CHICAGO QUANTUM EXCHANGE

ANNUAL REPORT 2025

Advancing through collaboration
The community joins forces on CQE-led initiatives, earning EDA and NSF funding

Building data-driven strategy
The CQE shares new economic projections, analyses on quantum jobs

Celebrating success across sectors
Discoveries, startup growth, and a planned quantum park drive ecosystem progress

The Chicago Quantum Exchange (CQE) is an intellectual hub in Illinois, Wisconsin, and Indiana that advances the science and engineering of quantum information, trains the future quantum workforce, and drives the quantum economy by connecting leading universities, national labs, and industry partners. The recipient of millions of dollars in government and corporate investment and home to some of the world's top experts in the field, the CQE community is a central driver of US leadership in quantum technologies.

OUR WORK

Advancing Research, Discovery, and Impact

Preparing the Quantum Workforce

Driving the Quantum Economy

OUR MEMBERS

THE UNIVERSITY OF CHICAGO

Argonne NATIONAL LABORATORY

Fermilab

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

WISCONSIN UNIVERSITY OF WISCONSIN–MADISON

Northwestern University

PURDUE UNIVERSITY

ON THE COVER: Walter Massey (left), a multifaceted leader and trailblazer, and a senior advisor to the University of Chicago president, engaged in conversation about inclusive quantum workforce development with University of Illinois Chicago Associate Professor Thomas Searles during the 2024 Chicago Quantum Summit. Massey, a physicist, has led the National Science Foundation, Argonne National Laboratory, Morehouse College, the School of the Art Institute of Chicago, the City Colleges of Chicago Board of Trustees, and more. Searles — who was a physics student at Morehouse when Massey was president — founded the IBM-HBCU Quantum Center and in November was elected president of the National Society of Black Physicists, an organization Massey co-founded. (Image by Anne Ryan.)

MESSAGE FROM THE CQE LEADERSHIP

It has been a year of unparalleled progress for the Chicago Quantum Exchange community. Industry, government, and academic leaders have leveraged millions of dollars in government research funding alongside our base of intellectual assets to put the Midwest region on pace for significant economic growth. A recent analysis for the CQE by Boston Consulting Group projects up to $60 billion in economic value creation by quantum technology providers alone in Illinois, Wisconsin, and Indiana by 2035 — 30% of the projected global impact. End users are projected to add another $20 billion, and the number of quantum jobs in the region is projected to reach as high as 191,000 by 2035.

This momentum is a product of the robust partnerships, strong government engagement, and deep expertise that the CQE community builds in our region. In 2024, two cross-sector, CQE-led coalitions received federal funding to drive quantum innovation, commercialization, and workforce development, and the State of Illinois budgeted a half billion dollars to build a first-of-its-kind park for quantum scale-up and related quantum and advanced microelectronics research and development on Chicago's Southeast Side. The Illinois Quantum and Microelectronics Park will be anchored by PsiQuantum and include the new Illinois-DARPA Quantum Proving Ground and IBM's new National Quantum Algorithm Center.

The CQE also experienced its largest-ever year of growth, adding 18 new corporate partners and a seventh member, Purdue University. With the addition of Purdue, the CQE now includes more than 210 researchers spanning a range of quantum technology expertise. In the coming years, the CQE aims to create on-ramps to enable new researchers to join the field; build an inclusive, employer-driven workforce; expand access to startup capital for companies growing in the region; and increase the adoption of quantum technologies by aligning the needs of talent, technology providers, and end users.

As you read this year's Annual Report, we hope you will join us in celebrating the community's achievements. We look forward to continued progress in 2025.

DAVID AWSCHALOM
Liew Family Professor of Molecular Engineering, University of Chicago; Director, Chicago Quantum Exchange; Senior Scientist, Argonne National Laboratory; Director of Q-NEXT, a US Department of Energy Quantum Information Science Research Center

BONNIE FLEMING
Chief Research Officer & Deputy Director of Science and Technology, Fermi National Accelerator Laboratory; Professor of Physics, University of Chicago

SUPRATIK GUHA
Senior Scientist / Senior Advisor to Physical Sciences & Engineering, Argonne National Laboratory; Professor of Molecular Engineering, University of Chicago

PAUL KWIAT
Professor of Physics, The Grainger College of Engineering, University of Illinois Urbana-Champaign

KATE WAIMEY TIMMERMAN
Chief Executive Officer, Chicago Quantum Exchange

CQE PARTNERS 2024

Corporate Partners
In 2024, the CQE welcomed 18 new corporate partners, including the five startups in Duality's fourth cohort. It marked the largest year of corporate partner growth in CQE history. New partners are indicated with *.

*Allstate
Ally
Applied Materials
Atom Computing
Boeing
*Cisco
Corning
Discover
*D-Wave
EeroQ
Great Lakes Crystal Technologies
HRL Laboratories
IBM
Infleqtion
JPMorgan Chase
*KPMG
Lake Shore Cryotronics
memQ
Microsoft
Proviti
PsiQuantum
qBraid
*QNu
*Qolab
QuantCAD
Quantinuum
Quantopticon
*Quantum Corridor
Quantum Design
Quantum Machines
Quantum Opus
Qubitekk
QuEra Computing
Rigetti
*SandboxAQ
*Seagate
*Sivananthan Labs
TOPTICA Photonics
Toshiba
*Unisys
*WD Advanced Materials
*Xanadu
Zurich Instruments

Nonprofit Partners
Le Lab Quantique
P33
QED-C

International Partners
CQC^{2}T
Indian Institute of Technology (IIT) Bombay
QuTech
Technion – Israel Institute of Technology
Weizmann Institute of Science

Regional Partner
The Ohio State University

Duality Startups
*Artificial Brain
*Photon Queue
*Quantum Rings
*QuantumAstra
*SynthBits

2024 SPOTLIGHTS

Historic Illinois Quantum and Microelectronics Park coming to Chicago's Southeast Side

Quantum scale-up park to be anchored by CQE partner and led by members of CQE community; will include industrial-scale cryoplant, prototype testing program, algorithm development center, and more

ABOVE: A rendering of the Illinois Quantum and Microelectronics Park on Chicago's Southeast Side. (Image courtesy of Related Midwest, CRG, Clayco & Lamar Johnson Collaborative.)

LEARN MORE

PsiQuantum to anchor IQMP with 300,000-square-foot facility

Multimillion-dollar DARPA-Illinois Quantum Proving Ground will strengthen national security, drive economic growth

IBM, Illinois, UChicago to establish National Quantum Algorithm Center in Chicago

PsiQuantum to anchor IQMP with 300,000-square-foot facility

Palo Alto-based startup PsiQuantum is coming to Chicago to build and operate quantum computers — bringing up to 150 jobs in the first five years and at least $1 billion in investment as it anchors a massive quantum park to be developed at the former US Steel South Works site on Chicago's Southeast Side, the company and Illinois Governor JB Pritzker announced in July. PsiQuantum, a CQE corporate partner that aims to build the first US-based, utility-scale, fault-tolerant quantum computer, will construct its facility on the state's groundbreaking Illinois Quantum and Microelectronics Park (IQMP) near the mouth of the Calumet River.

"PsiQuantum brings years of foundational research ... and shares in our vision for quantum as a powerful force for good."

ILLINOIS GOVERNOR JB PRITZKER

"Quantum computers have held theoretical promise for decades, but it is infrastructure projects like the Illinois Quantum and Microelectronics Park that are required to develop this technology and scale from hype to reality," said Jeremy O'Brien, PsiQuantum CEO and co-founder.

Pritzker — who has been a key champion, allocating $500 million for quantum technologies in the FY2025 state budget — hailed the first-of-its-kind park as "a monumental step forward for quantum in the state of Illinois."

A University of Illinois–led organization will manage the project on behalf of the State of Illinois. The IQMP's Board of Managers includes representatives from CQE member and partner institutions, including the University of Illinois Urbana-Champaign, the University of Chicago, Argonne National Laboratory, Fermi National Accelerator Laboratory, Northwestern University, and P33, as well as from Intersect Illinois, City Colleges of Chicago, Chicago State University, the Illinois Department of Commerce and Economic Opportunity, and Milhouse Engineering & Construction.

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"[I]t is very difficult to build innovation and also build the market at the same time ... We shouldn't be ashamed that difficult things take time."

NOEL GODDARD, CEO of Qunnect, at the 2024 Chicago Quantum Summit

"As DARPA's designated quantum skeptic, I am more optimistic now than I have been at any point in the past 10 years."

JOE ALTEPETER, DARPA program manager, at the 2024 Chicago Quantum Summit

QUANTUM AND MICROELECTRONICS PARK

Multimillion-dollar DARPA-Illinois Quantum Proving Ground will strengthen national security, drive economic growth

The Defense Advanced Research Projects Agency (DARPA) and the State of Illinois will develop a national proving ground for quantum technologies at the Illinois Quantum and Microelectronics Park (IQMP), leveraging the region's deep bench of world-leading scientists to strengthen national security.

Through the groundbreaking DARPA-Illinois Quantum Proving Ground, the State of Illinois aims to fuel innovation, drive economic growth, and attract leading quantum technology companies to the state. DARPA, a US Department of Defense agency that invests in breakthrough technologies for national security, will test quantum technology prototypes through its Quantum Benchmarking Initiative. Illinois will commit $140 million in co-investment for the Quantum Proving Ground, and DARPA's level of investment in the Quantum Benchmarking Initiative will be determined by the quality of proposals, evaluation results, and availability of federal funding.

"Illinois has long held the spirit of invention, innovation, and influence. The [IQMP] further establishes Illinois as a global hub for technology and innovation," said US Senator Dick Durbin. "Through the combined efforts of Illinois' national labs, world-class universities, industry leaders, and now our growing partnership with the Department of Defense with this Quantum Proving Ground, our state will continue to champion technologies and industries of the future."

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CHECK THIS OUT:

From Rivets to Qubits

In a personal essay posted on LinkedIn and shared on the CQE website, Sean Sullivan, co-founder and CTO of quantum startup memQ, talks about his family's long history with the South Works site and why he's excited about the IQMP.

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IBM, Illinois, UChicago to establish National Quantum Algorithm Center in Chicago

CQE corporate partner IBM will collaborate with the State of Illinois and CQE members, including the University of Chicago and the University of Illinois Urbana-Champaign, to establish the new National Quantum Algorithm Center in the Illinois Quantum and Microelectronics Park in Chicago. The center will be fueled by IBM's next-generation quantum computer, IBM Quantum System Two, which the company plans to deploy in Chicago in 2025. The center's capabilities will enable Illinois' growing ecosystem of quantum innovators across academia, national labs, and industries to discover how quantum-centric supercomputing could be used for complex industry challenges.

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Two cross-sector, CQE-led coalitions receive federal funding

Advancing Quantum Technologies in the Midwest team receives $1M from NSF, advances in national competition

A cross-sector coalition led by the Chicago Quantum Exchange advanced in the US National Science Foundation Regional Innovation Engines (NSF Engines) program. In October, NSF Engines announced that the Advancing Quantum Technologies in the Midwest group, which aims to grow the Illinois-Wisconsin-Indiana region into one of the world's foremost quantum innovation and economic zones, was among 71 teams moving to the next stage of the competition.

The coalition, which received a $1 million NSF Engines Development Award in April, held a series of workshops in 2024 aimed at deepening partnerships and strengthening workforce and economic development plans.

The NSF Engines program, developed as part of the CHIPS and Science Act of 2022, seeks to catalyze and foster innovation ecosystems across the United States to advance critical technologies, such as quantum technologies; address pressing national and societal challenges; cultivate partnerships across industry, academia, government, nonprofits, civil society, and communities of practice; promote and stimulate economic growth and job creation; and spur regional innovation and talent.

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The Bloch Quantum Tech Hub Awarded $500,000 by US Economic Development Administration

The Bloch Quantum Tech Hub was awarded a $500,000 Consortium Accelerator Award through the US Department of Commerce's Economic Development Administration (EDA) to continue implementing a strategy focused on accelerating the industry adoption of quantum technologies. The award will be used to strengthen the consortium and attract additional capital.

The Bloch is a Chicago Quantum Exchange–led coalition of Fortune 500 companies, quantum startups, world-leading universities, state and city governments, community colleges, and economic and workforce development nonprofits. It is the nation's only quantum innovation team rallying entire sectors around society's most urgent challenges — to combat financial fraud, secure the energy grid, and accelerate the development of lifesaving drugs.

In 2024, The Bloch rallied quantum technologists and the financial sector around fraud detection, collaborated with community colleges and industry partners to develop the future quantum workforce, partnered with MxD to cohost a daylong symposium to explore the integration of quantum technology into manufacturing, collaborated with the FBI Chicago to secure quantum assets, and more.

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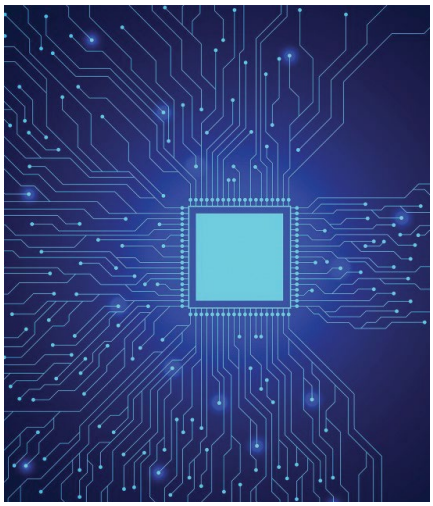

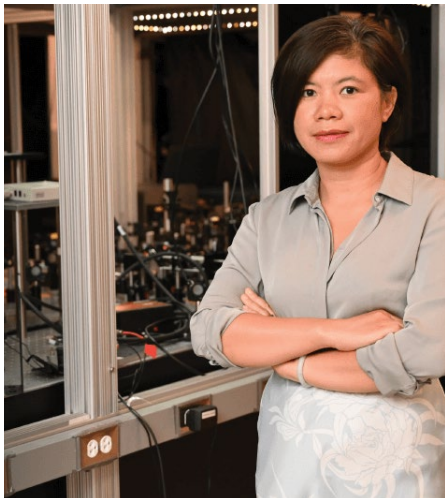

DOE funding advances work at Northwestern, Purdue

Northwestern University's Center for Molecular Quantum Transduction (CMQT) has received a new $14.5 million reinvestment from the US Department of Energy, extending the center's funding for another four years. Since its founding in August 2020, CMQT researchers made significant progress into understanding quantum transduction, the exchange of information between quantum systems.

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Purdue University has been selected by the US Department of Energy to lead the Quantum Photonics Integrated Design Center Energy Frontier Research Center. This initiative, in collaboration with partner institutions including Los Alamos National Laboratory, Stanford University, Northwestern University, the University of Chicago, the University of Maryland Baltimore County, the University of Oklahoma, and Virginia Tech, will advance the frontiers of quantum photonics research.

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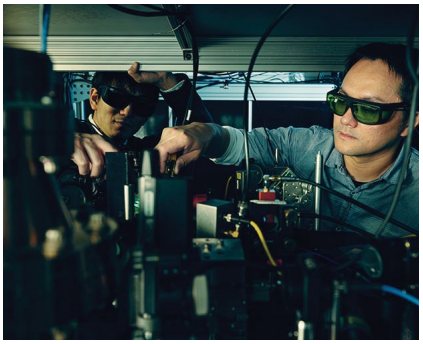

Purdue University joins Chicago Quantum Exchange

Purdue University has joined the Chicago Quantum Exchange as its seventh member. Central to the membership is the Purdue Quantum Science and Engineering Institute, which brings together leading quantum researchers and leverages collaborations with industry, government, and academia to drive discovery of quantum phenomena and development of chip-scale quantum systems for tomorrow's technology. Quantum science is also a pillar of Purdue Computes, a strategic university initiative to further scale Purdue's research and educational excellence.

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"Joining the Chicago Quantum Exchange represents an unparalleled opportunity for Purdue University to amplify our impact in the quantum realm."

PATRICK WOLFE, Purdue University provost and executive vice president for academic affairs and diversity

UIUC-led experiment tests quantum communication technology in space

The SpaceX CRS-31 mission carried a new quantum communication experiment to the International Space Station (ISS) in November. The Space Entanglement and Annealing QUantum Experiment (SEAQUE), led by Professor Paul Kwiat from the University of Illinois Urbana-Champaign, aims to advance quantum-level communication in space through the use of quantum entanglement technology.

The SEAQUE experiment will be integrated into the MISSE-20 platform, which exposes instruments directly to the harsh environment of space on the exterior of the ISS. By operating in such extreme conditions, SEAQUE will test the viability of quantum communication systems under radiation exposure, a key factor in developing robust quantum networks for space and Earth.

These experiments are initial steps of a scientific process that could help establish quantum networks spanning hundreds to thousands of miles, enabling secure, large-scale communications.

“We hope to give a proof of principle and show that it makes space quantum technology more feasible,” Kwiat said.

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“This whole effort has been several years in the making. It started when we were approached to design a space-bound quantum experiment but given a timeline of only 10 months. In retrospect, that was far too short a window, but we went for it anyway. ... We’re definitely excited to see the payoff of our payload!”

UIUC Professor PAUL KWIAT on the SEAQUE experiment

$79B
Projected economic impact from quantum technology and end-use applications in Illinois-Wisconsin-Indiana region by 2035

600+
In-person and virtual attendance at the 2024 Chicago Quantum Summit

$500M
Amount included in FY2025 Illinois budget for quantum technologies

RESEARCH AND DISCOVERY

‘Quantum optical antennas’ provide more powerful measurements on the atomic level

Theory has become practice as new work from the UChicago Pritzker School of Molecular Engineering taps diamond defects’ remarkable ability to concentrate optical energy

ABOVE: PhD candidate Zixi Li works in a quantum lab at the UChicago Pritzker School of Molecular Engineering. (Photo by Hong Qiao.)

Similar to how a radio antenna plucks a broadcast from the air and concentrates the energy into a song, individual atoms can collect and concentrate the energy of light into a strong, localized signal that researchers can use to study the fundamental building blocks of matter.

The more powerful the intensity enhancement, the better the antenna. But researchers have never been able to tap the potentially huge intensity enhancements of some “atomic antennas” in solid materials simply because they were solids.

“Most of the time when you have atoms in solids, they interact with

the environment. There's a lot of disorder; they get shaken by phonons and face other disruptions that reduce the coherence of the signal," said UChicago Pritzker School of Molecular Engineering Assistant Professor Alex High.

In a new paper published in *Nature Photonics*, a multi-institutional team led by the High Lab has cracked this problem. They have used germanium vacancy centers in diamonds to create an optical energy enhancement of six orders of magnitude, a regime challenging to reach with conventional antenna structures.

This million-fold energy enhancement creates what the paper calls an "exemplary" optical antenna and provides a new tool opening up entirely new research areas.

"It's not just a breakthrough in technology. It's also a breakthrough in fundamental physics," said PME PhD candidate Zixi Li, co–first author on the paper. "While it's well-known that an excited atomic dipole can generate a near-field with huge intensity, no one has ever demonstrated this in an experiment before."

But turning this theory into a practicable antenna took years, collaboration with researchers around the globe, and theoretical guidance from UChicago's Galli Group, led by PME's Liew Family Professor Giulia Galli, a co-author on the paper.

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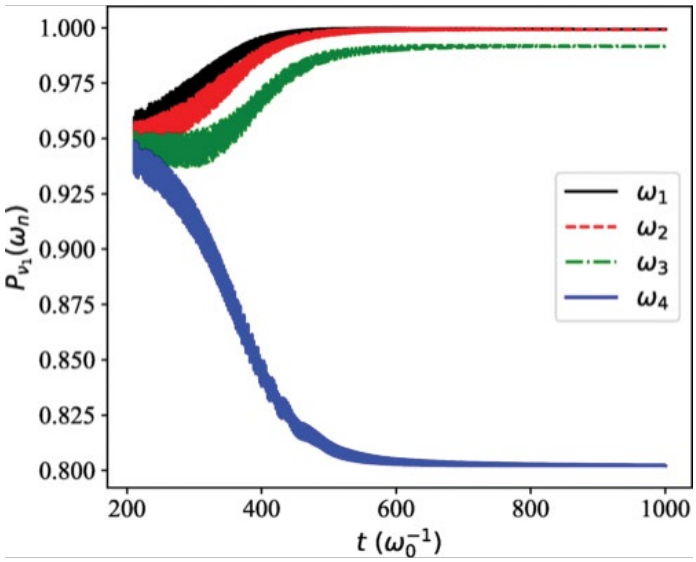

Bringing the quantum to the classical: a hybrid simulation of supernova neutrinos

A University of Wisconsin–Madison postdoc, undergraduate student, and professor combined classical and quantum computing techniques to leverage the advantages of both

Simulating quantum systems on classical computers is currently a near-impossible task, as memory and computation time requirements scale exponentially with the size of the system. Quantum computers promise to solve this scalability issue, but there is just one problem: they can't reliably do that right now because of exorbitant amounts of noise.

In a paper published in *Physical Review D* in October, UW–Madison physics postdoc Pooja Siwach, former undergrad Katie Harrison, BS '23, and Professor Baha Balantekin studied collective neutrino oscillations inside a supernova, using a quantum-assisted simulator, or QAS, which combines the benefits of the natural mapping of the system onto qubits and classical computers' strength in solving matrix equations.

"It's really complex, it's very hard to solve on classical computers," Siwach says. "That's why we are interested in quantum computing, because quantum computers are a natural way to map such problems."

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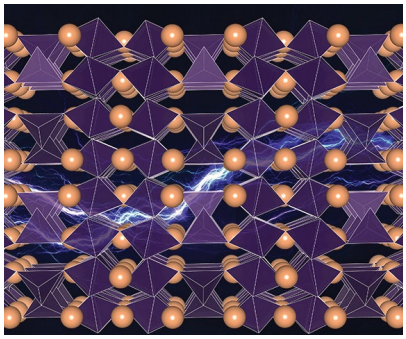

Creation of novel material could lead to new line of quantum research

In a study published in *Nature Materials*, Northwestern University researchers unveiled a class of metals that challenge the status quo of how metals behave, opening a realm where quantum strangeness reigns. The new compound, $Ca_3Co_3O_8$, holds potential applications in spintronics and the development of next-generation electronic devices. This discovery opens the door to a frontier of unique quantum phenomena never before seen in classical systems and conventional metals.

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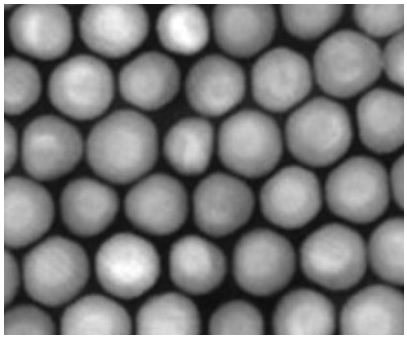

A quantum material could revolutionize high-energy X-ray imaging, particle detection

Researchers at the US Department of Energy's Argonne National Laboratory have developed a new colloidal scintillating material called "quantum shells" for use in high-resolution and ultrafast imaging, enabling scientists to bypass the limitations of traditional scintillator technology. This work, published in *Nature Communications*, showcases the potential of these nanoscale quantum materials to open new frontiers in fields ranging from particle physics to medical diagnostics.

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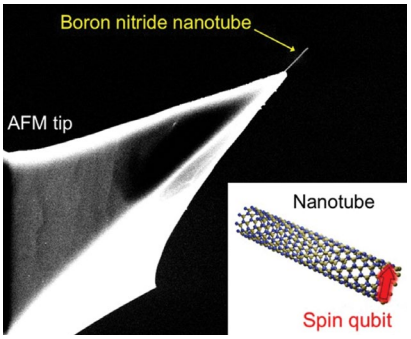

Researchers create orientation-independent magnetic field-sensing nanotube spin qubits

Purdue University researchers have developed patent-pending one-dimensional boron nitride nanotubes (BNNTs) containing spin qubits that have advantages over traditional diamond tips used in scanning probe magnetic-field microscopes. Applications include quantum sensing technology, semiconductor manufacturing, and nanoscale magnetic resonance imaging. The research is published in *Nature Communications*.

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"The collaboration between theory, computation and experiments ... not only contributed to understanding and interpreting the core science, but also opened new lines of research on the computational side."

UChicago PME Professor GIULIA GALLI on the collaboration with colleague Alex High

Researchers at SQMS Center achieve leading performance in transmon qubits

Scientists and engineers at the Superconducting Quantum Materials and Systems (SQMS) Center, hosted by the US Department of Energy's Fermi National Accelerator Laboratory, have achieved reproducible improvements in superconducting transmon qubit lifetimes with record values of 0.6 milliseconds. The result, published in *Nature Partner Journal Quantum Information*, was achieved through an innovative materials technique that eliminated a major loss source in the devices.

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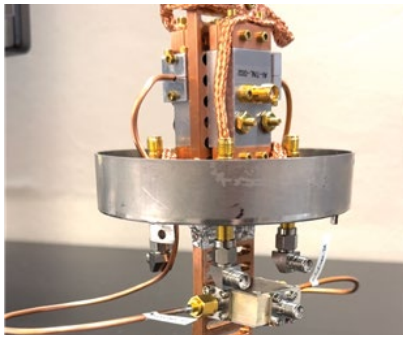

Creating stable entanglement through quantum reservoir engineering

Entanglement created in qubit platforms often deteriorates over time, frequently because of interactions between the qubits and their environment. A recent collaboration between the University of Illinois and the University of Chicago, published in *Physical Review Research*, addresses this problem by using the environment as a help, instead of a hindrance. In using the environment of superconducting qubits, sometimes referred to as a reservoir, the researchers show that more stable entanglement can be created.

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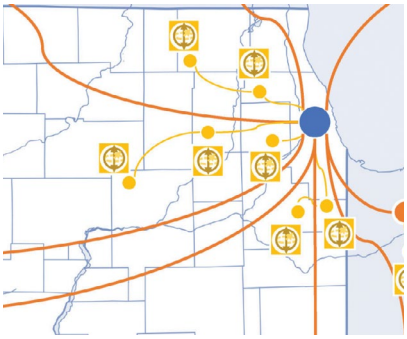

New method could yield fast, cross-country quantum network

To realize the full benefits of quantum computing, multiple quantum computers need to be connected in quantum networks or a quantum internet. Now, in work published in *Physical Review Letters*, researchers at the University of Chicago have proposed a new method of building a quantum network using vacuum beam guides. Networks with these devices would have ranges of thousands of kilometers and capacities of 10 trillion qubits per second, better than any existing quantum communication approach.

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210+
Researchers across member institutions

51
Boeing Quantum Creators since program began

22
Honors to CQE researchers

TRAINING AND EDUCATION

Fast-growing quantum tech industry has well-paid jobs — and most don't require a graduate degree

A new CQE analysis shows that fewer than half of quantum jobs need PhDs; employers say curiosity, basic retraining, and skills developed in other fields are the keys to getting hired for many roles.

ABOVE: Ten members of the 2023 IBM Quantum internship class pose in front of a dilution refrigerator, a piece of equipment that provides essential cooling for quantum computers. IBM Quantum hires at bachelor's, master's, and PhD levels. (Photo courtesy of IBM Quantum.)

In 2015, Marie Grubb, a supermarket cake decorator, spotted a job advertisement for a technician position at quantum technology company Infleqtion (then called ColdQuanta). The job didn't require a PhD, a background in physics, or even experience working with quantum computers; the posting only asked that applicants have "good fine motor skills." After years of carefully sculpting waves, letters, and roses with frosting, Grubb knew she qualified.

Cake decorating and quantum computers may not appear to have much in common, but Grubb thrived during her time at Infleqtion —

underscoring an under-recognized fact about the fast-growing, and often well-paid, quantum technology workforce: it isn't just for PhD physicists anymore.

> "There is something for anyone who is interested in getting in on the ground floor of this 'industry of the future.'"

CELIA MERZBACHER, the executive director of the Quantum Economic Development Consortium (QED-C®)

More than half of all quantum technology jobs do not require a graduate degree, according to a first-of-its-kind analysis conducted by the Chicago Quantum Exchange using job postings provided by the Quantum Economic Development Consortium (QED-C®) and the Quantum Computing Report. This is especially true in the industry sector, where the CQE found that about two-thirds of quantum jobs are open to those with a bachelor's degree or less — a number experts say is consistent with the field's recent commercialization but may run contrary to public expectation.

This is important because it represents a huge opportunity: quantum technology — which takes advantage of the unique properties of quantum mechanics — is a rapidly growing sector that has the potential to revolutionize multiple industries, boost economies, and revitalize vulnerable communities. Adjacent occupations most closely related to quantum technical roles are high paying: for instance, computer hardware engineers nationally earn a mean annual wage of $147,770; software developers earn an average of $138,110; and computer systems analysts earn an average of $110,800, according to 2023 data from the Bureau of Labor Statistics. Jobs like these generally do not require a PhD but do require skills that are transferrable to quantum technology with a small amount of retraining, either on the job or through professional education programs.

Quantum technology, while revolutionary, runs on a foundation of entirely classical systems. For this reason, many of the technical skills required for quantum jobs — coding in Python, working with analog circuits, etching semiconductor wafers — can be learned or acquired in fields that aren't quantum at all. Sometimes they can be learned on the job: that's why so many employers say that what they most need aren't PhD quantum physicists — although there are still important careers for those with doctorate degrees — but curious learners with experience in another field and a willingness to pivot.

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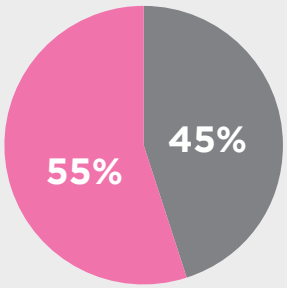
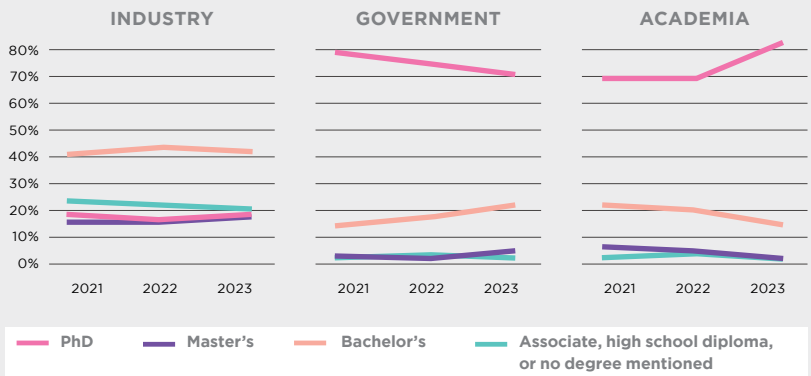
Degree Requirements for Quantum Technology Jobs



Source: CQE analysis of job postings maintained by QED-C and Quantum Computing Report.

Degree Requirements for Quantum Technology Jobs by Sector, 2021-2023



Source: CQE analysis of job postings maintained by QED-C and Quantum Computing Report.

UIC students advance creation of quantum materials through Q-NEXT program

Six undergraduates at the University of Illinois Chicago (UIC) have been writing the playbook for a process that will help accelerate the creation of materials that host qubits — specifically, membranes made of diamond.

The development of diamond membranes for quantum technologies is an important area of research at Q-NEXT, a US Department of Energy (DOE) National Quantum Information Science Research Center led by DOE's Argonne National Laboratory. During the students' 10-week internship at Argonne, they contributed to Q-NEXT by writing software to automate one of the more intensively manual parts of diamond-membrane production.

Their work is enabled through Break Through Tech Chicago, an initiative that provides women and nonbinary people with internship opportunities in science and technology. Argonne staff scientist Nazar Delegan, a Q-NEXT collaborator, and UIC Professor Dale Reed led the student team.

"We're doing work that has a possibility to change so many different things as we know them," said Aima Qutbuddin, a computer science junior. "It's innovative, it's thinking into the future."

The CQE honored the group's work with the Best Undergraduate Student Poster Award at the Chicago Quantum Summit in October.

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DID YOU KNOW?

2025 is the International Year of Quantum

The United Nations has designated 2025 as the International Year of Quantum, recognizing 100 years since the initial development of quantum mechanics. Learn more about the global initiative at https://quantum2025.org and visit the CQE website to see how our members and partners are celebrating.

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As the Midwest's quantum ecosystem grows, members of the South Chicago community gather for an evening of quantum games

In the Bowen High School gym on Chicago's Southeast Side one night in October, a young girl stood with a doughnut in her hand and a blue balloon tied around her wrist. The doughnut had a sugar decal with an icon depicting quantum entanglement, and the balloon featured a geometric object called a Bloch sphere and the word "qubit."

Young children don't typically know a lot about quantum science, but understanding the physics of nature's smallest scales wasn't necessary. Instead, the Quantum Game Night — hosted by the Chicago Quantum Exchange and featuring the University of Chicago Pritzker School of Molecular Engineering's STAGE Center, the University of Illinois Urbana-Champaign's LabEscape, and others — was meant to introduce the local community to quantum technology through games and activities.

Held in conjunction with the CQE's seventh annual Chicago Quantum Summit, the game night, which drew about 150 people, was an early step toward inviting the broader public to engage with the field at a pivotal time in the development of the Midwest's quantum economy.

"It was absolutely a phenomenal event," Bowen Principal Priscilla Horton said. "Programs and events like these provide exposure and learning experiences that create positive futures for students."

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60,000
Degrees and certificates awarded annually in quantum-relevant fields in the Illinois-Wisconsin-Indiana region

124
Quantum courses taught at CQE member institutions

270+
Attendees at the Quantum Recruiting Forum, including 31 companies

BUILDING THE QUANTUM ECONOMY

EeroQ invests $1.1M to expand Chicago headquarters with support from State of Illinois

EeroQ is the first quantum company in Illinois to receive state funding

ABOVE: Illinois Governor JB Pritzker speaks to CEO Nick Farina (not shown) and employees of quantum computing company EeroQ during a visit to company headquarters in Chicago's Humboldt Park neighborhood. (Image courtesy of the Office of the Governor of Illinois.)

Illinois officials and EeroQ Corporation leadership announced new investments in the company's quantum headquarters in Chicago's Humboldt Park community. EeroQ's $1.1 million investment in capital expenditures, bolstered by an Economic Development for a Growing Economy (EDGE) for Startups agreement and Illinois Innovation Venture Fund (INVENT) investments, will enable the company to develop the team and tools needed to build a quantum computer and revolutionize various fields. EeroQ will create five new full-time jobs and retain eight full-time jobs.

Founded in 2017, EeroQ is building a commercial-scale quantum computer using electrons floating on top of liquid helium and leveraging today's existing chip fabrication technology. This innovative strategy allows EeroQ to scale rapidly and with resource efficiency.

"This investment means more jobs and fresh opportunities right here in Chicago, while pushing the boundaries of what's possible in tech and innovation. I'm excited to see EeroQ not only shape the future of quantum computing, but do it from our own backyard."

ILLINOIS LT. GOVERNOR JULIANA STRATTON, at a news conference announcing support for the quantum computing company's expansion

"Illinois has been an incredible place to grow our company, from the best-in-class talent pool to the visionary leadership of the state government and other organizations," said Nick Farina, co-founder and CEO of EeroQ. "Quantum computing is the world's next great technological frontier with transformative implications for nearly every aspect of our lives, and I'm so grateful for the State's continued commitment to the work we're doing at EeroQ and to the Illinois quantum ecosystem."

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CQE RESOURCE HIGHLIGHT

The Founder Platform

What: The CQE's Founder Platform provides proactive and on-call supports to accelerate the growth of quantum startups in the Illinois-Wisconsin-Indiana region. It serves as a complement to critical programs such as Duality and Chain Reaction Innovations, ensuring that all regional startups have ecosystem supports that enable them to grow and thrive.

Who is eligible: CQE corporate partner quantum technology startups that are growing in the CQE region in Illinois, Wisconsin, or Indiana.

Founder Platform offerings include:

- **Free CQE corporate partnership** for early-stage quantum technology companies. Provides access to the CQE broad network of researchers, strategic partners, and future customers.
- **Idea generation and networking.** Can include topically focused research and commercial workshops and the annual Chicago Quantum Summit, international delegations and connections, and talent development and attraction initiatives.
- **Access to facilities and experts.** Connections to quantum science expertise and physical facilities to enable companies to refine their technologies to meet with emerging market opportunities.
- **Connections to funding.** Introductions to capital providers, including government, venture capital, and other near-term funding to ensure that startups have the financial resources necessary for tech development and scaling.

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FBI Chicago, Bloch Quantum Tech Hub partner to secure region's quantum assets

The FBI's Chicago office and the CQE-led Bloch Quantum Tech Hub held a first-of-its-kind symposium at Fermi National Accelerator Laboratory in May to build communication channels between law enforcement and technology developers — an effort aimed at creating a national model for cooperation between the quantum ecosystem and the government agencies that protect the nation and its assets.

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PNW unveils plan to establish major quantum commercialization center in Hammond, Indiana

Purdue University Northwest (PNW), a member of the CQE-led Bloch Quantum Tech Hub, announced in July that the university is working with other members of The Bloch on a quantum commercialization center as part of the Roberts Impact Lab, a regional technology transfer and commercialization hub under development by PNW. The impact lab is the centerpiece of a new $40 million-plus downtown innovation district.

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qBraid

Future Labs Capital leads qBraid investment round

Future Labs Capital, a private equity venture capital firm that invests in best-in-class quantum computing and artificial intelligence (AI) technologies, has invested an undisclosed amount into qBraid, a rapidly growing one-stop quantum computing software platform based in Chicago. The infusion of capital from Future Labs Capital will be used by qBraid, a Duality alum, to increase its enterprise contracts for the quantum platform and propel its expansion into lucrative markets such as Canada, the European Union, the United Kingdom, and Japan.

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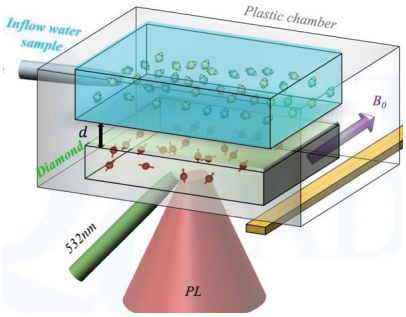
"This is a pivotal moment for our qBraid team. This significant investment accelerates our growth trajectory, enabling us to expand our impact exponentially."

KANAV SETIA, co-founder and CEO of qBraid, on receiving funding from Future Labs Capital



NASA Selects QuantCAD to advance quantum sensor designs

QuantCAD LLC, a physics startup and Duality alum based in Iowa City and Chicago, was selected by NASA to advance quantum sensing with a Small Business Innovation Research Phase II contract. NASA plans to use the quantum sensor developed by QuantCAD to investigate the origins of water on exoplanets. This is the second Phase II contract awarded to QuantCAD by NASA in the area of quantum sensing. NASA has also selected QuantCAD for a third Phase I award, which will expand its sensing capabilities in extreme environments.

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Cross-sector research showcases significant progress toward quantum advantage

In a new paper in *Science Advances*, researchers at JPMorgan Chase, the US Department of Energy's Argonne National Laboratory, and Quantinuum have demonstrated clear evidence of a quantum algorithmic speedup for the quantum approximate optimization algorithm. The work also highlights the value of partnerships.

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Quantum Corridor closes $10 million Series A raise

CQE partner Quantum Corridor Inc., a quantum-ready fiberoptic communications network connecting Chicago and Northwest Indiana, announced the close of its $10 million Series A round. The raise was funded by eight family offices and individual tech investors and brings Quantum Corridor's total funding to more than $27 million. Formed in 2021 as a public-private partnership with the state of Indiana, Quantum Corridor was established to enable advanced tech innovators in Indiana and Illinois to exchange data nearly instantaneously and achieve frontline breakthroughs.

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"By allowing us to look at the tiniest pieces of the universe, quantum sensing enables the search for life in unusual spaces — and ultimately lets us dance with the origins of human existence."

JENNIFER FLATTÉ, founder and CEO of QuantCAD, on the use of quantum sensors to search for water on exoplanets

What you need to know about quantum jobs in Illinois, Wisconsin, and Indiana

1. Analysts predict as many as 191,000 quantum economy jobs in the Illinois-Wisconsin-Indiana region by 2035.
2. The growth is expected to be fast: The number of quantum jobs is predicted to rise more than 200% from 2027 to 2030 — and more than 550% from 2030 to 2035.
3. Jobs will be open to workers at a range of education levels.

Projected number of quantum jobs (and degree requirements)

RESEARCH AND DISCOVERY

Scientists (PhD, master's) — 26,000

Engineers (bachelor's) — 52,000

Technicians (associate, technical training) — 26,000

BUSINESS/TRANSLATION

Applied scientists (PhD, master's) — 26,000

Consultants (master's, bachelor's) — 3,000

Support (bachelor's, associate) — 23,000

ADJACENT

Construction/manufacturing (associate, technical training) — 35,000

TOTAL — 191,000

Source: Boston Consulting Group for the CQE. Numbers are high end of projected ranges. This material is based upon work supported by the US National Science Foundation (NSF) under Award 2315739, a Regional Innovation Engine Development Award: Advancing quantum technologies in the Midwest. Any opinions, findings and conclusions or recommendations expressed in this material do not necessarily reflect the views of the NSF.

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CQE IN THE NEWS

Chicago Quantum Exchange researchers and institutions are strengthening the reputation of the Illinois-Wisconsin-Indiana quantum ecosystem. Here are highlights of their media coverage.

Chicago wants to build the Silicon Valley of quantum computing
The Wall Street Journal
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How quantum physics could 'revolutionise everything'
BBC
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How quantum computing could help us understand more about the universe
PBS NewsHour
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Decoding the universe: quantum
PBS Nova
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Illinois gov. adds $500 million to quantum computing quest
Axios
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Illinois Governor Pritzker secures $1 billion quantum tech win before convention
Bloomberg
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Pritzker aims to make Illinois lead the charge in quantum computing
Chicago Sun-Times
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Optimism meets skepticism at Quantum Summit in Chicago
Chicago Tribune
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How Chicago got ahead of the curve on quantum computing
Crain's
READ MORE >

Gov. Pritzker says Illinois is at the forefront of quantum computing
CBS News
READ MORE >

SELECTED CQE PATENTS

The following technologies from CQE-affiliated faculty members are available for licensing.

Title: Noble gas solid-state single electron qubit platform

Owner: UChicago Argonne, LLC

Inventors: Dafei Jin, Xianjing Zhou, Gerwin Koolstra, Ge Yang, David I. Schuster

US or International Patent App. No.: 17/672,389

Publication link/doi: https://doi.org/10.1038/s41586-022-04539-x

Contact: Phil Smith, pesmith@anl.gov

Title: Colloidal quantum fountains

Owner: UChicago Argonne, LLC

Inventor: Benjamin Diroll

US or International Patent App. No.: 17/676,307

Contact: Harrison Paul, hrpaul@uchicago.edu

Title: Methods of forming bonded diamond membrane heterostructures

Owner: University of Chicago

Inventors: Tanvi Deshmukh, Alex A. High, Xinghan Guo, Avery Linder, Ian Newton Hammock, Nazar Delegan, Clayton T. Devault, Joseph Paul Heremans

US or International Patent App. No.: Patent unpublished

Publication link/doi: https://doi.org/10.1038/s41467-024-53150-3

Contact: Harrison Paul, hrpaul@uchicago.edu

Title: A fluorescent-protein spin qubit

Owner: University of Chicago

Inventor: David Awschalom

Full Inventor List: Benjamin S. Soloway, David D. Awschalom, Peter C. Maurer, Jacob S. Feder

US or International Patent App. No.: Patent unpublished

Relevant publication: Feder, J. S. et al. A fluorescent-protein spin qubit. (2024).

Publication link/doi: https://arxiv.org/abs/2411.16835

Contact: Harrison Paul, hrpaul@uchicago.edu

Title: Robust techniques for magic state distillation in Clifford+T based quantum computers

Owner: University of Chicago

Inventors: Christopher Kang, Sophia Lin, Jason Chadwick, Frederic Chong

US or International Patent App. No.: NA

Relevant publication: NA

Publication link/doi: NA

Contact: Harrison Paul, hrpaul@uchicago.edu

Title: Quantum transduction with superconducting 3D resonators

Owner: Fermi National Accelerator Laboratory

Inventor: Silvia Zorzetti

US or International Patent App. No.: PCT/US2314928

Contact: FNAL Office of Partnerships and Technology Transfer, optt@fnal.gov

Title: Cryogenic microwave multiplexed readout of superconducting quantum devices

Owner: Fermi National Accelerator Laboratory

Inventors: Mohamed Hamed, Awida Hassan

US or International Patent App. No.: PCT/US22/40655

Contact: FNAL Office of Partnerships and Technology Transfer, optt@fnal.gov

Title: Dielectric nanolayer capacitor and method of charging a dielectric nanolayer capacitor

Owner: Board of Trustees of the University of Illinois

Inventors: Alexey Bezryadin, Eduard Ilin, Irina Burkova

US or International Patent App. No.: 12,131,867

Publication link/doi: https://pubs.rsc.org/en/content/articlelanding/2020/nr/d0nr04660d

Contact: Michelle Chitambar, mchitamb@illinois.edu

Title: Deterministic reset of superconducting qubit and cavity modes with a microwave photon counter

Owner: University of Wisconsin–Madison

US Patent No.: 12,159,193

Inventors: Robert McDermott, Alexander Opremcak

Contact: Emily Bauer, emily@warf.org

Title: Alkali metal optical clock

Owner: University of Wisconsin–Madison

US Patent No.: 11,868,095

Inventors: Mark Saffman, Shimon Kolkowitz, Arjav Sharma

Contact: Emily Bauer, emily@warf.org

Title: Methods of fabricating planar infrared photodetectors

Owner: Northwestern University

Inventor: Prof. Manijeh Razeghi

US or International Patent App. No.: 12080823

Publication link/doi: doi.org/10.3390/photonics9090664

Contact: Manijeh Razeghi, razeghi@northwestern.edu

Title: Monohydride passivation of high resistivity Si(111) for quantum information technologies

Owner: Northwestern University

Inventors: Michael Bedzyk, Dominic Goronzy, Mark Hersam, Carlos Gerardo Torres Castanedo

US or International Patent App. No.: PCT/US2024/011920

Publication link/doi: https://doi.org/10.1063/5.0145090

Contact: Phil Carter, phillip.carter@northwestern.edu

Title: Systems and methods for single-photon emission

Owner: Purdue University

Inventors: Vladimir M. Shalaev, Alexandra Boltasseva, Alexei Lagutchev, Alexander Senichev, Zachariah O. Martin, Demid Sychev, Samuel Peana, and Xiaohui XU

US or International Patent App. No.: US 2022/0317335 A1

Contact: David Stewart, davidstewart@purdue.edu

ABOVE: Students and postdoctoral researchers take a tour of a quantum lab at the University of Chicago's Pritzker School of Molecular Engineering during the National Science Foundation (NSF)-sponsored Quantum Leap Challenge Institute (QLCI) Quantum Careers Workshop on April 12, 2024. Lab is affiliated with the NSF Hybrid Quantum Architectures and Networks (HQAN) Quantum Leap Challenge Institute. (Image by Lloyd DeGrane)

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