



Q U A N T U M
S C I E N C E
C E N T E R

2nd Annual Quantum Summer School

MAY 8TH -12TH, 2022

Hosted by Purdue University in partnership with:

IBM Quantum

JPMORGAN CHASE & Co.

 **ColdQuanta**



EMERGING FRONTIERS CENTER
CROSSROADS OF QUANTUM AND AI

 **OAK RIDGE**
National Laboratory

Table of Contents

All lectures, panel discussions, and hands-on training sessions will be live-streamed on the Purdue Quantum Science and Engineering Institute's YouTube channel unless otherwise noted: <https://www.youtube.com/quantumcoffeehouse>

Cover Page	1
Table of Contents	2
Agenda	3
QSC Leadership Biographies	8
Summer School Speaker Biographies	10
Moderator Biographies	18
Acknowledgements	19

SUNDAY, MAY 8, 2022
Moderator: Morris Yang

11:30 a.m. – 12:30 p.m.	Registration & Lunch
12:30 p.m. – 12:45 p.m.	Opening Remarks Travis Humble , <i>Interim Director, Quantum Science Center</i> Alexandra Boltasseva , <i>The Ron and Dotty Garvin Tonjes Professor of Electrical and Computer Engineering, Purdue University; Workforce Development Lead, Quantum Science Center</i>
12:45 p.m. – 1:45 p.m.	Emerging Anyon Materials Yong Chen , <i>Karl Lark-Horovitz Professor of Physics and Astronomy, Professor of Electrical and Computer Engineering, Director of Purdue Quantum Science and Engineering Institute, Purdue University</i>
1:45 p.m. – 2:45 p.m.	Quantum Computer Systems for Research and in Industry Christopher Monroe , <i>Founder and Chief Scientist, IonQ; Gilhuly Family Presidential Distinguished Professor of Physics and of Electrical and Computer Engineering, Duke University; Director, Duke Quantum Center</i>
2:45 p.m. – 3:15 p.m.	Break
3:15 p.m. – 4:15 p.m.	Hybrid Quantum Photonics Vladimir Shalaev , <i>The Robert and Anne Burnett Distinguished Professor of Electrical and Computer Engineering, Purdue University</i>
4:15 p.m. – 5:00 p.m.	Panel Discussion Yong Chen, Christopher Monroe, & Vladimir Shalaev <i>Moderated by Morris Yang</i>
5:00 p.m. – 5:15 p.m.	Day One Closing Remarks Theresa Mayer , <i>Executive Vice President for Research and Partnerships, Professor of Electrical and Computer Engineering, Purdue University</i>
5:15 p.m.	Welcome reception

The IBM Quantum Day of Learning

IBM Quantum

MONDAY, MAY 9, 2022

Moderators: Zach Martin, Ethan Dickey and Blake Wilson

7:30 a.m. – 8:30 a.m.	<i>Registration/Breakfast</i>
8:30 a.m. – 8:40 a.m.	<i>Welcome</i>
8:40 a.m. – 9:40 a.m.	<i>Quantum Machine Learning for Complex Many-Body Systems</i> Sabre Kais , <i>Distinguished Professor of Chemistry, Purdue University</i>
9:40 a.m. – 10:40 a.m.	<i>Large scale quantum computation and simulation on QuEra Computing’s cloud-accessible quantum processors</i> Alexander Keesling , <i>CEO, QuEra Computing</i>
10:40 a.m. – 11:10 a.m.	<i>Break</i>
11:10 a.m. – 12:10 p.m.	<i>Frequency Bin Quantum Photonics</i> Andrew Weiner , <i>The Scifres Family Distinguished Professor of Electrical and Computer Engineering, Purdue University</i>
12:10 p.m. – 1:30 p.m.	<i>Lunch</i>
1:30 p.m. – 2:15 p.m.	<i>Panel Discussion</i> Sabre Kais, Alexander Keesling, Andrew Weiner, & Nick Bronn <i>Moderated by Blake Wilson</i>
2:15 p.m. – 2:45 p.m.	<i>So you want to join the quantum workforce?</i> Olivia Lanes , <i>Quantum Researcher and North American Team Lead for Quantum Education and Qiskit Research, IBM Quantum</i>
2:45 p.m. - 3:30 p.m.	<i>Quantum Workforce Panel Discussion</i> Olivia Lanes, Alexandra Boltasseva, Erica Carlson, & Mahdi Hosseini <i>Moderated by Blake Wilson</i>
3:30 p.m. – 4:00 p.m.	<i>Break</i>
4:00 p.m. – 5:00 p.m.	<i>Efficient Quantum Simulation of an Interacting Kitaev Chain on an IBM Backend with Qiskit</i> Nick Bronn , <i>Research Staff Member – Experimental Quantum Computing, IBM Quantum</i>
5:30 p.m. - 9:30 p.m.	<i>The <u>IBM Quantum</u> Kickoff Dinner and Poster Session</i> <i>Ross-Ade Stadium</i>

IBM Quantum

IBM Quantum

The JP Morgan Chase Day of Learning

JPMORGAN CHASE & CO.

TUESDAY, MAY 10, 2022

Moderators: Alex Senichev, Ethan Dickey and Morris Yang

7:30 a.m. – 8:30 a.m.	<i>Registration/Breakfast</i>
8:30 a.m. – 8:40 a.m.	<i>Welcome</i>
8:40 a.m. – 9:40 a.m.	<i>NISQ-Era Quantum Machine Learning for many-body Systems</i> Susanne Yelin , <i>Professor of Physics in Residence, Harvard University</i>
9:40 a.m. – 10:40 a.m.	<i>Programmable Quantum Systems based on Rydberg Atom Arrays</i> Mikhail Lukin , <i>The George Vasmer Leverett Professor of Physics, Harvard University</i>
10:40 a.m. – 11:00 a.m.	<i>Break</i>
11:00 a.m. – 12:00 p.m.	<i>Quantum Computing and Quantum Communication at JPMorgan Chase</i> Marco Pistoia , <i>Head of the Future Lab for Applied Research and Engineering, Distinguished Engineer, JPMorgan Chase</i> Dylan Herman , <i>Quantum Researcher, Future Lab for Applied Research and Engineering, JPMorgan Chase</i>
12:00 p.m. – 1:00 p.m.	<i>Lunch/Poster session</i>
1:00 p.m. – 1:45 p.m.	<i>Panel Discussion</i> Susanne Yelin, Mikhail Lukin, Marco Pistoia, Gerhard Klimeck, & Mariia Mykhailova <i>Moderated by Alex Senichev</i>
1:45 p.m. – 3:15 p.m.	<i>nanoHUB: serving millions of learners, teachers, and researchers in one overarching platform</i> Gerhard Klimeck , <i>Director of the Network for Computational Nanotechnology; Reilly Director of the Center for Predictive Materials and Devices; Professor of Electrical and Computer Engineering, Purdue University</i>
3:15 p.m. – 3:45 p.m.	<i>Break</i>
3:45 p.m. – 5:30 p.m.	<i>Introduction to Microsoft Quantum Development Kit and Azure Quantum</i> Mariia Mykhailova , <i>Principal Software Engineer, Microsoft</i>
5:45 p.m. – 7:30 p.m.	<i>Dinner Workshop - Engaged Science Communication</i> Sorin Adam Matei , <i>Professor of Communication and Associate Dean of Research and Graduate Education in the College of Liberal Arts, Purdue University</i> Neil R. Dilley , <i>Research Scientist, Birck Nanotechnology Center, Purdue University</i>

JPMORGAN CHASE & CO.

The ColdQuanta Day of Learning



WEDNESDAY, MAY 11, 2022

Moderators: Zach Martin and Colton Fruhling

7:30 a.m. – 8:30 a.m.	<i>Registration/Breakfast</i>
8:30 a.m. – 8:40 a.m.	<i>Welcome</i>
8:40 a.m. – 9:40 a.m.	<i>Introduction to crystal growth for quantum materials (Virtual Lecture - not on YouTube)</i> Michael McGuire , <i>Quantum Materials Discovery and Design Lead, Quantum Science Center at Oak Ridge National Laboratory</i>
9:40 a.m. – 10:40 a.m.	<i>Quantum Computers as Dark Matter Detectors (Virtual Lecture)</i> Aaron Chou , <i>Quantum Devices and Sensing Lead, Quantum Science Center at Fermilab</i>
10:40 a.m. – 11:10 a.m.	<i>Break</i>
11:10 a.m. – 12:10 p.m.	<i>Quantum Machine Learning Applications in Quantum Simulation and Quantum Metrology (Virtual Lecture)</i> Andrew Sornborger , <i>Quantum Algorithms and Simulation Lead, Quantum Science Center at Los Alamos National Laboratory</i>
12:10 p.m. – 1:30 p.m.	<i>Lunch/Poster Session</i>
1:30 p.m. – 2:30 p.m.	<i>Baking quantum cakes on ColdQuanta's quantum computer Hilbert</i> Alex Radnaev , <i>Lead Quantum Physicist, ColdQuanta</i>
2:30 p.m. – 4:00 p.m.	<i>Data science and machine learning using nanoHUB</i> Juan Carlos Verduzco , <i>Graduate Research Assistant</i> Zack McClure , <i>Graduate Research Assistant</i>
4:00 p.m. – 4:30 p.m.	<i>Break</i>
4:30 p.m. – 5:30 p.m.	<i>Postdoc Award Seminars</i> Marco Cerezo , <i>Los Alamos National Laboratory (Virtual Presentation)</i> Michael Chilcote , <i>Oak Ridge National Laboratory (Virtual Presentation)</i> Matthew Feldman , <i>Oak Ridge National Laboratory (Virtual Presentation)</i> Alexander Senichev , <i>Purdue University</i> Kelly Stifter , <i>Fermilab</i> Demid Sychev , <i>Purdue University</i>
6:00 p.m.	<i>Dinner at Ripple & Company</i> <i>1007 Main Street, Lafayette, IN</i>



**THURSDAY, MAY 12, 2022 - coupled with Elmore ECE Emerging Frontiers Center:
Crossroads of Quantum and AI
Moderators: Colton Fruhling and Blake Wilson**

7:30 a.m. – 8:30 a.m.	Registration/Breakfast
8:30 a.m. – 8:40 a.m.	Welcome Alexandra Boltasseva , <i>The Ron and Dotty Garvin Tonjes Professor of Electrical and Computer Engineering, Purdue University; Workforce Development Lead, Quantum Science Center</i>
8:40 a.m. – 9:40 a.m.	Re-thinking Computing with Neuro-inspired Learning: Algorithms, Circuits, and Devices Kaushik Roy , <i>Edward G. Tiedemann Jr. Distinguished Professor of Electrical and Computer Engineering, Purdue University</i>
9:40 a.m. – 10:40 a.m.	Photonic Topological Insulators in Synthetic Dimensions: 2D, 3D, and Hopefully Higher Mordechai Segev , <i>Robert J. Shillman Distinguished Professor of Physics, Technion; Neil Armstrong Distinguished Visiting Fellow, Purdue University</i>
10:40 a.m. – 11:10 a.m.	Break
11:10 a.m. – 12:10 p.m.	Panel Discussion: Christopher Brinton, Ali Shakouri, Mordechai Segev, Vladimir Shalaev <i>Moderated by Colton Fruhling</i>
12:10 p.m. – 1:30 p.m.	Lunch
1:30 p.m. - 2:00 p.m.	Fair and Explainable Machine Learning (Virtual Lecture) Xiaoqian (Joy) Wang , <i>Assistant Professor of Electrical and Computer Engineering, Purdue University</i>
2:00 p.m. - 2:30 p.m.	Physics-Guided Machine Learning: Rethinking the Role of Training Data Muhammad Ashraful Alam, Jai N. Gupta <i>Professor of Electrical and Computer Engineering, Purdue University</i>
2:30 p.m. - 3:00 p.m.	From Federated to Fog Learning: Challenges and Opportunities Christopher Brinton , <i>Assistant Professor of Electrical and Computer Engineering, Purdue University</i>
3:00 p.m. - 3:30 p.m.	Artificial Intelligence in Manufacturing: Challenges and Opportunities Ali Shakouri , <i>Professor of Electrical and Computer Engineering, Purdue University</i>
3:30 p.m. - 3:45 p.m.	Elmore Center Day Closing Remarks Mung Chiang , <i>Executive Vice President of Purdue University for strategic initiatives, the John A. Edwardson Dean of the College of Engineering, and the Roscoe H. George Distinguished Professor of Electrical and Computer Engineering</i>
3:45 p.m.	Closing Reception

Quantum Science Center Leadership



Travis Humble, *Interim Director*

As interim 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.



Stephen Jesse, *Deputy Director*

As well as serving as deputy director of the QSC, Stephen Jesse is a distinguished research scientist and head of the Nanomaterials Characterization Section at ORNL's Center for Nanophase Materials Sciences. His research has primarily focused on developing new approaches for both scanning probe and electron microscopy to not only image materials and discern functionality at nano and atomic scales, but also to use these platforms to transform materials at these scales to introduce new properties. His recent work is aimed at using the focused electron beam of the scanning transmission electron microscope to precisely build atomic defects with useful properties in order to "quantum functionalize" 2D material systems for use in devices for quantum information science.



Joel Moore, *Chief Scientist*

Moore, a theoretical physicist studying condensed matter, serves as the QSC's chief scientist. His chief research interest is in the properties of "quantum materials," in which electron-electron interactions or wavefunction topology yield new states of matter. Moore joined the physics department at UC Berkeley as an assistant professor in January 2002. He received his A.B. summa cum laude in physics from Princeton University in 1995 and spent a Fulbright year abroad before graduate studies at MIT on a Hertz fellowship.



Joe Lake, *Chief Operations Officer*

Lake is the chief operations officer for the QSC. In this role Joe 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, Joe 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. Joe 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, *Workforce Development Lead*

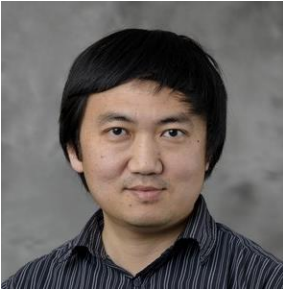
Boltasseva serves as the QSC’s workforce development lead. Boltasseva received her PhD from the Technical University of Denmark and is currently the Ron and Dotty Garvin Tonjes Professor of Electrical and Computer Engineering at Purdue University where she specializes in nanophotonics, optical metamaterials 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, *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



Yong Chen, *Purdue University*

Professor Yong Chen's 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.



Chris Monroe, *Duke/IonQ*

One of the world's leading experts in ion trapping for quantum applications and the director of the Duke Quantum Center, Professor Chris Monroe is working to engineer a scalable, practical quantum computer. His group focuses on the use of individual atoms and photons for fundamental studies of quantum physics and applications in quantum information science. A long-term goal of his research is the realization of large-scale quantum information networks that could store and process information in a way that could eclipse the performance of conventional computers.



Vladimir (Vlad) Shalaev, *Purdue University*

Professor Vladimir Shalaev is an American physicist of Russian descent known for his work in the fields of nanophotonics, plasmonics, and optical metamaterials. He is currently the Robert and Anne Burnett Distinguished Professor of Electrical and Computer Engineering, Professor of Biomedical Engineering and Professor of Physics at Purdue University. Prof. Shalaev also serves as Scientific Director for Nanophotonics at Purdue University's Birck Nanotechnology Center.



Theresa Mayer, *Purdue University*

Theresa S. Mayer is the executive vice president for research and partnerships at Purdue University, where she oversees the \$670 million research enterprise of the university and supports holistic engagements with federal, industry, and global strategic partners. Prior to this role, she was the vice president for research and innovation at Virginia Tech. During her 22-years at Penn State University, she served as the associate dean for research and innovation in engineering.



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 Full Professor of Chemical Physics, a Professor of Computer Science (courtesy), and a professor of Physics at Purdue University. He has published over 230 papers in peer-reviewed journals.



Alexander (Alex) Keesling, *CEO of QuEra*

While at Harvard earning his Ph.D. with Prof. Mikhail Lukin, Dr. Alex Keesling pioneered the development of programmable Rydberg atom arrays into a leading technology for quantum information processing. Among his accomplishments are the creation and coherent control of systems with hundreds of neutral atom qubits, the demonstration of high-fidelity entangling gates with neutral atoms, the discovery of quantum many-body scars and the observation of new quantum phases of matter.



Andrew (Andy) Weiner, *Purdue University*

Professor Andrew Weiner is the Scifres Family Distinguished Professor of Electrical and Computer Engineering. He is a member of the U.S. National Academy of Engineering and of the National Academy of Inventors and was selected as a Department of Defense National Security Science and Engineering Faculty Fellow. Professor Weiner previously served a three-year term as Chair of the National Academy's U.S. Frontiers of Engineering Meeting.



Olivia Lanes, *IBM Quantum*

Olivia completed her PhD in physics, focused on quantum measurement, in 2020 from the University of Pittsburgh. She joined IBM shortly after, where she works as the North American Lead for Qiskit Research/Education. In this capacity, she works to help put Qiskit into the hands of researchers and to make sure the people who are using our systems have access to the best tools and devices. She is also passionate about education, and works on IBM Quantum's challenges and summer schools with the aim of democratizing quantum education. She also sits on the national Q-12 education council to focus on workforce development at a national level.



Erica Carlson, *Purdue University*

Erica W. Carlson is a 150th Anniversary Professor and Professor of Physics and Astronomy at Purdue University. She holds a BS in Physics from the California Institute of Technology and a Ph.D. in Physics from the University of California, Los Angeles (UCLA). A theoretical physicist, she researches electronic phase transitions in quantum materials. Professor Carlson received the prestigious Cottrell Scholar Award from the Research Corporation for Science Advancement, and was elected a fellow of the American Physical Society.



Mahdi Hosseini, *Purdue University*

Mahdi Hosseini is an Assistant Professor of Electrical and Computer Engineering at Purdue University. He completed his Ph.D. and postdoctoral studies at the Australian National University (2012) and Massachusetts Institute of Technology (2016), respectively, where he studied quantum interactions of light with room-temperature and laser-cooled atomic gases. He joined Purdue in Aug 2016. His group at Purdue investigates rare-earth photonics and room-temperature light-atom interfaces for quantum optical communication and sensing. He is a recipient of the 2022 NSF Career Award and the director of the IQPARC, a DoD-funded institute on quantum education.



Nick Bronn, *IBM Quantum*

Nick Bronn is a Research Staff Member in the Experimental Quantum Computing group at the IBM TJ Watson Research Center in Yorktown Heights, NY. He received his Ph.D. in Condensed Matter Physics from the University of Illinois supported in part by a National Science Foundation Graduate Research Fellowship. Since joining IBM in 2013, Nick has been responsible for qubit device design, packaging, and cryogenic measurement, working towards scaling up larger numbers of qubits on a device and integration with novel implementations of cryogenic hardware.



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.



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.



Marco Pistoia, *JPMorgan Chase*

Marco Pistoia, Ph.D. is Managing Director, Head of JPMorgan Chase's Future Lab for Applied Research and Engineering (FLARE), where he leads research in various areas, particularly Quantum Computing. He joined JPMorgan Chase in January 2020. In January 2021, he was one of 21 new JPMorgan Chase Prolific Inventors in the class of 2021 and one of just 56 current JPMorgan Chase employees to reach this significant career milestone. In May 2021, he was nominated one of JPMorgan Chase's fortyfive Distinguished Engineers, the highest technical title in the firm.



Dylan Herman, *JPMorgan Chase*

Dylan is a Quantum Computing researcher at the JPMorgan Chase Future Lab for Applied Research and Engineering (FLARE). The focus of the FLARE quantum program is to develop quantum algorithms for financial applications and quantum-resistant cryptographic solutions. Dylan received his Bachelor's Degree in Electrical and Computer Engineering and Computer Science from Rutgers University in New Brunswick, NJ. He joined JPMorgan Chase in 2018. His current focus is on quantum algorithms research applied to machine learning and optimization.



Gerhard Klimeck, *Purdue University*

Formerly of Texas Instruments and NASA/JPL/Caltech. Professor Klimeck develops models of nanoelectronic devices, genetic algorithm-based optimization, and image processing. NEMO, the nanoelectronic modeling software built in his research group established the state-of-the-art in atomistic quantum transport modeling. He helped to create nanoHUB.org which now serves over 2.0 million users globally and published over 525 printed scientific articles.



Mariia Mykhailova, *Microsoft*

Mariia Mykhailova is a principal software engineer at Microsoft Quantum. She drives the developer outreach and education work for Microsoft Quantum Developer Kit and Azure Quantum. Mariia is a champion for Quantum outreach and education and develops tools for hands-on learning through Microsoft Quantum.



Sorin Matei, *Purdue University*

Professor Sorin Matei is the College of Liberal Arts Associated Dean of Research and Graduate Education and Professor of Communication at the Brian Lamb School of Communication. Professor Matei studies the relationship between information technology, group behavior, and social structures. His research investigates the role played by social media cognition and emotional responses on risk-prone or risk-averse behavior in natural emergencies.



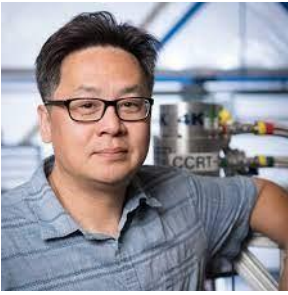
Neil Dilley, *Purdue University*

Dr. Neil Dilley is a physicist specializing in cryogenic measurements and design. His doctorate work at UC San Diego (Ph.D. 1999) focused on synthesis and characterization of rare earth intermetallic compounds which exhibit superconductivity and magnetism. Dr. Dilley's current research interests are in magnetic materials discovery, spintronics, and nanomagnetism. He joined Birck Nanotechnology Center at Purdue University after working for 16 years at Quantum Design, Inc. in both R&D and applications.



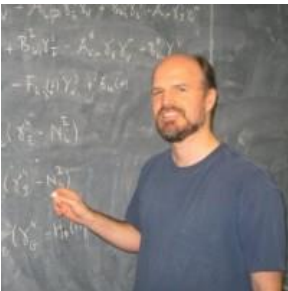
Michael McGuire, *Oak Ridge National Laboratory*

Dr. Michael McGuire uses crystal growth, solid state chemistry, crystallographic studies, and physical property measurements to explore structure-property relationships in complex materials, with particular emphasis on magnetism. His research is currently focused on van der Waals layered transition metal compounds and topological materials.



Aaron Chou, *Fermilab*

Dr. Aaron S. Chou is a senior scientist at the Fermi National Accelerator Laboratory and the Fermilab lead for the Quantum Science Center at Oak Ridge. Dr. Chou is an expert in dark matter detection and applies that expertise to develop technologies in testing and operating on topological qubits, which are expected to revolutionize the field of quantum computing.



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.



Alexander Radnaev, *ColdQuanta*

Dr. Alexander Radnaev is a lead quantum physicist at ColdQuanta. Dr. Radnaev received his Ph.D. from Georgia Institute of Technology in 2012 before joining ColdQuanta in 2020. Dr. Radnaev leads a team of 16 engineers and physicists to develop ColdQuanta's neutral atom quantum computers.



Juan Carlos Verduzco, *Purdue University*

Mr. Juan Carlos Verduzco is a PhD candidate in the School of Materials Science and Engineering at Purdue University. He holds a B.S. in Mechatronics from the Monterrey Institute of Technology and Higher Education, Mexico. His research is focused on coupling experimental techniques, physics-based simulations, and machine learning algorithms for the rational design of novel battery materials. Contact him at jverduzc@purdue.edu.



Zack McClure, *Purdue University*

A graduating Ph.D. candidate (May 2022) at Purdue University, Zack McClure Has provided physics-based modeling and computational tool development for the materials engineering community for 4+ years. Specialties include data-driven design of innovative materials, data pipelines and management, machine learning with small and large datasets, high performance computing resources, and cross-disciplinary communication.



Marco Cerezo, *Los Alamos National Laboratory*

Marco Cerezo obtained his undergrad and PhD in physics from the university of La Plata, in Argentina, where he focused his research on condensed matter, quantum information and foundations of quantum mechanics. In 2019 he joined Los Alamos National Laboratory (LANL) as a postdoctoral researcher, where he started working on variational quantum algorithms and the theory of near-term quantum computing. Currently, he is a staff scientist at the Information sciences division at LANL.

Michael Chilcote, *Oak Ridge National Laboratory*



Matthew Feldman, *Oak Ridge National Laboratory*

Matthew Feldman is a Postdoctoral Research Associate at Oak Ridge National Laboratory (ORNL). Matthew's research focuses on employing continuous variable quantum optics and quantum machine learning to develop state of the art quantum sensors. His research interests include quantum sensing, quantum computing, machine learning, and Bayesian statistics. Prior to being hired at ORNL, Matthew was a National Defense Science and Engineering Graduate Fellow.



Alexander (Alex) Senichev, *Purdue University*



Kelly Stifter, *Fermi National Accelerator Laboratory*

Kelly Stifter is a Lederman Fellow in the Cosmic Physics Center at Fermi National Accelerator Laboratory. She recently completed her Ph.D. in physics at Stanford, where she worked on detector development and background modeling and mitigation for the LZ Dark Matter Experiment. Now, as a postdoc at Fermilab and member of the Quantum Science Center, she is developing technology to help understand the fundamental sensing mechanisms in quantum devices, with the ultimate goal of leveraging these devices to build better, more sensitive dark matter detectors.

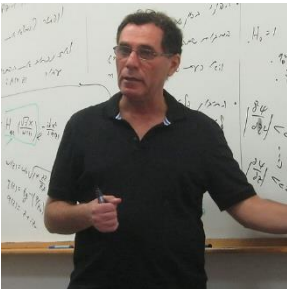


Demid Sychev, *Purdue University*



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 (Moti) Segev, *Technion*

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. 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.



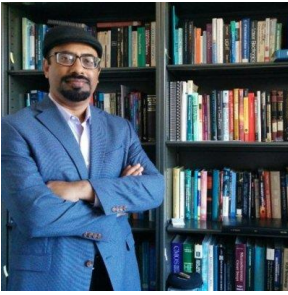
Christopher (Chris) Brinton, *Purdue University*

Chris Brinton is an Assistant Professor of ECE in the Elmore Family School of Electrical and Computer Engineering at Purdue University. His research is at the intersection of networking and machine learning. His group develops data-driven optimization methodologies for communication and social networks, with a particular emphasis on distributed edge intelligence. They investigate include Fog computing systems, the Internet of Things (IoT), and social learning networks (SLN).



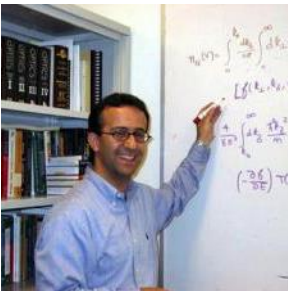
Xiaoqian (Joy) Wang, *Purdue University*

Joy Wang is an assistant professor of the Elmore Family School of Electrical and Computer Engineering and Weldon School of Biomedical Engineering (by courtesy) at Purdue University. She obtained her Ph.D. degree from the University of Pittsburgh in 2019, and her advisor was Prof. Heng Huang. Prior to this, she received her bachelor degree in bioinformatics from Zhejiang University in 2013. Her research focuses on machine learning and biomedical data science.



Muhammad Ashraful Alam, *Purdue University*

Professor Alam holds the Jai N. Gupta professorship at Purdue University, where his research focuses on the physics and technology of semiconductor devices. From 1995 to 2003, he worked in the Silicon ULSI group at Bell Laboratories, Murray Hill, NJ. Since returning to Purdue in 2004, his group has explored the reliability physics of nanotransistors, limits of nanobiosensors, atom-to-farm modeling of solar cells, and physics/technology of Landau transistors.



Ali Shakouri, *Purdue University*

Professor Ali Shakouri's group studies mutual interaction of heat, light and electricity in micro- and nanoscale materials and devices. Gaining a better understanding of these interactions directly assists in the improvement of device and circuit performance in applications such as energy conversion, computing and communication technologies. A variety of approaches are employed, ranging from theoretical modeling over Monte Carlo and FEM simulation to experiments.



Mung Chiang, *Purdue University*

Mung Chiang is the Executive Vice President of Purdue University for strategic initiatives, the John A. Edwardson Dean of the College of Engineering, and the Roscoe H. George Distinguished Professor of Electrical and Computer Engineering. Purdue Engineering in 2021 became the largest engineering school to ever ranked among top five in the U.S. During 2019-20, he served as the Science and Technology Adviser to the U.S. Secretary of State and the chief global technology office in the Department of State to launch Technology Diplomacy.

Moderators



Morris Yang, *Purdue University*

Morris Yang is a Ph.D. student at Purdue university under the tutelage of Sasha Boltasseva and Vladimir Shalaev. He serves as the Deputy Lead for the Postdoctoral and Graduate Student Association for the Quantum Science Center. Morris studies nitrogen vacancies and other single photon emitters as part of his interests in quantum photonics, as part of the effort he creates optical experiments and protocols to yield indistinguishable photons. He also investigates opto-electric properties of novel topological materials such as Weyl Semimetals.



Zach Martin, *Purdue University*

Zach Martin is a PhD student in Prof. Vlad Shalaev and Prof. Sasha Boltasseva's research group in the Department of Computer and Electrical Engineering at Purdue University. He received his bachelor's degree in Physics from Luther College in 2019.



Ethan Dickey, *Purdue University*

Ethan Dickey is a Ph.D. student in the Computer Science department at Purdue University under the advisement of Sabre Kais. Ethan's research is focused on theory of entanglement, quantum state creation complexity, quantum Turing machines, and more generally in quantum complexity theory.



Colton Fruhling, *Purdue University*

Colton Fruhling is a post-doctoral researcher at Purdue University. He received his B.S. in physics and astronomy for Colorado State University in 2014 and PhD from the University of Nebraska at Lincoln in 2021. His PhD work focused on the interaction of extreme light with matter in such systems as plasma wakefield acceleration and highly nonlinear Thomson scattering. At Purdue, his research into light-matter interaction extends over multiple projects such as nanolasing, random lasing, and ultrafast all-optical switching. Outside of academia, he enjoys spending time outdoors.



Blake Wilson, *Purdue University*

Blake Wilson is a Ph.D. student at Purdue University under the guidance of Sasha Boltasseva, Sabre Kais, Vlad Shalaev, and Alex Kildishev and he is the Postdoctoral and Graduate Student Association Team Lead for the Quantum Science Center at Oak Ridge National Lab. Blake's research is at the intersection of computer science and physics; his Ph.D. is focused on special relativity in quantum Turing machines, quantum machine learning-assisted global optimization of nanophotonic metastructures, cryptographic plasmonic systems, and variational quantum algorithms.

Special thanks for support from:



College of Engineering



Elmore Family School of Electrical
and Computer Engineering



Department of Physics and Astronomy



Executive Vice President for
Research and Partnerships



Purdue Quantum Science
and Engineering Institute



Elmore Family School of Electrical
and Computer Engineering

EMERGING FRONTIERS CENTER CROSSROADS OF QUANTUM AND AI

QSC Summer School Planning Committee

Sandy Araj, *Administrative Assistant, Purdue Quantum Science and Engineering Institute & Elmore Emerging Frontiers Research Center, Purdue University*

Alexandra Boltasseva, *The Ron and Dotty Garvin Tonjes Professor of Electrical and Computer Engineering, Purdue University; Workforce Development Lead, Quantum Science Center*

Robert Ooms, *Lead Event Planner, Purdue Conferences*

Tracy Hudson, *Operations Director, Office of the Executive Vice President for Research and Partnerships, Purdue University*

Thomas Roth, *Assistant Professor of Electrical and Computer Engineering, Purdue University*

Alexander Senichev, *Postdoctoral Research Associate, Purdue University*

David Stewart, *Managing Director, Purdue Quantum Science and Engineering Institute*

Blake Wilson, *QSC Postdoctoral and Graduate Student Association Lead, Graduate Research Assistant, Purdue University*

Morris Yang, *QSC Postdoctoral and Graduate Student Association Deputy Lead, Graduate Research Assistant, Purdue University*