



Department of Energy
Office of Science
Washington, DC 20585

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Dear Colleague Letter on Accelerating Development of and Research Impacts from Quantum Information Science (QIS)

Dear Colleagues:

Quantum science and instrumentation for next-generation computing, information, and other fields—the core of "quantum information science" (QIS)—constitutes a rapidly-developing interdisciplinary field, with substantial intersections with the missions, interests, capabilities, and portfolios of the program offices within the Department of Energy's (DOE's) Office of Science (SC), and significant implications for the Nation as a whole. Novel approaches to fundamental science and to applications such as sensing, communications, simulation, and computing are enabled by understanding and manipulation of the uniquely quantum phenomena of superposition, entanglement, and squeezing. The Office of Science has interests, expertise, and capabilities in a wide range of QIS-related topics, including frontier computing, machine learning, optimization, quantum materials, isotopes, cryogenics, imaging, and field theory. In addition, DOE resources relevant to QIS include numerous user facilities, unique and specialized equipment and infrastructure, and various avenues for interaction and collaboration with academic, industrial, and other external communities. These applications and resources span the National Laboratory system and multiple program offices.

In light of significant progress in QIS over the past several years, SC components have held a variety of workshops to define the scientific needs and opportunities.¹ QIS has now been identified as an important cross-cutting topic with potential impact across all SC program offices. To accelerate development of QIS and apply advances in quantum computing, sensing, and other areas to fundamental research questions, quantum information and materials have been emphasized in the [DOE SC Fiscal Year 2018 Budget Request](#). Recent specific FY 2017 program announcements were also issued for National Laboratory-led

¹ HEP-ASCR Study Group Report, [Grand Challenges at the Interface of Quantum Information Science, Particle Physics, and Computing](#), 2015

BES-HEP roundtable report, [Common Problems in Condensed Matter and High Energy Physics](#), 2015
ASCR [Report on Quantum Computing for Science](#), 2015

HEP-ASCR QIS roundtable report, [Quantum Sensors at the Intersections of Fundamental Science, QIS and Computing](#), 2016

BES [Basic Research Needs Workshop on Quantum Materials for Energy Relevant Technology](#), 2016

ASCR [Quantum Testbeds Stakeholder Workshop](#), 2017

NP [Quantum Computing for Nuclear Physics](#), 2017



exploration of [hardware approaches to quantum testbeds](#) and [development of quantum algorithm teams](#).

Through this Dear Colleague Letter, DOE SC encourages submission of innovative research ideas in QIS via [any appropriate existing mechanism](#). This letter does not add to the scope of any published announcement and it does not change the review criteria of any published announcement, but it should be taken as a statement of interest in encouraging activity in this field. DOE SC recommends that researchers contact program managers within the most relevant SC program office for details on appropriate programs and specifics on proposal submission; however, it is recognized that many efforts in this area are interdisciplinary and thus may undergo co-review or other joint evaluation by multiple program offices. Activities are particularly encouraged that involve collaboration between academia and DOE National Laboratories, and/or take advantage of the unique resources available in the National Laboratory system.

Sincerely,



J. Stephen Binkley
Deputy Director for Science Programs
Office of Science