The 28th Science in Japan Forum

GLIMPSE OF QUANTUM TECHNOLOGY AND QUANTUM COMPUTER

Cosmos Club
Washington, DC
June 20, 2025
1:00-6:00pm (Reception 6:15pm-)
On-site participation is by invitation only

RIKEN QUANTUM COMPUTING
RIKEN
QIQB UOsaka
EMBASSY OF JAPAN WASHINGTON, D.C.
AAAS
UNIVERSITY of MARYLAND SCHOOL OF MEDICINE
U.S. DEPARTMENT OF ENERGY
Office of Science
Alumni JSPS Association
JAPAN SOCIETY FOR THE PROMOTION OF SCIENCE FOUNDED 1932

The Twenty-Eighth
"Science in Japan" Forum

Glimpse of Quantum Technology and Quantum Computer

Cosmos Club
Washington, DC
June 20, 2025

Sponsored by
Japan Society for the Promotion of Science

Co-sponsored by
AAAS (American Association for the Advancement of Science)
Center for Quantum Information and Quantum Biology, The University of Osaka
DOE (Department of Energy)
Embassy of Japan in the United States of America
Institute of Physical and Chemical Research (RIKEN)
RIKEN Center for Quantum Computing
The University of Osaka
University of Maryland, School of Medicine
US and Canada JSPS Alumni Association

Agenda

12:00 pm - Registration

1:00 pm - 1:20 pm

Opening Remarks

Ambassador Takehiro Shimada, Deputy Chief of Mission, Embassy of Japan in the United States of America

B. Estefania Ortiz Calva, Senior Program Associate, International Affairs and Science Diplomacy, Center for Science Diplomacy, American Association for the Advancement of Science

Dr. Amit Sawant, Professor and Vice Chair for Medical Physics, Department of Radiation Oncology, University of Maryland, School of Medicine

1:20 pm - 2:00 pm

Introductory Speech: Quantum Mechanics 2025: Incredible Past, Amazing Present—what about the future and the role of quantum information?

Nobel Laureate Dr. William D. Phillips, Distinguished University Professor, University of Maryland, NIST Fellow, National Institute of Standards and Technology

2:00 pm – 2:40 pm

Session 1: Challenge toward Fault-Tolerant Universal Quantum Computer

Professor Masahiro Kitagawa, Director, Center for Quantum Information and Quantum Biology, The University of Osaka

2:40 pm – 3:00 pm Coffee Break

3:00 pm – 3:40 pm

Session 2: Challenges in superconducting quantum computing

Professor Yasunobu Nakamura, Director, RIKEN Center for Quantum Computing, RIKEN, and Professor, Department of Applied Physics, Graduate School of Engineering, The University of Tokyo

*Time Zone: Eastern Daylight Time

3:40 pm – 4:10 pm

Session 3: Development of System Software and Controller, Their Ecosystem, and Human Resources for Quantum Computers

Professor Makoto Negoro, Deputy Director, Center for Quantum Information and Quantum Biology, The University of Osaka

4:10 pm – 4:50 pm

Session 4: From Research to Real World: The Emerging Quantum Computer Economy

Dr. Celia Merzbacher, Executive Director of the Quantum Economic Development Consortium (QED-C) Managed by SRI International

4:50 pm – 5:00 pm Coffee Break

5:00 pm – 6:00 pm

Panel Discussion: Future of Quantum Computing

Moderator:

Dr. Robabeh Rahimi, Associate Professor, Department of Radiation Oncology, University of Maryland, School of Medicine

+ All Speakers

6:00 pm –

Closing Remarks

Dr. Keisuke Okamura, First Secretary, Embassy of Japan in the United States of America

6:10 pm –

Reception

*Time Zone: Eastern Daylight Time

<For All Participants>

- JSPS will take some photographs and video recordings during the forum. They may be used for the website and other publications by host organizations.
- Please do not take pictures or videos.

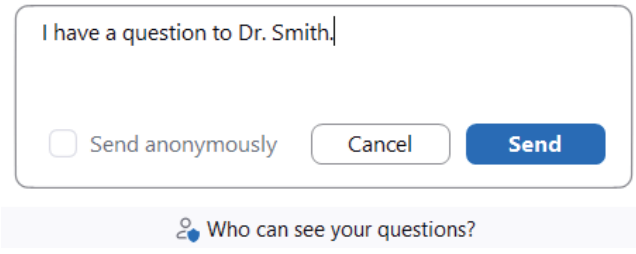
<Request for In-person Participants>

- There will be Q&A after each talk. If you have questions, please come to the mic stand.

<Request For Zoom Participants>

- Be sure to mute your microphone and turn off your camera.

- There will be Q&A after each talk.
  Questions from the online audience can be asked via Zoom Q&A function.



Foreword

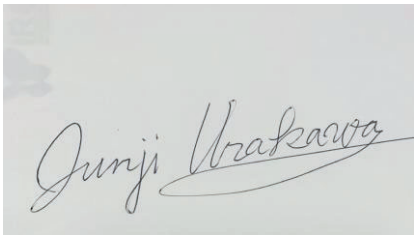
The “Science-in-Japan” Forum, started in 1996, is held annually in Washington, D.C., by Dr. Masatoshi Koshiba, the Director of the Japan Society for the Promotion of Science (JSPS) Washington Office (WO), to promote scientific cooperation between Japan and the United States.

The theme of the 28th forum, to be held in June 2025, is " Glimpse for Quantum Technology and Quantum Computer." Research and development on this topic are being conducted at the Quantum Information and Quantum Biology Center (QIQB), the RIKEN Quantum Computing Center (RQC), the National Institute of Standards and Technology (NIST), and other research institutes.

These research institutes aim to create applications in new scientific fields by comprehensively and continuously grasping technological development and dissemination, as well as predicting future developments. When I learned about quantum computing last May, I remembered a fascinating book called "What is Real?" by Adam Becker. The subtitle is "The ultimate question remaining in quantum mechanics." Another book, "Can quantum theory homework be solved?" was written by Japanese newspaper reporter Akira Ozeki. So, I reread them before this forum. I want to recommend these books to all of today's participants. I also hope that this forum will be an opportunity to promote cooperation and competition between Japan and the United States.

This forum is co-sponsored by AAAS (American Association for the Advancement of Science), DOE (U.S. Department of Energy), The University of Osaka, QIQB, RIKEN, RQC, University of Maryland School of Medicine, and the JSPS USA and Canada Alumni Association (AA). I want to express our sincere gratitude to the staff of the JSPS Washington Office for their efficient preparation of this forum.

I hope all the participants will find the Forum valuable and enjoyable.



Junji Urakawa
Director, JSPS Washington Office

Introductory Speech
Quantum Mechanics 2025: Incredible Past, Amazing Present—what about the future and the role of quantum information?

William D. Phillips
Physicist, Laser Cooling and Trapping Group
Quantum Measurement Division
Physical Measurement Laboratory
National Institute of Standards and Technology

and

Distinguished University Professor
Department of Physics and Institute of Physics Science and Technology
University of Maryland

PhD in Physics

Abstract: 100 years ago quantum mechanics gave birth to a scientific and technological revolution that touched most people on earth. Today, what is being hailed as a second quantum revolution is putting quantum weirdness to work.

Education

Camp Hill High School, Camp Hill, Pennsylvania, diploma
(Valedictorian) 1966.
Juniata College, Huntington, Pennsylvania, B.S., Physics, summa cum laude, 1970.
Massachusetts Institute of Technology, Cambridge, Massachusetts,
Ph. D., Physics, 1976. Thesis under Prof. Daniel Kleppner, thesis
title: I. The Magnetic Moment of the Proton in H_2O;
II. Inelastic Collisions in Excited Na.

Scientific Experience after Ph.D

1978-present: Physicist, National Bureau of Standards (Now National Institute for Standards and Technology; 1990-96: Group Leader of the Laser Cooled and Trapped Atoms Group of the Atomic Physics Division; 1996-98, NIST Fellow; 1998-2019: NIST Fellow and Group Leader of the Laser Cooling and Trapping Group; 2019-2023: NIST Fellow and Group Leader Emeritus; 2024-present Katharine Blodgett Gebbie Fellow and Group Leader Emeritus.

2001-present: Distinguished University Professor, University of Maryland, College Park MD;

2006-present, College Park Professor, University of Maryland;
Fellow of the Joint Quantum Institute (a joint venture of NIST and the University of Maryland).

2008-2022: Co-Director of the NSF Physics Frontier Center at the Joint Quantum Institute

2002-2003 George Eastman Visiting Professor, Balliol College and Clarendon Laboratory, Department of Physics, University of Oxford

1992-2001: Adjunct Professor of Physics, University of Maryland, College Park.

1989-1990: Visiting Professor at Ecole Normale Supérieure, Paris, in the laboratory of Claude

Cohen-Tannoudji and Alain Aspect:

1976-1978 Chaim Weizmann Postdoctoral Fellow at Massachusetts Institute of Technology:

Awards and Honors

Pennsylvania State Scholarship 1966-1970
C. C. Ellis Memorial Scholarship 1969-1970
Election to Juniata College Honor Society 1969.
Woodrow Wilson Fellow 1970
National Science Foundation Fellow 1970-1973
Chaim Weizmann Postdoctoral Fellow 1976-1978
Outstanding Young Scientist Award of the Maryland Academy of Sciences, 1982.
Scientific Achievement Award of the Washington Academy of Sciences, 1982
Silver Medal of the Department of Commerce, 1983
Samuel Wesley Stratton Award of the National Bureau of Standards,1987
Arthur S. Flemming Award of the Washington Downtown Jaycees, 1988
Gold Medal of the Dept. of Commerce, 1993.
Election to American Academy of Arts and Sciences 1995
Election as a NIST Fellow, 1995
Michelson Medal of the Franklin Institute 1996
Distinguished Traveling Lecturer (APS-DLS) 1996-98
Election to the National Academy of Sciences 1997
Nobel Prize in Physics 1997

Nobel Prize Citation: "for development of methods to cool and trap atoms with laser light"

The prize was shared with Steven Chu and Claude Cohen-Tannoudji.

Honorary Doctor of Science, Williams College 1998
Doctorado Honoris Causa de la Universidad de Buenos Aires 1998 Arthur L. Schawlow Prize in Laser Science (APS) 1998
Honorary Doctor of Science, Juniata College 1999
American Academy of Achievement Award 1999
Gold Medal of the Pennsylvania Society 1999
Richtmeyer Award of the Am. Assoc. of Physics Teachers 2000
Election to the European Academy of Arts, Sciences and Humanities (titular member), 2000
Condon Award of NIST 2002
Archie Mahan Prize of the OSA 2002
Election as an Honorary Freeman of the Worshipful Company of Scientitific Instrument Makers, London 2003
Election as an alumni member of Juniata College's chapter of Omicron Delta Kappa, the National Leadership Honor Society 2004
Election as an Honorary Member of the Optical Society of America
Appointed an Academician of the Pontifical Academy of Sciences 2004
Meritorious Senior Professional Award (Presidential Rank) 2005
Trotter Prize 2006
Service to America Medal, Career Achievement Award 2006
Election as Honorary Member of the Institute of Physics of the University of Sao Paulo in Sao Carlos, Brazil, 2009
Janus Award of the Institute of Physics at the University of Sao Paulo in San Carlos, Brazil, 2009

Doctorado Honoris Causa, Universidad Autónoma de San Luis Potosí, San Luis Potosí, Mexico, 2009
Appointment to Lifetime Membership in Sigma Xi 2009
Moyal Medal, Faculty of Science, Macquarie University, Sydney, 2010
Doctorat *Honoris Causa*, École Normale Supérieure, Paris 2010
Doctor of Science, *Honoris Causa*, University of Strathclyde, Glasgow, 2011
NIST Equal Opportunity/Diversity Award 2011
Doctor of Science, *Honoris Causa*, University of Oxford, 20 June 2012.
Inaugural recipient of the "Wall of Honor" award of the Camp Hill (Pennsylvania) School District, 26 January 2013
Pioneer in Photonics Award, Fitzpatrick Institute of Photonics, Duke University, 11 March 2013
Galileo Ferraris Prize, INRiM, Torino Italy, 06 December 2014
Appointment as a Corresponding Member of the Mexican Academy of Sciences (Academia Mexicana de Ciencias) December 2016.
Sir George Thomson gold medal of the Institute of Measurement and Control, 2018.
(Awarded at the Belfast meeting of IMEKO)
Election as a Fellow of the American Association for the Advancement of Science, 2018
Honorary degree (Doctor of Humane Letters, *Honoris Causa*) from the Graduate School of Arts and Sciences of Georgetown University (May 2018)
Named 79th among the 100 Greatest Pennsylvanians of All Time by Sean Adams sadams@pennlive.com (June 2018)
Commemorative Medal of the Senate of the Parliament of the Czech Republic (July 17, 2019) for excellent contributions to the development of quantum physics
Katharine B. Gebbie Lifetime Achievement Award for Outstanding Federal Service awarded by the Arthur S. Flemming Awards Commission, 20 April 2020.

Professional societies

American Physical Society (Fellow)
Optical Society of America (Fellow and Honorary Member)
American Academy of Arts and Sciences (Fellow)
National Academy of Sciences
Korean Academy of Science and Technology (foreign honorary member)
European Academy of Arts, Sciences and Humanities (titular member)
Sigma Xi Research Society (lifetime member)
Society of Physics Students
Pontifical Academy of Sciences
Academia Mexicana de Ciencias, foreign corresponding member
American Association for the Advancement of Science (Fellow)

Challenge toward Fault-Tolerant Universal Quantum Computer

Masahiro Kitagawa
Director, Center for Quantum Information and Quantum Biology,
The University of Osaka
PhD in Science

Abstract
The present quantum computers suffer from quantum errors. They cannot achieve promises initially expected from quantum computers, such as factoring large numbers or precisely calculating molecular energy by quantum algorithms. The quantum error rates are currently 0.1% to 0.01%, while factoring a 2048-bit number or precisely calculating the energy of FeMoco involved in nitrogen fixation by rhizobia requires $5x10^9$ quantum gate operations, resulting in virtually zero probability of success. There is currently a 6 to 7 orders of magnitude gap between available and required error rates, which cannot be closed only by physical improvement of quantum devices. Quantum Error Correction (QEC) is a way to detect and correct errors without destroying quantum information. Fault-Tolerant Quantum Computation (FTQC) is a way to maintain an error rate as low as the application requires by repeating QEC while doing quantum computing. Recently, two breakthroughs have been achieved toward FTQC. Google performed QEC below the fault-tolerant threshold with a 105-qubit superconducting quantum processor and achieved a logical error rate below the physical error rate. Preparing a precise magic state is believed to be the most difficult part to realize universal FTQC. Google proposed magic state cultivation which might be as easy as a typical two-qubit gate operation. However, they are just the first two steps toward universal FTQC. To close the gap between the available physical error rate of 0.1% (10^{-3}) and 10^{-10} required by applications, 449 physical qubits are needed to build a logical qubit. If the physical error rate is 0.01% (10^{-4}), 95 physical qubits per logical qubit are needed. Factoring a 2048-bit number requires 6k logical qubits, and FeMoco calculation requires 2k logical qubits, requiring 3M and 1M physical qubits of error rate 0.1%, 600k and 200k physical qubits of error rate 0.01%, respectively. Currently, only 100 to 1000 physical qubits are available. Therefore, the number of physical qubits must be increased by a factor of 1000 or more. Lowering the physical error rate is very effective in relaxing the factor.
Currently, several physical modalities of qubits are actively studied as candidates for universal FTQC: superconducting, ion-trap, neutral atom, photonic, and semiconducting qubits. There are many attempts to achieve FTQC with 100 logical qubits by 2030. It is hard to predict which will achieve utility-scale universal FTQC and when. However, we will never give up utility-scale universal FTQC to enable the promises of quantum computing.

I am interested in various aspects of quantum information, including quantum measurement, quantum information theory, quantum computing, and quantum biology. I have been mainly working on quantum computing from 2020, on universal FTQC as the program director of JST Moonshot Goal 6 “Realization of a fault-tolerant universal quantum computer that will revolutionize economy, industry, and security by 2050” and on quantum computing system and software as the project leader of JST COI-NEXT “Quantum Software Research Hub”.

Present

Director, Center for Quantum Information and Quantum Biology,
The University of Osaka

Education

1977 - 1981 Undergraduate Student in the Faculty of Engineering,
The University of Osaka, Obtained B.Eng.

1981 - 1983 Graduate Student in the Graduate School of Engineering, The Institute of Scientific and Industrial Research, The University of Osaka, Obtained Ms.Eng.

1994 Obtained Ph.D. (Thesis advisor; Dr. Tetsuro Kobayashi) from the Graduate School of Engineering Science, The University of Osaka.

Academic Career

1983 - 1985 Research staff at Musashino Electrical Communication Laboratory,
Nippon Telegraph and Telephone Public Corporation

1985 - 1992 Research staff at Basic Research Laboratory, NTT

1992 - 1993 Senior Research Scientist at Basic Research Laboratory, NTT

1993 - 1997 Assistant Professor at the Faculty of Engineering Science, The University of Osaka

1997 - 2003 Associate Professor at the Graduate School of Engineering Science,
The University of Osaka

2003 - 2024 Professor at the Graduate School of Engineering Science, The University of Osaka

2024 - Director and Specially Appointed Professor, Center for Quantum Information and Quantum Biology, The University of Osaka

Academic awards

2020 Physical Review A 50th Anniversary Milestones
Squeezed spin states, Phys. Rev. A 47, 5138 (1993) was selected

Challenges in superconducting quantum computing

Yasunobu Nakamura
Director, RIKEN Center for Quantum Computing, RIKEN, and
Professor, Department of Applied Physics, Graduate School of Engineering,
The University of Tokyo
PhD in Applied Physics

Abstract
Superconducting quantum circuits are among the most extensively studied and significantly advanced platforms for quantum computing. The first demonstration of coherent control of a superconducting qubit occurred in 1999, shortly after breakthroughs in quantum computing theory in the mid-1990s. Notably, research on superconducting quantum circuits began even earlier, in the 1980s, driven by the curiosity to observe quantum superposition and coherence in a macroscopic object. The physics of superconductivity and electrical circuits, mesoscopic physics, nanotechnology, and quantum optics have nurtured the field through interdisciplinary collaboration. Today, thanks to technological advancements, many groups around the world are developing superconducting quantum computing systems that utilize tens or hundreds of qubits. The initial demonstrations of quantum error correction have been reported, emphasizing the need for further improvements in fidelity and scaling up to achieve quantum computers applicable to practical problems. Many challenges await us.

Yasu Nakamura has led the ten-year MEXT Q-LEAP Flagship project on the research and development of superconducting quantum computers since 2018. In the program, he and his colleagues are focusing on building superconducting quantum computing systems. His interests are primarily focused on realizing high-fidelity control gates and readout through understanding the physics behind them and devising novel techniques. Enabling technologies for scaling up are also within the scope of his research. He is also interested in quantum mechanics and its applications in a broader sense. Learning quantum mechanics and its historical development is always fascinating and stimulating to him.

Education

Oct 2011	Ph.D.	Department of Applied Physics, The University of Tokyo (2011)
Mar 1992	M.S.	Superconductivity Research Course, The University of Tokyo (1992)
Mar 1990	B.S.	Department of Applied Physics, The University of Tokyo (1990)

Academic career

Apr 2022 - present	Professor, Department of Applied Physics, Graduate School of Engineering, The University of Tokyo (UTokyo)
Apr 2021 - present	Director, RIKEN Center for Quantum Computing (RQC)
Apr 2012 - Mar 2022	Professor, Research Center of Advanced Science and Technology, UTokyo
Jan 2012 - Mar 2012	Professor, Department of Applied Physics, Graduate School of Engineering, UTokyo
Mar 2010 - Jan 2012	Research Fellow, Green Innovation Research Laboratories, NEC Corporation (NEC)
Apr 2007 - Mar 2010	Research Fellow, Nanoelectronics Research Laboratories, NEC
Jun 2005 - Mar 2007	Research Fellow, Fundamental and Environmental Research Laboratories, NEC
Jun 2001 - Mar 2004	Principal Researcher, Fundamental Research Laboratories, NEC
Jul 1997 - May 2001	Senior Researcher, Fundamental Research Laboratories, NEC
Apr 1992 - Jun 1997	Researcher, Fundamental Research Laboratories, NEC

[Other appointments]

Oct 2020 - Mar 2021	Group Director, RIKEN Center for Emergent Matter Science (CEMS)
Feb 2014 - Sep 2020	Team Leader, RIKEN CEMS
Apr 2013 - Jan 2014	Researcher, RIKEN CEMS
Apr 2008 - Mar 2013	Researcher, Advanced Science Institute, RIKEN
Sep 2002 - Mar 2007	Researcher, Frontier Research System, RIKEN
Sep 2001 - Aug 2002	Visiting Researcher, Department of Applied Physics, Delft University of Technology

Academic awards

2023	C&C Prize (with Jaw-Shen Tsai; Tokyo, Japan)
2023	Hoko Award (with Jaw-Shen Tsai; Tokyo, Japan)
2023	Japan Academy Prize (with Jaw-Shen Tsai; Tokyo, Japan)
2022	Micius Quantum Prize 2021 (with John Clarke and Michel Devoret; Hefei, China)
2021	Clarivate Highly Cited Researchers 2021
2021	Asahi Prize (with Jaw-Shen Tsai; Tokyo, Japan)
2020	American Physical Society Fellow
2019	Japan Society of Applied Physics Outstanding Achievement Award (Tokyo, Japan)
2014	Leo Esaki Prize (with Jaw-Shen Tsai; Tsukuba, Japan)
2014	Thomson Reuters Highly Cited Researcher
2008	Simon Memorial Prize (with Jaw-Shen Tsai; Leiden, The Netherlands)
2004	Agilent Technologies Europhysics Prize (with Michel Devoret, Daniel Esteve, and Hans Mooij; Prague, Czech)
1999	Nishina Memorial Prize (Tokyo, Japan)
1999	Sir Martin Wood Prize (Tokyo, Japan)

Development of System Software and Controller, Their Ecosystem, and Human Resources for Quantum Computers

Makoto Negoro
Deputy Director, Center for Quantum Information and Quantum Biology,
The University of Osaka
PhD in Science

Abstract
The development of qubit devices, quantum algorithms, and the exploration of use cases are widely recognized as key topics in the field of quantum computing. However, these elements alone are not sufficient to realize a practical and operational quantum computer. Controllers that directly interface with qubits, along with software that drives the system according to user intent, are essential components. In Japan, it was decided that a large-scale superconducting quantum computer based on RIKEN's chip devices would be developed through collaboration between the public and private sectors. As quantum computers continue to scale, controllers and software are becoming increasingly complex. Our center has taken the lead in developing these technologies. We successfully developed a controller for a 64-qubit chip device, along with a complete software stack—comprising firmware, microwave control software, pulse-layer software, cloud integration, a gate compiler, and a user interface. These components enabled the successful operation of the RIKEN machine in March 2023. For the sustainable growth of the quantum computing field, ecosystem development is critical. I co-founded QunaSys, a company focused on quantum software, and QuEL, which specializes in controller technology. In December 2023, we also succeeded in operating another quantum computer at our university, launching an industry-driven use case exploration initiative in collaboration with 42 companies. As part of this effort, we are actively fostering talent capable of contributing to all layers of quantum computing development.

I have conducted research on a variety of qubit devices, including superconducting, ion-based, nuclear spin, and electron spin qubits. I have also worked on quantum algorithms and large-scale implementations of quantum machine learning. Additionally, I am advancing research that applies nuclear spin qubit initialization techniques to enhance MRI sensitivity, with the aim of contributing to cancer treatment evaluation. More recently, I have been engaged in the development of software and control hardware, presented in this talk, to support large-scale quantum computing systems.

Career

2011	Completed Ph.D. in Department of Systems Innovation, Graduate School of Engineering Science, Osaka University
2011	Assistant Professor, Graduate School of Engineering Science, Osaka University
2018	Specially-appointed Associate Professor (full-time), Institute for Open and Transdisciplinary Research Initiatives, Osaka University
2018	Technical Advisor, QunaSys Inc
2020	Group Leader, Quantum Life Science Division, National Institutes for Quantum Science and Technology (QST)
2021	Associate Professor and Deputy Director, Center for Quantum Information and Quantum Biology, Osaka University
2021	Chief Scientific Officer (CSO), QuEL, Inc
2022	Concurrent position at the Human Metaverse Disease Research Center, Osaka University
2025	Professor and Deputy Director, Center for Quantum Information and Quantum Biology, Osaka University

From Research to Real World: The Emerging Quantum Computer Economy

Celia Merzbacher
Executive Director of the Quantum Economic Development Consortium (QED-C) Managed by SRI International
PhD in Geochemistry and Mineralogy

Abstract
While quantum mechanics has been a field of research for more than a century, utilization of the quantum properties of superposition and entanglement as the basis of a computer was only proposed in the 1980's. Academic and industry research and development related to quantum computers has intensified over the last two decades. Large tech companies and small startups are racing to build a "utility scale" quantum computer that provides capabilities beyond those possible with a classical computer. With useful quantum computers just over the horizon, organizations that could benefit from them are assessing applications that could provide business value. Studies show that use cases of quantum computing could impact sectors from pharmaceuticals and chemicals to energy and transportation. The quantum computing industry is already generating more than $1 billion in revenues and employs an estimated 200,000 workers. However, it is still an emerging industry, and the ultimate economic and societal value is expected to match or exceed classical information technology. The future is bright for quantum computing.

EMPLOYMENT

Executive Director, Quantum Economic Development Consortium, SRI International (2021–present)

Deputy Director, Quantum Economic Development Consortium, SRI International (2019-2021)

Director of Strategic and Institutional Planning, Oak Ridge National Laboratory (2017-2018)

Vice President for Innovative Partnerships, Semiconductor Research Corporation (2008–2017)

Executive Director, President's Council of Advisors on Science and Technology (PCAST) (2005–2008)

Assistant Director for Technology R&D, White House Office of Science and Technology Policy (OSTP) (2003–2008; concurrent with above position)

Licensing Executive, Naval Research Laboratory (NRL) (1999–2003)

Research Scientist, Naval Research Laboratory (1989–1999)

Postdoctoral Fellow, Lawrence Livermore National Laboratory (1987 – 1989)

EDUCATION

1987 Ph.D., Geochemistry and Mineralogy, The Pennsylvania State University, University Park, PA.

1983 M.S., Geochemistry and Mineralogy, The Pennsylvania State University, University Park, PA.

1978 B.S., Geology, Brown University, Providence, RI (Outstanding Senior in Geology)

ACCOMPLISHMENTS AND AWARDS

- Recipient of the GovExec Fed100 award for "significant contributions to advancing vital government missions through the innovative use of information technology." (2025)
- Member of the U.S. delegation to the NATO Transatlantic Quantum Community (2024 – present)
- U.S. Co-chair of the Quad Investors Network (2023)
- Elected Fellow of the AAAS (2022)
- Member of the Innovation Policy Forum of the National Academies of Science, Engineering and Medicine (2022 – present)
- High Impact Technology Exchange Conference (HI-TEC) Industry Recognition Award (2018)
- Review Coordinator for National Academies report Frontiers of Materials Research: A Decadal Survey (2018)
- Chair of the National Research Council Triennial Review of the National Nanotechnology Initiative Committee (2015 – 2016)
- Department of Energy Basic Energy Sciences Scientific User Facilities Division Committee of Visitors (2016)
- IEEE Cyber Security Initiative Steering Committee (2015 – 2017)
- National Research Council National Materials and Manufacturing Board (2013–2017); Chair (2016–2017)
- National Research Council Panel on Globalization of Science and Technology: Opportunities and Challenges for the Department of Defense (2013–2014)
- National Research Council Triennial Review of the National Nanotechnology Initiative Committee (2012–2013)
- National Academies Government-University-Industry Research Roundtable, SRC representative (2008–2015)
- 2001 Naval Research Laboratory Berman Publication Award for Basic Science
- Naval Research Laboratory Special Act Award for leadership in NRL Mentor Program (1999)
- Associate Editor, American Mineralogist (1999 – 2004)

BOARD AND ADVISORY POSITIONS

- Global Research and Development Center for Business by Quantum-AI Technology, International Advisory Board (2023 – present)
- Novo Nordisk Foundation Quantum Foundry, Board of Directors (2023 – present)
- Quantum System Accelerator, External Advisory Board (2021 – present)
- Potomac Quantum Innovation Center, Advisory Board (2021 – present)
- Southeast Nanotechnology Infrastructure Center (SENIC) Advisory Board (2016 – present)
- Florida International University Center for Research Excellence in Science and Technology External Advisory Board (2017 – present)
- Digital Solid State Propulsion LLC, Board of Advisors (2008–2014); Board of Directors (2014–2022)
- American National Standards Institute, Board of Directors (2006–2008)

SELECTED PUBLICATIONS (FROM A TOTAL OF MORE THAN 50)

C.I. Merzbacher (2020) *National Nanotechnology Initiative: A model for advancing revolutionary technologies,* In: Norris P., Friedersdorf L. (eds) Women in Nanotechnology. Women in Engineering and Science. Springer, Cham.

C.I. Merzbacher (2002) *Materials that emit light by chemical reaction,* Philosophical Transactions of the Royal Society of London Series A, **360**, 89-96.

C.I. Merzbacher et al. (2001) *Carbon aerogels as broadband non-reflective materials*, Journal of Non-crystalline Solids, **285**, 210-215.

C.I. Merzbacher et al. (1997) *Effect of re-wetting on silica aerogel structure: a SANS study*, Journal of Non-crystalline Solids, **224**, 92-96.

C. I. Merzbacher et al. (1996) *Fiber optic sensors in concrete structures: A review*, Smart Materials & Structures, **5**, 196-208.

N. W. Winter, C. I. Merzbacher and C. E. Violet (1993) *The Nuclear Quadrupole Interaction in High Temperature Superconductors*, Applied Spectroscopy Reviews, **28**, 123-164.

C.I. Merzbacher (1992) *Infrared reflectance of barium gallogermanate glasses*, Physics and Chemistry of Glasses, **33**, 233-238.

C.I. Merzbacher and W.B. White (1991) *The structure of alkaline-earth aluminosilicate glasses as determined by vibrational spectroscopy*, Journal of Non-crystalline Solids, **130**, 18-34.

Contributed to the following reports of the National Academies of Science, Engineering and Medicine:

Frontiers of Materials Research: A Decadal Survey (2019)

Triennial Review of the National Nanotechnology Initiative (2016)

Optimizing the Air Force Acquisition Strategy for Secure and Reliable Electronic Components (2016)

Strategic Engagement in Global S&T: Opportunities for Defense Research (2014)

Triennial Review of the National Nanotechnology Initiative (2013)

PATENTS

Alkaline earth modified germanium sulfide glass, Harbison et al., US patent no. 5,599,751

Modified germanium sulfide glass, Aggarwal et al. US patent no. 5,629,248

Electrically conducting ruthenium dioxide-aerogel composite, Ryan et al. US patent no. 6,290,880

Long duration infrared-emitting material, Merzbacher et al., US patent no. 6,296,678

Mesoporous composite gels and aerogels, Rolison et al., US patent no. 6,492,014

Electrically conducting ruthenium dioxide aerogel composite, Ryan et al., US patent no. 6,649,091

Moderator

Robabeh Rahimi, PhD, DABR
Associate Professor, Department of Radiation Oncology, University of Maryland, School of Medicine

Present

Associate Professor, Department of Radiation Oncology, University of Maryland, School of Medicine

Education

1994 – 1999 B.Sc., Applied Physics, Sharif University of Technology, Iran
2000 – 2002 M.Sc., Elementary Particle Physics, National University, Iran
2003 – 2006 Ph.D., Quantum Information Devices, Osaka University, Japan
Thesis Advisor: Professor Masahiro Kitagawa
Thesis title: Studies on Entanglement in Nuclear and Electron Spin Systems for Quantum Computing.

Academic Career

2006-2010/3 Postdoctoral Fellow Kinki University, Japan
2010/4-2010/10 Postdoctoral Fellow Osaka City University, Japan
2010-2015 Postdoctoral Fellow Institute for Quantum Computing, University of Waterloo, ON
2015-2017 Research visitor, University of Chicago
2017-2019 Medical Physics Resident, University of Miami
2019-2023 Medical Physicist, Inova Health System
2024-present Associate Professor, Department of Radiation Oncology, University of Maryland School of Medicine

Academic awards

2003-2005 Osaka University Scholarship and Tuition awards
2003 Women's Federation for World Peace International Scholarship awarded for Selected Speech in Japanese Language
2005-2006 Rotary Yoneyama Fellowship, Suita Club
2007 Travel Allowance, Institute for Quantum Computing
2013 Travel Allowance, C3QS Conference
2014 Outstanding Contribution in Reviewing Papers Award, Elsevier, the Netherlands
2015 Supportive Grant for attending Bruker BioSpin EPR training, Billerica
2024 Japan Society for Promotion of Science Bridge research fellowship for research on quantum computing in radiation oncology

NOTES

JAPAN SOCIETY FOR THE PROMOTION OF SCIENCE
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JSPS Washington Office

2001 L Street NW, Suite 1050
Washington D.C. 20036

(202)659-8190
was-science-in-japan@overseas.jsps.go.jp

www.jspsusa.org