Call for Proposals

FY 2020
Laboratory Directed Research and Development
(LDRD) Program

I. Overview

The purpose of the LDRD program is to encourage innovation, creativity, originality, and quality to keep the Laboratory's research activities and staff at the forefront of science and technology.

The FY2020 LDRD program will have three funding tracks for proposals. Please note that these tracks are not in order of priority and are as follows:

- Lab-wide Initiative
- Area-Initiative
- Early Career Development

The Lab-wide Initiative Track

Proposals in the Lab-wide Initiative track should foster the development of new teams and activities in fields that directly support the high level strategic goals of the Laboratory (http://www.lbl.gov/LBL-Programs/). The intent of this track is to ensure that appropriate review is provided for those topics of strategic importance which cut across several Laboratory Areas. These proposals will be submitted to one of five strategic initiatives:

- Beyond Moore's Law
- Genetically-Encoded COmposites (GECO)
- Machine Learning for Science
- Solid State Energy Storage
- Water-Energy Nexus

Proposals outside of the topics listed above that may support other potential Lab strategic goals will be reviewed under the Area Priority funding track.

Principal Investigators (PIs) will indicate on their proposal submission that they wish to be reviewed via the Lab-wide Initiative funding track.

<u>Criteria</u>

All proposals will be evaluated based on: i) their alignment with the Lab's strategic initiatives; ii) the quality of the proposed research; iii) the ability to leverage the unique cross-area capabilities of the Laboratory; and iv) the uniqueness and novelty of the proposed project.

<u>Review</u>

Lab-wide Initiative proposals will be reviewed in two rounds: First by a committee formed and managed by the *Initiative Review Lead* (see table below), and then by the Scientific Division Directors, Associate Laboratory Directors, and Senior Lab management.

Both reviews will involve a combination of an evaluation of the written proposal and presentation(s) to a review team. The proposal text and presentation may be modified after the first round based on input from the review committee.

The *LDRD Lab-wide Initiative Review Leads* will organize and manage the first round of reviews, including selection of other experts for the review committee.

For the second round of reviews, a selected set of related Lab-wide Initiative proposals will be presented as a portfolio to a review committee of the Scientific Division Directors, Associate Laboratory Directors, and other Senior Lab management. For the second presentation, the Initiative Review Lead will also be responsible for a coordinated presentation of the proposals and may include one or more of the PIs.

Proposals that are considered scientifically competitive by the first review committee, but not well aligned with the Lab-wide Initiative track, will be automatically reviewed via the Area Initiative track.

The Area Initiative Track

Area Initiative track proposals will be accepted in each of the scientific Areas of the Lab:

- Biosciences
- Computing Sciences
- Earth and Environmental Sciences
- Energy Sciences
- Energy Technologies
- Physical Sciences

Criteria

Area Initiative proposals will be evaluated based on their novelty and scientific quality, as well as the ability to introduce new research activities in areas important to one or more of the Scientific Divisions of the Lab. High-risk projects with the potential for significant scientific impact are strongly encouraged.

Follow-up proposals to previous year Laboratory Initiative projects should still be submitted and reviewed by the corresponding areas.

Multi-divisional and multi-area proposals are encouraged. These proposals should be submitted by the lead division/area, usually the PI's division/area.

Review

The Associate Laboratory Director and the Area-specific Division Directors will review the proposals in their area; they may also include additional reviewers in the process. The PI will be involved in a single round of reviews involving the written proposal and follow-up to Area and Division management. The highly ranked Area Proposals will be presented by the relevant ALD or Division Director to the Lab Director and Deputy Lab Director for final ranking and funding level recommendations. For multi-area proposals, the submitting area ALD should seek input from the ALDs of the partner areas and present this input during the final presentation to the lab director.

Early Career Development Track

The intent of the Early Career Development (ECD) track is to develop the future scientific workforce and prepare early career PIs for a successful scientific career. An ECD LDRD grant is intended to be a first opportunity for an early career scientist to develop a PI experience at a national lab, and prepare for a DOE Early Career Grant application. Considering the future scientific workforce of Berkeley Lab, it is a goal of the laboratory to develop a diverse group of early career scientists and applications from underrepresented and other employee groups are very much encouraged. A maximum funding amount not to exceed $225,000 per PI will be allocated.

Criteria

PIs must have received their Ph.D. no earlier than January 1, 2011. Current postdocs are also encouraged to submit proposals, and, if successfully funded, must have a scientific job title (career or career track, research scientist or staff scientist) before the project starts. The topic of the proposed project should be consistent with the Area strategy, as well as create a strong basis for a future DOE Early Career grant application.

A typical proposal should consist of funding for up to 50% of an FTE for the PI, and additional funding for a postdoc, and/or students. It is expected that the early Career LDRD project will be independent from and carried out in parallel to their assigned work in their home Divisions.

Please direct any further questions or inquiries about eligibility to your Division Director or ALD.

<u>Review</u>

Applying for this LDRD award invites early career scientists to start thinking strategically about their long term plans and how these plans fit into the program goals of the Lab and the DOE. Thus, the ALD and the Area-specific Division Directors should encourage and mentor outstanding early career scientists to become ECD PIs in their area, paying particular attention to diversity and inclusion. Ongoing mentorship by the area or division will be essential for the success of the ECD PIs, thus ALDs/Division Directors should also prepare a mentoring plan for the PIs, and a mentoring plan should be submitted with the application.

ALDs and Division Directors will review the ECD proposals in their area; they may also include additional reviewers in the process. The ECD PIs will be involved in a single round of review involving the written proposal and possibly a presentation to Area and Division management. Each ALD should forward and recommend up to two ECD Proposals from their area.

The selected ECD proposals from all Areas will then be presented by their PIs to the Lab Director, Deputy Lab Director, and all ALDs for final ranking and funding level recommendations.

II. FY20 Lab-wide Initiatives

As described above, new Lab-wide Initiative proposals will be considered, especially those aligned with one of the topics of the Lab Strategic Plan. These initiatives are listed below in alphabetical order:

Beyond Moore's Law: We intend to fund proposals that address new paradigms of digital computing showing promise for scientific computations. DOE is a leader on the use of advanced computing techniques for both simulation and data analysis, but with transistor density improvements slowing, there is a growing interest in reimagining the digital computing paradigm starting from new materials and physical concepts, new architectures to novel technologies with new functionalities that could lead to unprecedented computing efficiency. Proposals must be in the foundational areas for new computing models and algorithms for novel technologies, new materials and physical phenomena to reduce energy consumption in microelectronics as well as cross-area collaborations to demonstrate novel technologies and their relevance to scientific problems.

Only continuation proposals will be accepted under the Lab Initiative funding track. New proposals related to Beyond Moore's Law will be submitted and reviewed via the Area Priority track.

Genetically Encoded COmposites (GECO): Living organisms produce a variety of biominerals composed of soft and hard materials, including bone, shells, and exoskeletons. These composites, whose

synthesis and morphology is genetically-encoded, are created in an energy-efficient manner and are frequently hierarchically-structured, yielding properties superior to traditional materials. This initiative aims to discover existing genetically-encoded composites, understand their synthesis and structure-function relationships, and leverage this new knowledge to produce non-natural composites with improved function. Thus, it will develop the characterization, computational, and synthetic tools needed to advance genetically-encoded composites.

Machine Learning for Science: We encourage multi-disciplinary and multi-area teams of researchers to propose the use of advanced machine learning methods to analyze complex data sets that arise in science and applied energy applications of importance to Berkeley Lab. A limited number of new projects (1-2) will be awarded; new proposals should focus on the development of machine learning for controlling complex systems, and should address science domains not represented in the current portfolio.

Solid State Energy Storage: Solid-state systems are an exciting prospect for safe, high energy density batteries. We seek proposals that address the critical science of solid state batteries, including modeling, design and synthesis of novel solid-state conductors and their integration into membranes, modeling and characterization of reactivity at buried interfaces, and innovative new processing methods of integrated electrodes and complete solid-state batteries.

Water-Energy: Recognizing that new paradigms are needed to quantify water-energy dependencies and to ensure water resiliency, we seek continuing LDRD proposals that contribute to building a crosscutting Berkeley Lab Water initiative. Analogous to electricity, to ensure water resiliency, we must develop understanding and new approaches associated with energy-efficient water distribution, use, generation and storage. We thus seek continuing proposals that focus on: quantifying water distribution and use under future conditions and implications for energy strategies; breakthrough solutions that lower the energy intensity and cost of desalination to generate water; revolutionary concepts to store and reuse water; and data science and systems analysis to enable optimized water resiliency solutions across large regions. More information about this initiative is at www.werri.lbl.gov.

Only continuation proposals will be accepted under the Lab Initiative funding track. New proposals related to Water-Energy may be submitted and will be reviewed via the Area Priority track, but please contact Peter Fiske at pfiske@lbl.gov to coordinate the submission in advance.

Initiative Topic	LDRD Lab-wide Initiative Review Lead(s)
Beyond Moore's Law	Ramamoorthy Ramesh
Genetically Encoded COmposites	Caroline Ajo-Franklin
Machine Learning for Science	Jonathan Carter and Kathy Yelick
Solid State Energy Storage	Gerbrand Ceder
Water-Energy Nexus	Peter Fiske

III. FY20 Area Initiatives

The Area Initiative LDRDs are encouraged in new "breakthrough" science areas. Within each Area, the particular research topics for which proposals are especially encouraged are:

Biosciences: i) Machine learning for Biosciences; ii) Integration of computational and experimental approaches to predict and validate gene function and metabolism across Taxa; iii) Characterization and manipulation to achieve predictive environmental interaction of organisms and communities across scales using fabricated ecosystems; iv) Cryo-EM; v) C1 Biomanufacturing; vi) Biodefense and Biodetection

Computing Sciences: i) new cross-divisional partnerships, including ones that explore new "superfacility" use cases; ii) new mathematical and statistical methods, including machine learning methods, that enable new capabilities in modeling and analysis; iii) methods and systems to address complex data problems using HPC, including those involving cross-institutional collaborations; iv) models of programming and systems software for resilience, security, productivity and performance on future architectures.

Earth and Environmental Sciences: i) Dynamic biological-environmental interactions with climate extremes; ii) subsurface properties and dynamics; and iii) system resilience to climate change and natural hazards, including earthquakes and fires.

Energy Sciences: novel theoretical, experimental, and synthetic approaches for: i) Ultrafast science, especially time-resolved measurements beyond pump-probe, and techniques to observe rare events and/or transient intermediates; ii) Utilizing the brightness and coherence of the upgraded ALS, with an emphasis on the tender X-ray energy regime; iii) Beyond Moore's Law/Beyond CMOS microelectronics; iv) Quantum information science, including with new capabilities at the Molecular Foundry; v) Electro- and photoelectro-chemistry and materials beyond the scope of JCAP; and vi) Understanding complex chemical and material transformations that span broad length and time scales (e.g. atomic to macroscopic), including in situ/operando approaches

Energy Technologies: i) Next Gen Grid: measurement, control, and communication techniques for energy and environmental systems, particularly, focused on next generation Grid and energy distribution; ii) Urban Systems: with a strong focus on buildings efficiency, operating systems and controls, plus building and city scale resilience; iii) EV Everywhere: next generation transportation: including low cost storage concepts; EVs as a part of the grid; integration of transportation with buildings; and, iv) Advanced Manufacturing: this will be a new focal point for this year and we are looking for proposals that will help establish LBL as a key player in the Manufacturing space, with a focus on energy systems (generation, storage, additive manufacturing, 3-D printing); (v) Energy Efficient Electronics for Beyond Moore's Law: New concepts and manufacturability, vi) Transforming transport, storage, conversion and utilization of heat (HEATER)

Physical Sciences: i) new scientific opportunities in particle physics and cosmology; ii) new opportunities in nuclear science; iii) advanced accelerator systems for colliders and other applications; iv) novel technical concepts and capabilities: especially microelectronics, semiconductor detectors, "Quantum Information Science" sensors, superconducting magnets.

An important priority for the Physical Sciences Area is to establish the technical capabilities for Berkeley Lab leadership roles in upcoming scientific opportunities identified in the Nuclear Physics Long Range Plan and the High Energy Physics P5 report. These include the Electron-Ion Collider (EIC), the Stage 4 Cosmic Microwave Background project (CMB S4), long baseline neutrino experiments, ton-scale neutrino-less double-beta decay experiments, high power lasers, and other opportunities.

IV. Detailed Requirements and Review Process

Proposals must include a:

- Cover Sheet
- Technical proposal (as described below)
- Budget Request form
- NEPA/CEQA form
- Human Subject and Animal Use form
- Intellectual Property forms

The technical proposal section may not exceed a maximum of three pages of text with one additional page for figures and references. *Continuing project* proposals must include within the page limit a statement of progress to date, detailed scope and deliverables for the current fiscal year, as well as prospects for follow-on funding.

Proposed work cannot supplement existing DOE projects, nor can it contain construction line items or maintenance activities. *The expected duration of projects started in FY20 is two years*, with a third year available in outstanding and exemplary circumstances.

Proposals should be prepared carefully following the given specifications and requirements available online at Detailed Proposal Guidance.

Budget

Budgets must include payroll burden, procurement burden and support burden, if applicable, along with scientific organization burden. A Site Support overhead estimate should be included as a separate line item if applicable.

V. Schedule and Support

The nominal schedule for the FY 2020 cycle is posted - see LDRD Review Schedule. Final detailed scheduling of the review period and any presentations will be arranged by the ALD and/or Lab Director's offices.

Investigators should work with their divisional or Area support staff to prepare their LDRD proposals. Administrative questions on LDRD may be addressed to Darren Ho (dho@lbl.gov).

For additional information about the purpose and implementation of the LDRD program at Berkeley Lab, please click this link: http://www.lbl.gov/DIR/assets/docs/LDRD_Guidelines_10-09-c.pdf

Information about the Laboratory LDRD proposal submission and review process can be found at: http://www.lbl.gov/DIR/LDRD/cfp/process.html

FY 2020 Laboratory Directed R&D (LDRD) Proposal Schedule

Schedule as of December 1, 2018. For any updates, please go to: http://www.lbl.gov/DIR/LDRD/cfp/schedule.html

Before January 1, 2019

Director issues Call for Proposals and guidance for FY 2020 LDRD to ALDs, Division Directors, and staff scientists via e-mail and TABL.

March 22, 2019

Principal investigators submit and lock FY 2020 LDRD proposals in the web-based submission system for Division processing. Associate Laboratory Directors (ALDs) initiate review processes.

March 25, 2019

ALDs begin preliminary review of all marked Lab Initiative proposals and send non-selected proposals back to the appropriate Division and Area review teams for consideration.

April 15, 2019

ALDs identify proposals selected for Early Career Development track review.

April 22, 2019

Lab Initiative Leads and ALDs complete and submit rankings for Lab Initiative and Area/Divisional Priority proposals.

April 29, 2019

Preliminary LDRD Review Meeting schedules created and distributed.

May 6, 2019

Presentation and Review Meetings for all FY 2020 ECD and Lab Initiative proposals.

May 7, 2019

Presentation and Review Meetings for all FY 2020 Area/Divisional Priority proposals.

July 1, 2019

Director or Deputy Director notifies Associate Laboratory Directors and Division Directors of preliminary FY 2020 awards.

September 1, 2019

LDRD Office notifies successfully awarded FY 2020 PIs. Project concurrence requests are provided to DOE-Berkeley Site Office.

October 1, 2019

DOE project concurrence is provided, and LDRD projects begin work.

December 15, 2019

Awards announced in Today at Berkeley Lab after final allocations are made.