



TUFTS UPDATE – NOVEMBER 9, 2018
PREPARED BY LEWIS-BURKE ASSOCIATES LLC

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Introduction

This edition of the Tufts Washington Update includes early November funding opportunities and agency updates. Faculty, staff, and researchers are welcome to schedule calls with the Lewis-Burke Tufts team or meet with the team when they visit Washington, DC. Contact Amber Cassady, Lewis-Burke Associates LLC, at amber@lewis-burke.com with any questions or comments related to the Update's content or for more information on updates and opportunities.

Funding Opportunities

National Science Foundation Releases Materials Research Science and Engineering Centers

The National Science Foundation (NSF) released the solicitation for the 2019 Materials Research Science and Engineering Centers (MRSEC) competition. The MRSEC program supports interdisciplinary and multidisciplinary large scale, complex materials research and education at campus based centers, and contributes to a national network of materials research facilities. MRSECs compliment the NSF materials portfolio of traditional individual research projects, small group projects, national user facilities, and instrumentation in materials research.

MRSECs are made up of Interdisciplinary Research Groups (IRGs). Each IRG focuses on a major topic or research area and is composed of several researchers with complementary skills and expertise. Each MRSEC may include between two and three IRGs, which can be thematically related or address different topics related to materials science. Proposals should address “fundamental, timely and complex materials problems that are intellectually challenging and important to society.” NSF staff will ensure a balance of research topics and center size across the MRSECs proposals, in addition to evaluating the proposals using the standard merit review criteria.

Unlike the previous MRSEC solicitation, this solicitation names specific potential areas of interest for the MRSEC program, although proposals are not limited to these areas. NSF seeks proposals that align with the Division of Materials Research (DMR) participation in the NSF 10 Big Ideas. DMR is active in the following Big Ideas:

- Harnessing the Data Revolution
- The Future of Work at the Human-Technology Frontier
- Understanding the Rules of Life
- The Quantum Leap

The solicitation also calls out several other areas of interest that are not represented in the current MRSEC portfolio:

- Machine Learning for Materials Science Complex Problems, especially related to Ceramics, Metals, and Metallic Alloys
- Synthetic Materials Biology
- Recyclable Plastics and Alternative Materials for Sustainable Development

Within the MRSEC award, NSF will provide seed funding to enable the center to respond quickly and effectively to new and emerging opportunities. Seed funding is also intended to support partnerships with industry and national laboratories and support high risk / high impact transformative research.

Centers are expected to work in collaboration with other academic organizations, agencies, industry, national and government laboratories, and international partners where appropriate. NSF expects all MRSECs to engage fully in a national network of university materials research centers. Each center must integrate research and education, including Research Experiences for Undergraduates (REU), and

develop outreach activities. MRSECs should foster increased participation of members of underrepresented groups at all levels.

MRSECs will offer shared experimental and computational facilities that are accessible to the broader research community, and will contribute to a national network of materials research facilities to support research infrastructure in the U.S. Proposals should address how they will contribute to existing cyber infrastructure and computational facilities.

Letters of Intent: Not required.

Due Dates: Preliminary proposals are due June 24, 2019 and, if invited to submit, full proposals are due November 26, 2019.

Total Funding and Award Size: NSF anticipates that there will be \$31.5 million to support 8-10 MRSEC awards. Each award will be between \$2.6-4 million per year for an initial duration of up to six years.

Eligibility and Limitations: Academic institutions in the U.S. with existing programs in materials research and education may submit proposals. There is no limit on the number of PIs per proposal. An institution may only submit one MRSEC preliminary proposal as the lead. When an organization proposes research covering multiple research areas, a single MRSEC proposal should be submitted containing multiple IRGs (a minimum of two and a maximum of three). Institutions awarded MRSECs as the lead in the FY 2017 competition are not eligible to be the lead in this competition.

Sources and Additional Information:

- The complete solicitation can be found at https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5295.
- Information on NSF's 10 Big Ideas is available at https://www.nsf.gov/news/special_reports/big_ideas/.
- Information about centers, current research areas, and the national networks supported by MRSECs can be found at <http://www.mrsec.org/>.
- More information about this Materials Research Facility Network can be found at www.mrfn.org.

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National Science Foundation Releases Materials Innovation Platforms Solicitation

The National Science Foundation (NSF) released the second Materials Innovation Platforms (MIP) solicitation. MIP is a mid-scale research infrastructure program that seeks to support novel infrastructure and tools for cutting-edge materials research. MIPs are intended to support a community of researchers and build a scientific ecosystem that is accessible to universities, national laboratories, and industry.

The 2019 MIP competition is focused “on the convergence of materials research with biological sciences for developing new materials.” To achieve breakthroughs, MIP is aligned with the Materials Genome Initiative’s approach to materials breakthroughs which includes “materials synthesis/processing, materials characterization, and theory/modeling/simulation applied to targeted outcomes.” NSF seeks proposals that are collaborative and understand the iterative process of discovery.

The MIP solicitation is in line with many of NSF’s 10 Big Ideas, including Growing Convergence Research, Harnessing the Data Revolution, and Mid-Scale Research Infrastructure. Proposals may also support progress on any of the other Big Ideas. Activities of a MIP include:

- Develop new experimental and computational tools and advance current tools
- Conduct research focused on a grand challenge of basic science and meet a national need
- Operate a user facility that provides unique materials research tools, samples, data, and technical services
- Educate the next generation of tool developers and users

The MIP program is intended to support acquisition and development of novel, cutting edge infrastructure and instruments. The MIP program will not support construction or renovation of buildings or research facilities; purchase of supporting equipment, like fume hoods; sustaining infrastructure, like power or water supply; or general purpose platforms.

Letters of Intent: Not required.

Due Dates: There are no preliminary proposals, full proposals are due **February 4, 2019**.

Total Funding and Award Size: NSF expects to award one to three MIPs, with awards totaling \$15 million to \$25 million over five years. NSF expects \$12 million to be made available for this solicitation in fiscal year (FY) 2019.

Eligibility and Limitations: Institutions of higher education are eligible to apply. There are no restrictions on who can serve as the principal investigator, but institutions can only submit one proposal where they are the lead. If an organization was awarded a MIP as the lead in the 2015 competition, they are not eligible to submit a proposal as a lead in this competition.

Sources and Additional Information:

- The complete solicitation is available at <https://www.nsf.gov/pubs/2019/nsf19526/nsf19526.pdf>.
- Additional information on the MIP program can be found at https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505133.
- Additional information on NSF’s 10 Big Ideas can be found at https://www.nsf.gov/news/special_reports/big_ideas/.
- Additional information on the Materials Genome Initiative can be found at <https://obamawhitehouse.archives.gov/mgi>.

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National Science Foundation Releases Harnessing the Data Revolution Data Science Corps Capacity Building Solicitation

The National Science Foundation (NSF) recently released a solicitation for its new *Data Science Corps* program. This program is part of the Harnessing the Data Revolution (HDR) Big Idea, and this particular solicitation is for “Building Capacity at HDR” with funding to support the engagement of undergraduates in data science research. *Data Science Corps* looks to bolster the national data science workforce and fill gaps where utilization of data science is lacking but could be transformative “for the benefit of society, industry, government, and science.”

The HDR Big Idea is a cross-NSF, multi-year priority area to advance the field of data science in multidisciplinary ways, including increasing fundamental knowledge, developing algorithms and frameworks, using this field to propel science and engineering, and supporting education and workforce efforts. *Data Science Corps* is one of several expected HDR solicitations, with future opportunities likely to address research and infrastructure needs. NSF has previously released other solicitations through HDR, such as the Transdisciplinary Research in Principles of Data Science (TRIPODS) and TRIPODS+X programs that address foundational data science topics and link data science with other disciplines. NSF has also made big data investments such as the Big Data Regional Innovation Hubs and Spokes.

Data Science Corps award funds are to be used to support student stipends and enable the addition of data science projects into undergraduate classrooms. NSF encourages applicants to utilize the *Data Science Corps* by adding a data science track to established programs such as internships, traineeships, and study abroad.

The program looks to build capacity to leverage the data revolution to help society and further science by having undergraduate students collaborate with communities and organizations to help solve problems using data science tools. Students will be integrated into “real-world data science implementation projects” aiding communities or organizations at the local, state, national, or international level. Program activities can include working with the community of interest in a hands-on manner to provide training in relevant data science best practices. A December 2017 *Data Science Corps* conference addressed additional challenges relating to connecting data scientists with community needs.

Applicants are also directed by NSF to include a diverse set of participating higher education institutions such as universities, two-year and four-year colleges, and minority-serving institutions (MSIs). The agency strongly encourages applicants to include MSIs and emphasize underserved communities and organizations. NSF plans to make awards that represent diverse geographical areas. Additionally, NSF envisions that all of the *Data Science Corps* awards will ultimately be coordinated by a “central entity,” and recipients of the building capacity awards should plan to engage and coordinate with each other as a first step.

Proposals should include both a “coordination” organization and one or more “implementation” organizations. A single institution can be responsible for both, but proposals must include more than one institution. The coordinator will also help with monitoring and evaluation, including a longitudinal study. Additional responsibilities of the coordinator include providing faculty professional development,

organizing and sharing information with the *Data Science Corps* participants, creating an advisory group, and assembling information on best practices. Implementation organizations will each adopt *Data Science Corps* into undergraduate courses. A *Data Science Corps* project can be incorporated into various courses at one institution, or as courses at multiple institutions. While proposals must be submitted to the Division of Information and Intelligent Systems (IIS) in the Directorate for Computer and Information Science and Engineering (CISE), proposals will be handled by a cross-disciplinary group of program directors from various NSF directorates.

Eligibility: Both two-year and four-year institutions of higher education may apply. Non-profits engaged in educational or research efforts may also apply. There is a limit of one proposal per institution and one proposal per principal investigator (PI). Additional information is available in the solicitation regarding involvement of international branches of U.S.-based institutions of higher education.

Due Date: Full proposals are due between **January 28, 2019 – February 04, 2019**. Letters of intent and preliminary proposals are not required.

Total Funding and Award Size: NSF anticipates eight to 12 awards totaling up to \$10 million. Individual awards are expected to range between \$1 million and \$1.2 million over three years.

Sources and Additional Information:

- The full solicitation is available at <https://www.nsf.gov/pubs/2019/nsf19518/nsf19518.htm>.
- Information on a Data Science Corps Conference held December 2017 is available at <https://mccourt.georgetown.edu/DataScienceCorp>.
- The report from the Data Science Corps Conference can be found at <https://georgetown.app.box.com/s/22z8z42xdhe27jhx6xz7f9pycx7l4put>.

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Army Research Laboratory Releases Funding Opportunity Announcement for Collaborative Alliance on Strengthening Teamwork for Robust Operations in Novel Groups

The Army Research Laboratory (ARL) released a funding opportunity announcement (FOA) for the Strengthening Teamwork for Robust Operations in Novel Groups (STRONG) program. STRONG seeks to develop the foundational sciences for the Army that will enable teaming between future warfighters and intelligent agents, “and specifically, on influencing individuals team members, human or agent, to enhance positive team properties and performance.” The program is structured around eight annual program cycles from fiscal year (FY) 2019 to 2026. Each year, the new topics will build on the progress from the previous year and broader scientific and technological advancement.

Unlike ARL’s previous Collaborative Research Alliances and Technology Alliances (CRA/CTAs), ARL will execute STRONG using a different program management model. STRONG will fund 10 to 15 awardees annually, through one-year cooperative agreements (CAs), known as “seedling projects.” Recipients of the seedling projects are required to participate in a 4- to 8-week Summer Innovation Summit at one of the Centers for Agent-Soldier Teaming (CAST), which are located at the Aberdeen Proving Ground in

Aberdeen, MD and ARL Northeast in Burlington, MA. At the Summer Innovation Summits, awardees will present evidence of scientific breakthroughs from the seedling projects and collaborate with other seedling project recipients, promoting the co-development of follow on proposals and creating a critical mass of partnerships between scientists and engineers.

At the conclusion of year one, seedling awardees are eligible for a three-year extension. ARL envisions the project extension as an opportunity to promote collaboration between ARL and other seedling project recipients, which is stated as a key metric for the program's success. The annual program cycles coupled with seedling collaborations are intended to provide the Army with flexibility to make program adjustments as scientific breakthroughs are achieved.

The Cycle 1 topic for FY 2019, Theory Development and Team-Level Process, will focus on fundamental research for developing "theories of team-level processes for heterogeneous human-agent teams." Specifically, research under this topic should address "innovative solutions to advance the development and validation of theoretical principles related to identifying, measuring, understanding, and predicting the team-level states and processes that are critical for effective group-level performance in heterogeneous human-agent teams."

More details on the Cycle 1 topic are available in the full FOA. It should be noted that STRONG could build upon previous advances from ARL's Cognition and Neuroergonomics CTA program. ARL plans to host a webinar to discuss the opportunity on **November 15, 2018 1:00 PM ET**. Lewis-Burke Associates LLC will monitor this webinar and provide additional information to interested applicants.

Due Dates: For the FY 2019 cycle, full proposals should be submitted no later than **December 21, 2018 at 3:00 PM ET**.

Total Funding and Award Size: ARL anticipates awarding 10-15 seedling projects each cycle, ranging from \$50,000 to \$100,000 for the initial phase. Projects selected for extensions will be larger in scope and are anticipated to receive between \$350,000 and \$500,000 per year for up to three years. These estimates are subject to funding in the budget and appropriations process.

Eligibility and Limitations: ARL is accepting proposals from institutions of higher education, nonprofit organizations, and industry. Federally Funded Research and Development Centers (FFRDCs) are eligible to apply. ARL envisions that awardees will have participation from both junior investigators (students, research fellows, and early-career faculty who are less than five years from receiving their PhD or an equivalent degree) and senior investigators.

Sources and Additional Information:

- The full solicitation can be found at www.grants.gov under solicitation number "W911NF-19-S-0001."
- More information on STRONG can be found at <https://www.arl.army.mil/www/default.cfm?page=3501>.
- More information on the Cognition and Neuroergonomics CTA can be found at <https://www.arl.army.mil/www/default.cfm?page=393>.

- Registration information can be found on the STRONG webpage <https://www.arl.army.mil/www/default.cfm?page=3501>.

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Advanced Research Projects Agency – Energy Announces Grid Optimization Competition

On October 31, Secretary of Energy Rick Perry announced phase one of the new Grid Optimization (GO) Competition, a \$4 million initiative through the Advanced Research Projects Agency – Energy (ARPA-E) to create a more resilient electrical grid through the development of innovative software management solutions. This is only the second time ARPA-E has sponsored a prize competition—the last time being in 2015 for the LightWeighting Technologies Enabling Comprehensive Automotive Redesign (LITECAR) Challenge.

The competition will take place in several stages and address an array of resilience and efficiency issues including but not limited to the utilization of both conventional and emerging technologies; restoration and response following extreme events; and the efficient management of distributed energy resources (DER). To avoid disrupting current grid operations and protecting proprietary and security information of current grid operators and utilities, ARPA-E created a virtual grid and the first set of prizes is intended to help teams develop algorithms and software packages that optimize and improve the virtual grid based on current conditions. Specifically, in the first phase of the challenge, competitors will develop algorithms to address the grid’s security-constrained optimal power flow (SCOPF) issues, identifying the most cost-effective and reliable methods for routing power to customers across the grid.

The need stems from a grid structure built around centralized power plants that are incapable of keeping pace with the rapid development of distributed, alternative energy sources like wind and solar power, leading to inefficient grid management and higher energy costs. In addition, strengthening the resilience of the grid will require further development of these alternative power sources, a degree of innovation that the current centralized structure is ill-equipped to handle. Additional phases of the GO Competition are expected in early 2019 and could address a range of topics including but not limited to intermittent resilience, energy storage, grid resilience, and cyber threats. ARPA-E is considering specific scenarios to test the resiliency of the grid involving extreme weather events and an all-solar grid.

Award Information: ARPA-E anticipates making \$4 million available for an unspecified number of prizes.

Sources and Additional Information:

- Additional information about the GO Competition can be found at <https://arpa-e.energy.gov/?q=arpa-e-programs/go-competition>.
- A press release announcing stage one of the competition can be found at <https://arpa-e.energy.gov/?q=news-item/department-energy-announces-first-ever-grid-software-competition>.

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Agency Updates

Department of Energy Investments in Quantum Computing and Quantum Information Science

The following report highlights current and future investments by the Department of Energy (DOE) Office of Science in quantum computing and quantum information science.

Background

DOE is becoming the largest federal funder of quantum computing and quantum information science (QIS). DOE, through the Office of Science, plans to leverage its unique strengths, such as the DOE national laboratories and world-class user facilities, and serving as the largest federal government sponsor of the physical sciences, to advance QIS. In particular DOE plans to provide the basic scientific and technological foundations for myriad quantum applications, including computing, simulation, sensing and metrology, and communications. Below is a graphic that captures some of the fundamental science at the DOE Office of Science that will help advance QIS in the major program offices, including Advanced Scientific Computing Research (ASCR), Basic Energy Sciences (BES), High Energy Physics (HEP) and Nuclear Physics (NP).



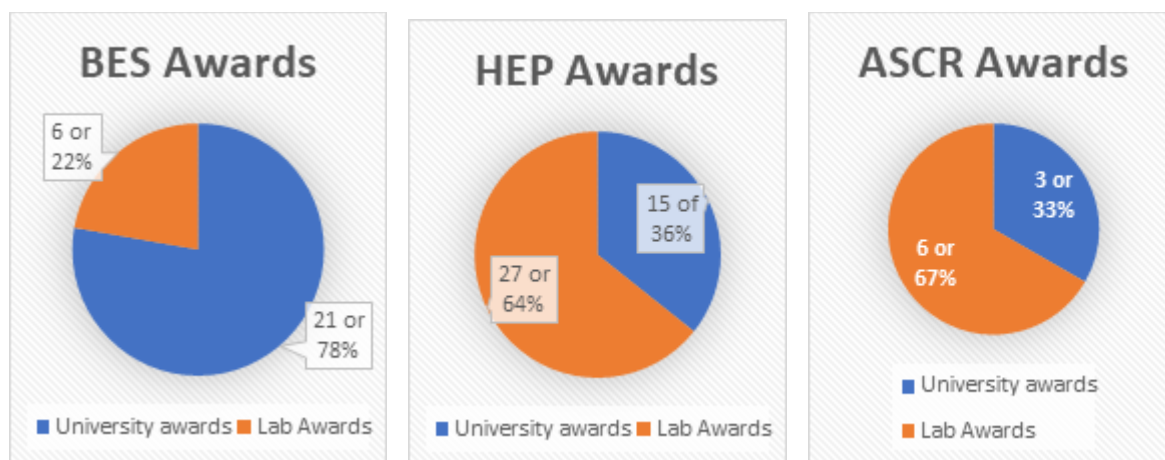
Source: DOE Office of Science.

In addition, some of the grand challenges for the Office of Science that quantum computing can help address include discovery of materials and chemical processes and nuclear matter equation of state, simulations of quantum field theory and quantum dynamics, machine learning for large data sets and inverse molecular design, and optimization for prediction of biological systems such as protein folding.

Current QIS Awards

The DOE Office of Science’s first large-scale investment in QIS was in fiscal year (FY) 2018 and totals approximately \$105 million, which includes:

- \$15 million to support the six quantum materials-focused Energy Frontier Research Centers,
- \$10 million to support quantum efforts at the five DOE Nanoscale Science Research Centers,
- \$7 million in initial investments by the Nuclear Physics program through its annual solicitation, and
- \$73 million in awards announced in September 2018 made under three quantum-specific funding opportunity announcements from three major offices—ASCR, BES, and HEP. The awards, totaling \$218 million over three years, are led by scientists from 28 institutions of higher education and nine DOE national laboratories. Additional information on the distribution of awards between universities and national laboratories for each of these programs is available below.



Future Funding Opportunities

FY 2019 funding opportunities will continue to target single PI and small group awards to build a broad foundation of innovative quantum research. In addition, DOE plans to make significant investments in QIS through its Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs. For FY 2020, DOE Office of Science will focus on Energy Frontier Research Center competitions, including for QIS research areas and large-scale DOE quantum centers.

Fiscal Year 2019

The Office of Science plans to release additional targeted QIS funding opportunities in FY 2019 between November 2018 and January 2019. The table below shows funding levels for QIS across the Office of Science for FY 2017 – FY 2019. For FY 2019, the Office of Science has at least an additional \$32 million available for single PI and small group awards above FY 2018 levels.

Office of Science QIS Funding			
(\$ in millions)			
	FY 2017 Enacted	FY 2018 Enacted	FY 2019 Appropriated
ASCR	\$5.8	\$21	\$33.5
BES	-	\$23	\$31.6
BER	-	-	\$4.5
HEP	-	\$29	\$27.5
NP	-	-	\$8.3
Total	\$5.8	\$73	\$105.4

Each program office has specific priorities:

Basic Energy Sciences (BES)

BES will continue to invest in **quantum materials and quantum chemistry**. The success rate for the first round of awards in FY 2018 was below 20 percent and BES plans to further expand its portfolio. Funding opportunities in FY 2019 will have a greater emphasis on quantum chemistry since a larger share of awards in FY 2018 were in quantum materials. Quantum computing awards emphasizing quantum chemistry and correlated electron systems are seen as the most likely early applications for quantum computing.

These future investments in quantum chemistry applications are divided into two categories:

- Opportunities for chemical sciences to advance QIS which involves designing and creating tunable qubits; developing probes such as nonlinear, ultrafast x-ray spectroscopies of quantum phenomena; and contributing to the understanding of fundamental principles of quantum phenomena for quantum control; and
- Opportunities to exploit QIS for chemical sciences which involves quantum sensing of chemical processes (e.g., coherence in photosynthesis) and quantum computing.

BES will also continue to invest in quantum systems awards that cover a broad range of material and molecular systems based on both proven concepts (e.g., cold atoms, trapped ions) and more high-risk, speculative approaches (e.g., 1-D and 2-D topological states, molecular systems). In addition, BES will support its five Nanoscale Science Research Centers, which are seen as a critical capability in qubit research and self-assembly, synthesis, and the development of nanophotonics for quantum applications.

More detailed information on BES research priorities can be found in its quantum workshop reports:

- BES Roundtable on Opportunities for Quantum Computing in Chemical and Materials Sciences, https://science.energy.gov/~media/bes/pdf/reports/2018/Quantum_computing.pdf and
- BES Roundtable on Opportunities for Basic Research for Next-Generation Quantum Systems, https://science.energy.gov/~media/bes/pdf/reports/2018/Quantum_systems.pdf.

High Energy Physics (HEP)

HEP's top priorities are **quantum sensors** to advance the strategic priorities of the Particle Physics Project Prioritization Panel (P5) plan, such as new tools to explore dark energy, dark matter, properties of neutrinos, and **field theory**. The major priorities include:

- Quantum sensors,
- Foundational gauge theory using entanglement,
- Quantum computing on annealers,
- Quantum algorithms for particle physics,
- Quantum information and emerging space time, and
- Quantum simulations on entangled qubits.

QIS and associated technologies are viewed as powerful new windows to accomplish the HEP mission in addition to the P5 priorities. For example, foundational concepts and mathematical formulations can be used to explore black hole physics but understanding how black holes scramble information can lead to new ways to study how qubits stabilize in the laboratory. As another example, quantum error correction codes can improve techniques to understand the cosmos and the emergence of space time.

More detailed information on HEP research priorities can be found in its quantum workshop reports:

- Grand Challenges, Opportunities, and Gaps in Research at the intersections of Quantum Information Science, Particle Physics, and Computing, https://science.energy.gov/~media/hep/pdf/files/Banner%20PDFs/QIS_Study_Group_Report.pdf.
- Roundtable on Common Problems in Condensed Matter and High Energy Physics, https://science.energy.gov/~media/hep/pdf/Reports/HEP-BES_Roundtable_Report.pdf.
- Roundtable on Quantum Sensors at the Intersections of Fundamental Science, Quantum Information Science, and Computing, https://science.energy.gov/~media/hep/pdf/Reports/DOE_Quantum_Sensors_Report.pdf.

Advanced Scientific Computing Research (ASCR)

ASCR's top priority is to build out the two **quantum computing testbeds** to make them available as user facilities to test quantum algorithms and specific applications. The two testbeds are located at Sandia National Laboratory using trapped ions and Lawrence Berkeley National Laboratory using superconducting qubits. The goal is to build out a 5-qubit system in the next year and open it up to quantum algorithm teams to start testing the system. The eventual goal is to open the system to the larger research community to submit proposals for use through a peer-reviewed process. The systems will eventually be built out to 64 qubit systems, but the system and controls are all open access and there is no proprietary information related to these systems.

ASCR plans to issue three funding calls related to QIS in FY 2019:

- **A quantum Co-Design Center:** This center would start to integrate quantum computer systems design processes with algorithm and software design considerations to make sure that future quantum architectures are well-suited for DOE target applications and major DOE scientific problems.
- **A quantum Scientific Discovery Through Advanced Computing (SciDAC) Institute:** This institute would form partnerships primarily between applied mathematicians and computer scientists and scientists engaged in quantum materials and chemistry to find computational solutions to advance QIS.
- **Quantum networking:** This call would focus on hardware and other technology solutions to advance quantum networking.

More detailed information on ASCR's research priorities can be found in its quantum workshop report, "Quantum Computing Testbed for Science" available at <https://science.energy.gov/~media/ascr/pdf/programdocuments/docs/2017/QTSWReport.pdf>.

Nuclear Physics (NP)

In FY 2019, NP plans to issue a more targeted funding opportunity announcement similar to the other Office of Science programs in FY 2018. The focus will be on how QIS can help advance issues unique to NP, such as quantum chromodynamics, and specific fields of study that can help advance QIS, such as investigating natural radioactivity in superconducting qubits to help with calibration. More detailed information on NP's research priorities can be found in its quantum workshop report, "Quantum Computing for Theoretical Nuclear Physics" available at http://www.int.washington.edu/PROGRAMS/17-66W/QuantumComputing_NUCLEARPHYSICS_FINAL_pdf.pdf.

Fusion Energy Science (FES)

FES also plans to make some targeted investments in QIS in FY 2019 and its priorities are described in its most recent report, "Fusion Energy Sciences Roundtable on Quantum Information Science," available at https://science.energy.gov/~media/fes/pdf/workshop-reports/FES-QIS_report_final-2018-Sept14.pdf.

Biological and Environment Research (BER)

BER has the least developed quantum program and plans to pull together workshops in the next few months that help identify the benefits of QIS for biological systems.

Fiscal Year 2020

For FY 2020, in addition to continued investments in single PI and small group awards, DOE plans two large competitions:

- **Energy Frontier Research Centers (EFRC):** While the EFRC competition will involve several different research priority areas, such as energy storage and the energy-water nexus, one of the

priority research topics will be QIS. The current quantum related centers are mostly focused on quantum materials and BES would like to explore other QIS research topics.

- **DOE Quantum Centers:** In September 2018, the House unanimously passed the National Quantum Initiative Act (H.R. 6227), which includes authorization for up to five large-scale DOE quantum centers. The Senate is currently working on similar legislation and plans to pass it before the end of the year. Consistent with the legislation, DOE plans to fund three to five centers each in the \$15 million to \$25 million scale a year over five-years with a possibility of renewal for another five-year term. The centers would be focused on grand challenge questions that would advance the basic understanding of quantum science and help advance applications like quantum computing, sensing, and communications, but not tied to any specific technology. The centers must be multi-disciplinary, bringing together disparate fields (e.g., physics, materials research, computer science, electrical engineering). The centers must also be multi-institutional bringing together universities, national labs, and private industry. Most of these centers will likely be led by national labs, but there are opportunities for university leads.

Sources and Additional Information:

- ASCR awards can be found at https://science.energy.gov/~media/ascr/pdf/funding/2018/ASCR_Quantum_Information_Science_Awards_FY-2018.pdf.
- BES awards can be found at https://science.energy.gov/~media/bes/pdf/Funding/BES_QIS_Research_Awards_FY-2018.pdf.
- The BES Quantum Nanoscale Science Research Center awards can be found at https://science.energy.gov/~media/bes/pdf/Funding/BES_QIS_NSRC_Awards_FY-2018.pdf.
- HEP awards can be found at <https://science.energy.gov/~media/78921BDAD1894BBF9A686A2125C3B3C0.ashx>.

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