist, composer, poet, and TED lecturer. She is Artist in Residence at the Technion & a guest lecturer at the Royal Academy of Music in London. Her unique Concert Series, hosted at the Tel Aviv Museum of Art, has garnered a large following of subscribers who appreciate her interdisciplinary approach to classical music. Recognized as one of the top lecturers on Leadership, Innovation, and Music, she was also named one of the 100 most influential people of the year by The Marker Magazine in 2010. Wolf is a recipient of the Kahn Award for the Arts (USA) and the Rosenblum prize for her unique interdisciplinary work in the performing arts.

Susanne Yelin, *Harvard University*

Serving as Vice Director of Max Planck/Harvard Research Center for Quantum Optics, Professor Susanne Yelin's group studies theoretical quantum optics and quantum information science. Their current research directions include quantum control of ultracold polar molecules, investigation of novel coherence-based optical elements, single-photon nonlinear optics using dipolar systems, coherent metamaterials and negative refractivity, coherent control in condensed matter systems, as well as superradiance.

Special thanks for support from:

College of Engineering

College of Science

Purdue Quantum Science and Engineering Institute

Department of Physics and Astronomy

Elmore Family School of Electrical and Computer Engineering

Department of Chemistry

EMERGING FRONTIERS CENTER
CROSSROADS OF QUANTUM AND AI

OAK RIDGE National Laboratory

QSC Summer School Planning Committee

Alexandra Boltasseva, *The Ron and Dotty Garvin Tonjes Distinguished Professor of Electrical and Computer Engineering, Purdue University; Workforce Development Lead, Quantum Science Center*
Tracy Hudson, *Managing Director, Birck Nanotechnology Center, Purdue University*
Robert Ooms, *Lead Event Planner, Purdue Conferences*
Thomas Roth, *Assistant Professor of Electrical and Computer Engineering, Purdue University*
David Stewart, *Managing Director, Purdue Quantum Science and Engineering Institute, Purdue University*
Nicole Wardlaw, *Administrative Assistant, Purdue Quantum Science and Engineering Institute & Elmore Emerging Frontiers Research Center, Purdue University*
Morris Yang, *QSC Postdoctoral and Graduate Student Association Deputy Lead, Graduate Research Assistant, Purdue University*