NATIONAL SCIENCE FOUNDATION
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**NSF 19-061**

# Frequently Asked Questions (FAQs) about the Quantum Leap Challenge Institutes (QLCI) Program

## A. PROJECT FORMULATION

1. In what way is the QLCI program different from other NSF programs supporting large-scale quantum information science and engineering research projects?
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3. Would a CG proposal be an appropriate venue to request funding to help set up a program in quantum information science?
4. Is an institute focused only on theoretical aspects of quantum information science eligible to participate in the QLCI program, or is an experimental component required?
5. Would the study of quantum communications or quantum sensing in biological systems be eligible for the QLCI program?
6. The QLCI program solicitation points towards "entanglement," "emergence," and "superposition" as mechanisms through which science and technology developments are expected. There are other "purely quantum" phenomena that could also lead to new regimes of science and engineering as well as applications. Would science and engineering as well as applications development based on such unlisted quantum ideas be (a) considered responsive and (b) treated at par with listed topical ideas?
7. For CG proposals, how much emphasis should be given to the education/outreach aspect? How closely should that align with the proposed research topics?
8. Is a new quantum Master's degree program desirable, or does the NSF prefer PhD programs?
9. Would it be advisable to address multiple research areas in one project?
10. Is the potential Challenge Institute necessarily a physical institute or can it: be a network; have a hub-and spokes structure; be wholly virtual?

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## SUBMISSION DEADLINES

Letters of intent and proposals must be submitted via FastLane or Grants.gov by 5:00 p.m., submitter's local time, to the applicable deadline date below:

| **Round I (Conceptualization Grant (CG) and Challenge Institute (CI) proposals):** | |
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| Letters of Intent for CG proposals due | April 1, 2019 |
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| CG proposals due | June 3, 2019 |
| Letters of Intent for CI preliminary proposals (Round I) due | June 3, 2019 |
| CI preliminary proposals (Round I) due | August 1, 2019 |
| CI full proposals (by invitation only) due | January 2, 2020 |
| **Round II (CI proposals only):** | |
| Letters of Intent for CI preliminary proposals (Round II) due | August 3, 2020 |
| CI preliminary proposals (Round II) due | September 1, 2020 |
| CI full proposals (by invitation only) due | February 1, 2021 |

The following set of questions and answers refer to frequently asked questions (FAQs) about the Quantum Leap Challenge Institutes (QLCI) Program Solicitation. They are not intended to modify the Program Solicitation. If there are any inconsistencies between the QLCI Program Solicitation and these FAQs, the information in the Program Solicitation prevails.

Before preparing QLCI proposals please read the QLCI solicitation and refer to the general information about NSF proposal submission including the Proposal and Award Policies and Procedures Guide (PAPPG) submission guidelines.

This document is organized as follows:

## A. PROJECT FORMULATION

1. **In what way is the QLCI program different from other NSF programs supporting large-scale quantum information science and engineering research projects?**

   Quantum Leap Challenge Institutes are expected to foster multidisciplinary approaches

to specific scientific, technological, and educational workforce development goals in quantum information science and engineering. Challenge Institutes will integrate expertise from multiple domains such as physics, materials science, engineering, mathematics, chemistry, computer science, and biology. Challenge Institutes, in collaboration with industry and other research institutions, are also expected to develop new cross-disciplinary approaches for education, training, and workforce development. Combining these elements, the Quantum Leap Challenge Institutes will promote a sustainable innovation ecosystem where expertise from various disciplines, research institutions, and industry can be leveraged, as needed, to overcome scientific, engineering, technological, and workforce challenges in quantum information science and engineering.

2. **If I participate in a project awarded by a different NSF program, or have a proposal pending to such a program, am I at a disadvantage in applying to the QLCI program?**

   Applications to other NSF programs do not preclude Principal Investigators (PIs) from applying to the QLCI program. Nor does involvement in other NSF-funded centers or projects preclude an application to the QLCI program. Note, however, that the QLCI program aims to support activities of a different scale and scope from those of other programs. Successful QLCI proposals will make clear the distinction between the QLCI activity and other projects in the Current & Pending Support for the senior project personnel.

3. **Would a CG proposal be an appropriate venue to request funding to help set up a program in quantum information science?**

   No. Seed funding to initiate a new quantum information science program is not within the scope of the CG awards. The purpose of Conceptualization Grants is to facilitate team building as well as conceptualization and crystallization of a team's ideas for the overall challenge research theme and focus areas for a future Challenge Institute proposal.

4. **Is an institute focused only on theoretical aspects of quantum information science eligible to participate in the QLCI program, or is an experimental component required?**

   An experimental component is not required. The QLCI program solicitation does not constrain the type of research to be undertaken by a Challenge Institute.

5. **Would the study of quantum communications or quantum sensing in biological systems be eligible for the QLCI program?**

Yes.

6. **The QLCI program solicitation points towards "entanglement," "emergence," and "superposition" as mechanisms through which science and technology developments are expected. There are other "purely quantum" phenomena that could also lead to new regimes of science and engineering as well as applications. Would science and engineering as well as applications development based on such unlisted quantum ideas be (a) considered responsive and (b) treated at par with listed topical ideas?**

   Yes, the program is open to research in all areas of quantum information science and engineering.

7. **For CG proposals, how much emphasis should be given to the education/outreach aspect? How closely should that align with the proposed research topics?**

   NSF does not prescribe a balance of possible education/outreach activities relative to research activities. NSF expects that PIs will determine the scope of education/outreach activities that would be well integrated and appropriate for a potential Institute and then articulate that vision and the associated justification in a CG proposal to enable the team building and concept crystallization needed. Note that Conceptualization Grants are not meant to support research on the proposed elements or educational/outreach efforts.

8. **Is a new quantum Master's degree program desirable, or does the NSF prefer PhD programs?**

   Both Master's and PhD programs are acceptable as potential human resources development activities in QLCI projects.

9. **Would it be advisable to address multiple research areas in one project?**

   As mentioned in the QLCI solicitation, addressing multiple research areas is certainly feasible if that makes sense for an Institute's overall unifying challenge research theme, but multiple areas are not required. The nature of research challenges and resources needed to address them may be different.

10. **Is the potential Challenge Institute necessarily a physical institute or can it: be a network; have a hub-and spokes structure; be wholly virtual?**

    The QLCI program solicitation does not constrain the nature of a proposed Institute.

11. **Can a single institution form a Quantum Leap Challenge Institute?**

Yes, projects from single institutions as well as multiple institutions are welcome. Proposals for multiple-institution projects should be submitted from only one (lead) institution, with funding for other participating organizations requested through subawards.

12. **Is having an institutional partner a requirement?**

    It is not required that a QLCI project involve a partner institution. However, CI full proposals are expected to include plans for synergistic partnerships and links with local organizations, national laboratories, government agencies, industry, and international partners to leverage expertise in quantum information science, education and workforce development, and technology transfer.

    CI full proposals are also expected to include plans for creating an innovation ecosystem for working with industry, national laboratories, and other agencies to translate research into applications.

13. **Can a two-year community college be a QLCI partner institution?**

    Yes.

14. **Could a multinational corporation apply to the QLCI program as the lead institution?**

    No, proposals may only be submitted by institutions of higher education or non-profit organizations associated with educational or research activities.

15. **Would it be feasible to propose joint NSF/DOE centers with half funded by the NSF QLCI program and the other half funded by the Department of Energy centers program?**

    As a practical matter, it would not appear feasible to submit a proposal to the NSF QLCI program for an institute whose success would be contingent upon receipt of additional support from a different agency.

    The QLCI program does encourage plans for synergistic partnerships and links with local organizations, national laboratories, government agencies, industry, and international partners to leverage expertise in quantum information science, education and workforce development, and technology transfer.

16. **Is my plan competitive enough?**

    Proposals will be reviewed according to the information in Section VI.A. "Merit Review Principles and Criteria" of the QLCI program solicitation NSF 19-559. It is not appropriate for NSF program directors to offer their opinion about the competitiveness of

project ideas prior to submission and review of proposals.

## B. COMPETITION TIMELINE

17. **If we submit an LOI for a Conceptualization Grant, but then later decide to pursue a Challenge Institute proposal under Round I, would we be able to withdraw the CG LOI and submit a new LOI for the CI?**

    Prospective teams may submit either a CG or a CI proposal, but not both, in Round I. A CG Letter of Intent would not need to be withdrawn if plans change, but a new Letter of Intent for the new CI proposal is needed. In that situation, please indicate the change in the second Letter of Intent.

18. **If we apply with a Round I QLCI proposal and are not selected, can we then submit a proposal in Round II?**

    Yes. The QLCI program solicitation does not impose restrictions on personnel who participated in an unsuccessful Round I proposal.

19. **If we submit a Challenge Institute (CI) proposal for Round I, would that process be fully completed by the time the LOI for Round II is due?**

    The timeline is designed to allow CG awardees to develop ideas for the Round-II CI deadline, but the timeline may not accommodate a situation where PI of a declined Round-I CI proposal wants to revise and resubmit the CI proposal in Round II. The QLCI program encourages teams who are not ready to submit a (preliminary) proposal this year to instead apply for a Conceptualization Grant to facilitate team building and planning. The QLCI program timeline is designed to allow teams who receive a Conceptualization Grant to submit a preliminary proposal for a Challenge Institute approximately one year later.

20. **Can a person serve as PI, co-PI, or senior personnel on one CG and one CI proposal in Round I?**

    The QLCI program solicitation does not preclude a person serving as senior personnel (or PI or Co-PI) on two different teams applying, respectively, for CI and CG proposals in Round I.

    However, it is expected that the conceptualization and establishment of a Challenge Institute will take significant and sustained effort from the proposing team. For this reason, reviewers of a Round I CI proposal may question whether a person with a pending CG proposal would be able to devote sufficient time to both projects. Reviewers are likely also to realize the potential longer-term consequences in the event an individual is on the teams of both a successful Round I CI proposal and a successful CG

proposal. In that case, a successful Round II CI proposal from the latter team would result in the individual playing key roles in two different Challenge Institutes, for which sufficient time would seem unlikely.

The QLCI Management Team encourages individuals to focus efforts on the end goal of creating a multi-disciplinary institute that has real impact in bringing together multiple research communities to successfully address a challenge project that advances the frontiers. Such focus would necessitate choosing the project that has the highest potential impact.

21. **Can people and institutions associated with an awarded Round I CI proposal also be associated with a separate Round II CI proposal?**

    It is expected that the conceptualization and establishment of a Challenge Institute will take significant and sustained effort from the proposing team. For this reason, reviewers of a Round II CI proposal may question whether a person associated with a Round I CI award would be able to devote sufficient time to both projects.

    The QLCI Management Team encourages individuals to focus efforts on the end goal of creating a multi-disciplinary institute that has real impact in bringing together multiple research communities to successfully address a challenge project that advances the frontiers.

## C. LETTERS OF INTENT

22. **Is the number of senior project personnel limited for a QLCI project? Is the number of participating organizations limited?**

    There is no limit on the number of senior project personnel or participating organizations in a Quantum Leap Challenge Institute proposal (or letter of intent).

    The NSF Letter of Intent system has a software limitation on number of entries for Other Senior Project Personnel and Participating Organizations, but this is not intended to limit the number of subawards or senior personnel or participating organizations in a QLCI project.

    For letters of intent, please simply ensure that all participating organizations (subawardee or not) and senior project personnel (including senior collaborators) are listed somewhere in the Letter of Intent. If there is not enough room among the available slots for Other Senior Project Personnel and Participating Organizations, please list the additional senior personnel and organizations in the text boxes of the Letter of Intent.

    Letters of Intent will not be subject to review and are used only to help NSF staff anticipate potential conflicts of interest of potential reviewers for the (subsequent)

proposals. NSF will not provide feedback to Letters of Intent, and proposers should not expect a response.

23. **How are the potential industrial and national laboratory collaborators identified in the Letter of Intent? Are they listed as senior personnel, Co-PIs, or simply as collaborators?**

    Letters of Intent will not be subject to review and are used only to help NSF staff anticipate potential conflicts of interest of potential reviewers for the (subsequent) proposals. For letters of intent, please simply ensure that all senior project personnel (including senior collaborators) are listed somewhere in the Letter of Intent. If there is not enough room among the available slots for Other Senior Project Personnel and Participating Organizations, please list the additional senior personnel and organizations in the text boxes of the Letter of Intent.

24. **Is it permissible for the project team in a proposal to have a different composition (changed project roles or changed personnel) from the team specified in the letter of intent?**

    It is permissible for the roles of personnel in a proposal to be different from those in the letter of intent. It is also permissible to add or remove personnel when preparing the proposal; however, such modifications should be kept to a minimum. In particular, a proposal that involved personnel whose institutional affiliations had not been mentioned in the letter of intent would cause difficulties for NSF staff.

## D. PROPOSAL SUBMISSION

25. **Is this considered a collaborative project? Is one organization responsible for the submission?**

    For submissions involving multiple organizations, the proposal should be submitted from only one (lead) institution, with funding for participating organizations requested through subawards. Proposals should not be submitted as separately submitted collaborative proposals. A single Letter of Intent should be submitted for an entire project; submission of multiple Letters of Intent for the same project is not permitted.

26. **Is there a limit on the number of PI/co-PIs in a proposal?**

    There is no limit on the number of senior personnel in a QLCI project; however, the proposal Cover Sheet allows a single PI and at most 4 co-PIs. An unlimited number of Other Senior Personnel may be included in a proposal. For letters of intent, please ensure that all senior project personnel (including senior collaborators) are listed somewhere in the Letter of Intent. If there is not enough room among the available slots

for Other Senior Project Personnel and Participating Organizations, please list the additional senior personnel and organizations in the text boxes of the Letter of Intent.

27. **What budget items are allowed in a Conceptualization Grant proposal?**

    There are no restrictions on the type of activities that may be proposed in a CG budget. The most successful CG proposals will reflect concrete plans for development of integrative and multidisciplinary research teams and meaningful stakeholder engagement. Proposals must present a clear strategy for enabling the crystallization of the overall challenge research theme and focus areas for a future Institute. CGs are not meant to support research on the proposed elements.

28. **Can Challenge Institute award funds be used to develop new infrastructure? If so, are there limitations on the type of infrastructure or the budget for this?**

    The QLCI program solicitation does not constrain the budget items that can be requested.

    However, Challenge Institutes are expected to build on other NSF investments and are expected to coordinate and integrate with ongoing and new initiatives, including center-scale, infrastructure, and workforce development activities. The Challenge Institute teams are expected to coordinate with their constituent organizations and partners to develop a concrete and workable plan for leveraging existing infrastructure resources.

    If major infrastructure investment is needed to address the proposed research challenge, the appropriate venue is not the QLCI program, but rather other NSF sources of funding specifically for experimental research infrastructure, such as the Major Research Instrumentation program and the Mid-Scale Research Infrastructure program.

29. **Does the NSF 2-month salary limit apply to (non-tenure track) research faculty whose salary is funded through directly billing contracts and grants?**

    It is not anticipated that salary support would be limited to two months annually for individuals who are not regular faculty members.

    Details on the practice and the associated NSF policy are contained in the NSF PAPPG (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg) Chapter II.C.2.g.(i)(a). Please note that section specifies: "If anticipated, any compensation for such personnel in excess of two months must be disclosed in the proposal budget, justified in the budget justification, and must be specifically approved by NSF in the award notice budget. [NSF grantees remain subject to the provisions of OMB M-01-06, "Clarification of OMB A-21 Treatment of Voluntary Uncommitted Cost Sharing and Tuition Remission Costs" regarding requirements for committing and tracking "some level" of faculty (or senior researcher) effort as part of the organized research base.]"

## E. INTERNATIONAL PARTNERSHIPS

30. **Do all participating investigators need to be based in the US?**

    No. It is anticipated that the Challenge Institute teams will develop synergistic partnerships with industry, US national laboratories, and international partners as appropriate.

31. **Is it encouraged or discouraged to have funded co-PIs from institutions outside the US?**

    The QLCI program will not normally support salary of non-US collaborators.

    In cases where the proposer considers a foreign organization's involvement to be essential to the project (e.g., through subawards or consultant arrangements), the proposer must explain why equivalent expertise is not available in the US. In addition, the proposed activity must demonstrate how one or more of the following conditions have been met:

    - The foreign organization contributes a unique organization, facilities, geographic location, and/or access to unique data resources not generally available to U.S. investigators (or which would require significant effort or time to duplicate) or other resources that are essential to the success of the proposed project; and/or
    - The foreign organization to be supported offers significant science and engineering education, training, or research opportunities to the United States.

    Such information must be included in the project description of the proposal.

    The QLCI program does encourage collaborative arrangements and development of shared infrastructure with other universities and colleges, national laboratories, private sector research laboratories, industrial partners, non-profit organizations, state and local government laboratories, and international partners, as appropriate, to advance the Institute's vision and goals. The top priority of the QLCI program is to support the US academic community in advancing the frontiers of quantum information science and engineering. The program will provide support for collaborations of US-university-based faculty, postdoctoral researchers, and graduate students as appropriate with non-US partners, including travel expenses, consultant fees, facility charges, usage fees, etc. Projects with an interest in such activities should include these expenses as part of proposals to the QLCI program.

32. **Are there limitations on how expenditures can be allocated for non-US universities?**

Yes, support of participating institutions is to be arranged through subawards managed by the submitting institution. It is the responsibility of the Sponsored Research Office (SRO) of the submitting institution to determine the allowability of subaward expenses, subject to the NSF terms and conditions that apply to awardees.

## F. PARTNERSHIPS WITH FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS (FFRDC)

33. **Is a Federally Funded Research and Development Center (FFRDC) eligible to participate as a subawardee to a University?**

    NSF does not normally support research or education activities by scientists, engineers, or educators employed by Federal agencies or FFRDCs. Under exceptional circumstances, research or education projects at FFRDCs that can make unique contributions, not available elsewhere, to the needs of a QLCI project may receive NSF support.

    The top priority of the QLCI program is to support the US academic community in advancing the frontiers of quantum information science and engineering. The program will provide support for collaborations of US-university-based faculty, postdoctoral researchers, and graduate students as appropriate with non-academic partners, including travel expenses, consultant fees, facility charges, usage fees, etc. Projects with an interest in such activities should include these expenses as part of proposals to the QLCI program.

## G. INDUSTRIAL PARTNERSHIPS

34. **Can companies receive NSF funds?**

    Section II.B.4 of the solicitation describes the general nature of partnerships between Quantum Leap Challenge Institutes and industrial partners.

    In general, industrial research partners are not permitted to use or receive NSF funds. Only under the exceptional circumstance that research or education activities at non-academic US organizations can make unique contributions, not available elsewhere, to the proposed project would such activities be considered for NSF support.

    Small businesses (per the Small Business Administration definition, which includes an upper limit of 500 employees) may be able to leverage relevant programs from the NSF IIP Division (https://seedfund.nsf.gov/). All partnerships need to be aligned with the research goals and objectives of the Institute.

    The top priority of the QLCI program is to support the US academic community in

advancing the frontiers of quantum information science and engineering. The program will provide support for collaborations of US-university-based faculty, postdoctoral researchers, and graduate students as appropriate with non-academic partners, including travel expenses, consultant fees, facility charges, usage fees, etc. Projects with an interest in such activities should include these expenses as part of proposals to the QLCI program.

35. **How can companies benefit from becoming part of a QLCI proposal?**

    Potential benefits to industrial partners from participating in a QLCI project include:

    - Opportunity to collaborate (on a pre-competitive basis) with QLCIs to further the objectives of both the QLCIs and the industrial partners;
    - Opportunity to provide technical input to the research directions of QLCIs;
    - Opportunity to provide input regarding use-cases, thereby helping technology transition for commercial and societal outcomes;
    - Access to QLCI intellectual property under agreed-upon conditions;
    - Interactions with other partners, which may bring multiple benefits, for example:
        - Networking and collaboration – e.g., to develop solutions for targeted use-cases; and
        - Insight into the state of play in quantum R&D to enable better planning for the adoption of quantum technologies; and
    - Access to the next-generation quantum information science and engineering workforce.