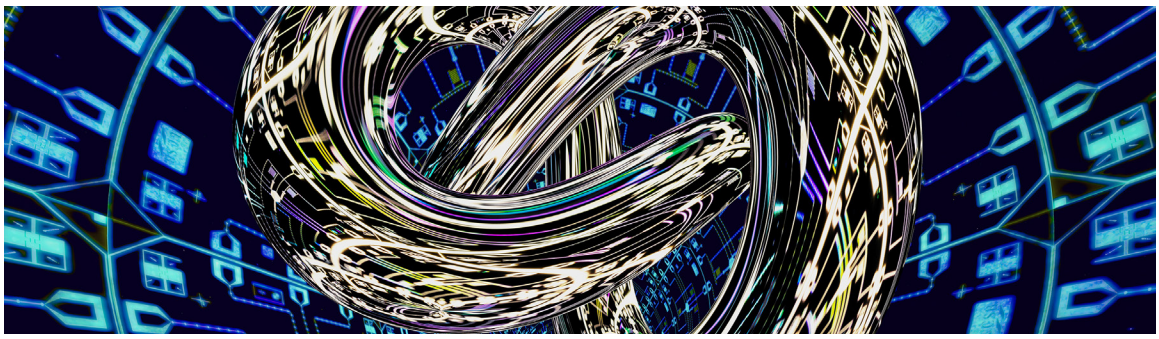
AMERICAN LEADERSHIP IN QUANTUM



GPS systems, MRI technology, and lasers that enable today's internet are a few examples of quantum-based technologies that have already transformed society and the American economy. The future of quantum information science promises to be even more impactful, enabling a new era in sensing, computing, modeling, and communication that is more secure, accurate, and efficient than ever before. As a leading federal funder of quantum research, the U.S. National Science Foundation is at the forefront of quantum discovery, exploring the fundamental research questions that have enabled the quantum innovations of today and will drive the quantum revolution of tomorrow.

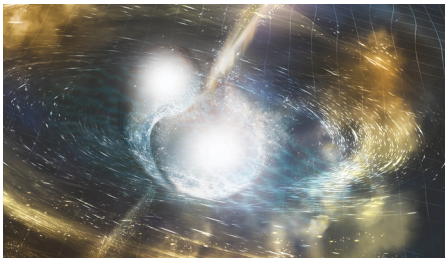
GLOBAL R&D IN QUANTUM

Nations worldwide are accelerating quantum research, as new quantum-based methods for computing, communicating, and encrypting data could have global, economic and security implications.

NSF's portfolio is closely aligned with the Administration's **National Strategic Overview for Quantum Information Science** and the **National Quantum Initiative Act**, which provide a coordinated federal approach for securing America's world-leading position in quantum research.

NSF AND THE HISTORY OF QUANTUM RESEARCH

NSF has been supporting research in quantum information science since the field's inception in the early 1980s, building on earlier quantum investments that helped make QIS possible. Early NSF studies in quantum mechanics and information theory laid the groundwork for several concepts and tools that are being explored today.



For example, a 1979 NSF grant to Kip Thorne employed a new approach to quantum measurement that is being implemented at the Advanced Laser Interferometer Gravitational-Wave Observatory, also known as Advanced LIGO. This approach, developed by his student Carleton Caves, is expanding LIGO's already revolutionary ability to detect gravitational waves and changing our understanding of the universe.

NSF'S QUANTUM RESEARCH AGENDA

NSF targets key fundamental research challenges that must be overcome to advance America's quantum capabilities.

FAST FACTS

1982
Approximate year NSF began supporting research in the newly developed field of quantum information science.

31
Number of NSF-supported Nobel Laureates honored for quantum studies.

2017
Year NSF designated Quantum Leap as one of its 10 Big Ideas, investing $180M for convergent research.

2018
Year the National Quantum Initiative Act was signed into law.

2023
Year NSF-funded projects expect to deliver a practical quantum computer.

$75M
NSF investment to establish three Quantum Leap Challenge Institutes.

22
Number of industry partners supporting NSF's first three Quantum Leap Challenge Institutes.

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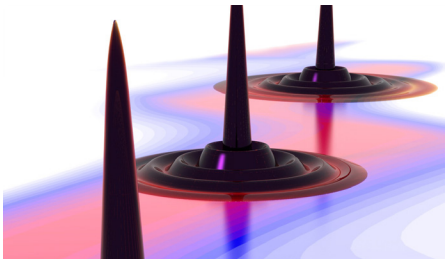

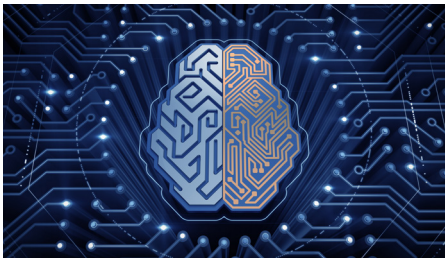

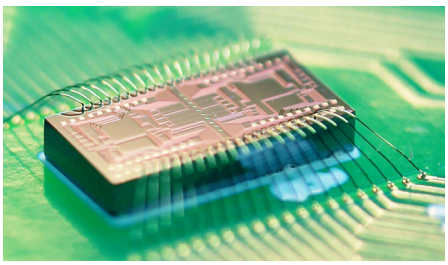

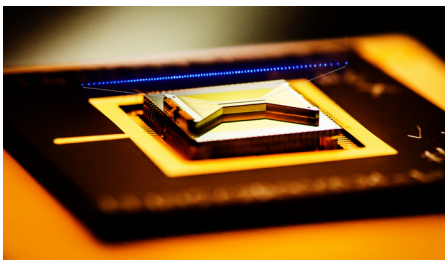

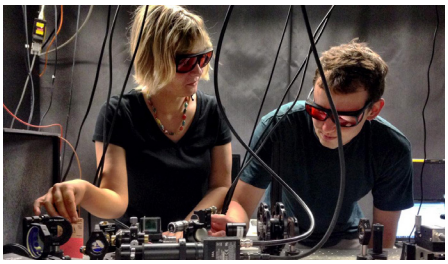

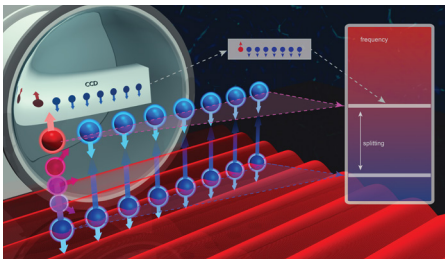

MULTIDISCIPLINARY COLLABORATION

NSF is uniquely positioned to build bridges across all quantum-related disciplines and to nurture partnerships with academia, industry, and international allies – all of which are vital to advancing quantum discoveries.

NSF Quantum Leap Challenge Institutes provide large-scale interdisciplinary research centers designed to leverage expertise from various disciplines, research institutions, and industry to address research and workforce development challenges across all areas of quantum information science.

NSF Quantum Idea Incubator for Transformational Advances in Quantum Systems enables bold and collaborative research approaches by supporting small interdisciplinary teams that come together to imagine original ideas in quantum science, computing, and engineering.

NSF Convergent Accelerated Discovery Foundries for Quantum Materials Science, Engineering, and Information accelerate the translation of fundamental materials engineering and information research for quantum applications.

NSF partners in quantum research with private and public organizations from Amazon to Department of Energy and from Microsoft and IBM to National Institutes of Standards and Technology.

CREATING NEXT-GENERATION TECHNOLOGIES

NSF is accelerating the development of advanced quantum-based applications, including new materials and circuits, more precise sensors and detectors, and new algorithms that fuel powerful computers and more secure communications.

Seeking Secure Quantum Communications
To advance the technology necessary for practical quantum communication, NSF is supporting Advancing Communication Quantum Information Research in Engineering to engineer systems that use entangled photons in pre-determined quantum states as a way to encrypt data.

Building a More Advanced Quantum Computer
To accelerate the development of a practical quantum computer that will one day answer currently unsolvable research questions, NSF is investing in the multi-institution Software-Tailored Architecture for Quantum co-design project. By bringing together experts who have outlined a path to a practical quantum computer and supporting its development, NSF is working to take the quantum revolution from theory to reality.

NURTURING QUANTUM INNOVATORS

NSF is working to empower a diverse, quantum-literate workforce that will drive and implement quantum innovations well into the future.

NSF Building "Triplets" to Bridge Academia and Industry initiative links the talents and resources of academia and industry, by creating three-person teams of university faculty, industrial researchers, and graduate students who will work together on quantum challenges.

NSF Quantum Computing & Information Science Faculty Fellows program supports the hiring of academic faculty specializing in quantum computing and/or communication to departments of computer and information science and engineering at U.S. institutions of higher education.

DID YOU KNOW?

Five of the researchers behind Google's groundbreaking quantum computer were supported by NSF early in their careers.

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