Written Testimony of Dr. Charles Tahan
Assistant Director of Quantum Information Science and Director of the National Quantum Coordination Office
White House Office of Science and Technology Policy

For a hearing on
"Advancing American Leadership in Quantum Technology"

Before the
Committee on Science, Space, and Technology
U.S. House of Representatives

June 7, 2023

Introduction

Chairman Lucas, Ranking Member Lofgren, and esteemed Members of the Committee, I am honored to appear before you today to discuss the future of the National Quantum Initiative.

I wish to express my gratitude to this Committee and each of you individually for your relentless efforts to advance U.S. science and technology for the betterment of all Americans.

I currently hold the positions of Assistant Director of Quantum Information Science and Director of the National Quantum Coordination Office, both at the White House Office of Science and Technology Policy (OSTP). I am also a practicing quantum physicist, with over two decades of experience spanning academia, industry, and government. My mandate at OSTP includes coordinating and collaborating with agencies to devise and maintain the National Strategy for Quantum Information Science, a strategy that has been consistently improved over the last few years through supplemental reports and ongoing work within the National Science and Technology Council (NSTC). I am also privileged to co-chair the two NSTC Subcommittees responsible for overseeing the National Quantum Initiative—the Subcommittee on Quantum Information Science and the Subcommittee on the Economic and Security Implications of Quantum Science, as well as the National Quantum Initiative Advisory Committee, a Presidential advisory committee comprised of representatives from industry, academia, and the government.

The National Quantum Coordination Office

The National Quantum Coordination Office (NQCO) was established under the National Quantum Initiative Act. The value of the NQCO lies in our team of government experts in quantum physics and computer science detailed from the Department of Energy (DOE), the National Science Foundation (NSF), the National Institute of Standards and Technology (NIST), the Department of Defense (DOD), and the Intelligence Community (IC). As stipulated by the National Quantum Initiative Act, our duties extend to regular

interactions with industry, academia, National and Federal Labs, and the National Quantum Initiative Act-authorized quantum information science research and education centers, and the global quantum community including our foreign counterparts. Our extensive workforce development activities and public outreach initiatives, such as U.S. participation in World Quantum Day and launching with NSF the National Q-12 Education Partnership, underscore our commitment to the entire quantum community. In fact, the NQCO's model has been so successful that we have witnessed several countries copy it. One of the NQCO's most important roles is to facilitate interactions between the agencies who oversee, implement, support, and will ultimately benefit from the National Quantum Initiative. Members from more than twenty Federal organizations and agencies attend and actively participate in the working groups, meetings, workshops, and events that we help organize for the NSTC quantum subcommittees. More information can be found on Quantum.gov.

The Potential of Quantum Information Science

The impact of information technology on our society has been profound, and quantum information science represents a foundational shift in our understanding of information technology. Quantum information science applies the most surprising properties of quantum mechanics – the rules that describe how really small things behave – to how we process, store, and transfer information.

Quantum science has already made disruptive impacts via technologies like the Global Positioning System (GPS), based on atomic clocks, and Magnetic Resonance Imaging (MRI), based on quantum sensors. Next generation quantum sensors that incorporate new principles of quantum information science will create even more transformative systems for precision navigation and biomedical applications. Future quantum computers will enable new science, as well as drug and materials discovery. Quantum networks may one day connect these new types of computers and sensors, making them function as a larger system that is fundamentally more powerful than the individual quantum components. But to get to this future, numerous scientific and engineering challenges must still be overcome.

Large-scale quantum computers are also expected to solve the computationally-hard mathematics problems that underpin cryptographic algorithms, jeopardizing existing public key encryption which secure current web-based and other communications. This requires the U.S. to balance the economic and national security implications of quantum information science. *National Security Memorandum-10 on Quantum Computing*, signed by President Biden last year, addresses these concerns directly.

The U.S. National Quantum Strategy and National Quantum Initiative

Given this immense potential and the consequent risks, U.S. leadership in quantum information science is crucial. The national strategy has three broad goals: getting the science right, enhancing U.S. competitiveness, and empowering our people. Six policy pillars guide agency actions: take a science-first approach, grow the quantum

workforce, nurture the nascent quantum industry, invest in the right infrastructure, balance economic and national security, and grow international cooperation.

The first five years of the National Quantum Initiative has succeeded in strengthening the quantum ecosystem in the U.S. It has solidified our all-of-nation response, recruited new researchers and Federal departments and agencies to the field, and helped spur significant industry investment. Federal R&D funding for quantum information science, technology, and engineering has doubled since the National Quantum Initiative Act's passage. We now have thirteen new quantum information science research and education centers: five from NSF and five from DOE, authorized by the National Quantum Initiative Act, along with three from the DOD and the IC, authorized by the National Defense Authorization Act of 2020. The Quantum Economic Development Consortium, established under the National Quantum Initiative Act and launched by NIST, includes over 150 companies. In fact, our success can be seen by those who have emulated the United States, with many countries making substantial investments in quantum information science and launching national quantum initiatives of their own. The U.S. has signed ten bilateral quantum cooperation statements and held numerous multilateral engagements with countries who share our values for building a trusted global quantum ecosystem.

Alongside the activities of the National Quantum Initiative, the Administration is working to address the potential risks associated with quantum computing, with NIST working to standardize quantum resistant encryption algorithms, due to be finalized in 2024. Through the National Security Memorandum on Quantum Computing and the Quantum Computing Cybersecurity Preparedness Act, the country is moving toward quantum-resistant cryptography by 2035.

Strengthening the National Quantum Initiative

It is critical that the U.S. reaffirms and strengthens its commitment to quantum information science by reauthorizing the National Quantum Initiative Act. By doing so, the U.S. will signal to the world that it will continue to lead in this critical, yet emerging, field. U.S. involvement is more important now than ever as it is essential that we continue to work with trusted partners to get the development and protection of this technology right, which includes the rapid deployment of quantum-resistant cryptography. Because of this importance, OSTP coordinated an interagency process for recommending policies to enhance the National Quantum Initiative Act that the Committee may consider as it reauthorizes the law.

In many respects, our recommendations backstop the work Congress has already done with the National Quantum Initiative Act over the last four years, including updates in the CHIPS and Science Act, the recent National Defense Authorization Acts, and other legislation. Here are the most important points from our recommendations:

1. Reauthorize the NSF and DOE quantum information science research and education centers. Remove the limit on the number of centers authorized for

these agencies. Provide support to enable fundamental science research, applied research, demonstration, and commercialization.
2. Support NSF programs to expand and broaden participation in quantum information science, including potential new mid-career development programs and potential bridge programs focused on preparing post-baccalaureate students for graduate programs in quantum information science and engineering.
3. Strengthen the whole-of-government approach of the original National Quantum Initiative Act by expanding the authorized core agencies, which were initially NSF, DOE, and NIST. In particular, the need for a dedicated international fund to follow-up on U.S. commitments to international cooperation, led OSTP to recommend including the State Department in the National Quantum Initiative Act. The National Institutes of Health (NIH), the National Aeronautics and Space Administration (NASA), and the Department of Homeland Security (DHS) also have important roles to play, for example, in both terrestrial and space-based quantum sensing. We welcome further integration of the DOD and the IC research funding organizations and laboratories, which have played an important role in the development of quantum information science in this country since the beginning.
4. Begin translating discoveries in quantum information science to commercial utility and agency missions through lab-to-market engineering and systems integration programs and public-private partnerships. In particular, the NSF Directorate for Technology, Innovation and Partnerships (TIP) offers a new pathway to focus technology development and engineering for promising applications. Other opportunities include those previously authorized in the CHIPS and Science Act such as the DOE Quantum Network Infrastructure Research Program and the Quantum User Expansion for Science and Technology program (QUEST). A NIST Center for Quantum Engineering Research could conduct engineering research to accelerate scientific breakthroughs and accelerate quantum technology transfer.
5. Prioritize funding to upgrade the aging infrastructure of laboratory facilities and create and equip new laboratories with the tooling necessary to engage in cutting edge quantum information science research. High-quality research capital is essential for the United States to remain competitive with world-wide investments and to recruit and retain the best talent.

These recommendations are in alignment with and complementary to those of the National Quantum Initiative Advisory Committee, whose first report on recommendations to enhance the National Quantum Initiative is now available and included in my written testimony.

Conclusion

I will end by reinforcing the importance of people to our success. Training and recruiting talent both here and across the world are the most important actions we can take to strengthen U.S. leadership in this promising new field.

Thank you again for this opportunity to appear before you today. I welcome your thoughts and questions.

Links to Additional Information on Quantum.gov

National Quantum Initiative Advisory Committee

- Report: Renewing the National Quantum Initiative: Recommendations for Sustaining American Leadership in Quantum Information Science, June 2023

National Strategy for Quantum Information Science

- National Security Memorandum 10 on Promoting United States Leadership in Quantum Computing While Mitigating Risks to Vulnerable Cryptographic Systems, May 2022
- Bringing Quantum Sensors to Fruition, March 2022
- Quantum Information Science and Technology Workforce Development National Strategic Plan, February 2022
- The Role of International Talent in Quantum Information Science, October 2021
- A Coordinated Approach to Quantum Networking Research, January 2021
- Quantum Frontiers Report, October 2020
- A Strategic Vision for America's Quantum Networks, February 2020
- National Strategic Overview for Quantum Information Science, September 2018

National Quantum Initiative Annual Reports

- National Quantum Initiative Supplement to the President's FY 2023 Budget
- National Quantum Initiative Supplement to the President's FY 2022 Budget
- National Quantum Initiative Supplement to the President's FY 2021 Budget

International Statements

- International quantum cooperation statements with Australia, Denmark, Finland, France, Japan, the Netherlands, Sweden, Switzerland, South Korea, and the United Kingdom
- Pursuing Quantum Information Together: 2^N vs 2N multilateral roundtable series

Entanglement Exchange clearinghouse for quantum exchange opportunities with Australia, Canada, Denmark, Finland, France, Germany, Japan, the Netherlands, Sweden, Switzerland, South Korea, the United Kingdom, and the United States