CSES FY23 Guidebook

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1   Introduction

The Center for Space and Earth Science (CSES) at Los Alamos National Laboratory (LANL) is one of the six Science Institutes in the Lab's National Security Education Center (NSEC). CSES covers six specific science disciplines, plus a new cross-Center initiative, PI-SATS, each directed by focus leaders:

- Astrophysics & Cosmology   (Ingo Tews; itews@lanl.gov)
- Space Science   (Vania Jordanova; vania@lanl.gov)
- Planetary Science   (Ann Ollila; amo@lanl.gov)
- Geophysics   (Youzuo Lin; ylin@lanl.gov)
- Earth Systems   (Sanna Sevanto; sanna@lanl.gov)
- Biological Systems   (Jeanne Fair; jmfair@lanl.gov)
- PI-SATS   (Ann Ollila; amo@lanl.gov and Peter Bloser; pbloser@lanl.gov)

1.1   CSES Science Discipline Portfolio

Astrophysics & Cosmology - with the goal of advancing our understanding of astrophysical phenomena throughout the universe using theoretical modeling, data science, computational studies, and related experimental research and to develop capabilities that map to needs in divisions involved in weapon simulation (e.g., nuclear physics, radiation hydrodynamics, plasma physics, Magneto HydroDynamics (MHD), uncertainty quantification) and national security (e.g., nuclear detection, transients, sensing, imaging).

Space Science - with the goal of advancing our understanding of the space environment from the Sun to the Earth and beyond - with the particular goal of understanding how the space environment affects the systems in space that support security and quality of life in our increasingly technological society. We include here development of heliophysics mission concepts.

Geophysics - with the goal of advancing theoretical, experimental, modeling, and simulation studies in basic Earth processes as well as promoting capabilities needed for a better understanding the perturbation of natural geologic systems in response to human actions and how we can leverage observations of geophysical properties in response to natural or anthropogenic events. These perturbations include changes in pore pressure, temperature, permeability; fluid/gas chemistry; as well as density, rigidity, compressibility, electromagnetic properties and seismic propagation characteristics.

Earth Systems - with the goal of advancing our understanding of the Earth System, its components and their interactions using theory, modeling, and simulation in combination with observations and experiments that advance our abilities to 1) predict change, variability and evolution of Earth System components resulting from natural and anthropogenic forcings, 2) understand the impacts of these changes on climate, and 3) strengthen the resilience of interdependent infrastructures, both in today's and in future climate states.

Planetary Science - with the goal to advance our knowledge of planetary bodies beyond Earth, including surface properties and processes, internal structures, atmospheres, and evolution over time. We seek to advance our abilities to design, build, and operate remote instruments in extreme

environments. Planetary Science utilizes data from a broad swath of platforms, including satellite, airborne, in situ, and laboratory measurements.

Biological Systems - with the goal of advancing the study of biological systems as part of complex natural systems, and addressing the signatures of natural or human-induced phenomena on such biological systems, including disease dynamics at the human/environment interface. This includes observational, experimental and modeling approaches.

1.2 CSES Strategy

As one of the six strategic centers organized under NSEC, CSES is chartered to foster high quality research efforts, specialized recruiting, and strategy development within its assigned scientific discipline areas.

The main purpose of strategic centers is to:

1. Focus on laboratory wide strategically important areas of science, engineering, or technology that span areas of expertise beyond that residing in any single management structure,
2. Provide external visibility and collaboration in strategic areas of need that require a single laboratory voice,
3. Provide education for present and future scientists and engineers that are required to maintain LANL competitiveness,
4. Help with recruitment or retention of technical talent.

This call supports initial research through student, postdoc, and staff opportunities that build new capabilities or explore new approaches for the LANL mission, or that support anticipated future mission needs and new mission areas in the science disciplines supported by CSES. The science goals for the CSES disciplines are in support of the broader strategic goals of the Laboratory Agenda and the Science Pillars that map to it. The Laboratory's Signature Science goals encapsulated in the Science Pillars is the LANL response to a range of national strategic plans that cover LANL's mission area. CSES is particularly responsive to the Department of Energy's Strategy to Advance American Space Leadership (FY 2021–FY 2031), "Energy for Space." CSES supports the three strategic goals, "Solve the Mysteries of Space," "Support the Secure and Peaceful Use of Space," and "Enable the Development of Space."

There is also a large overlap in the CSES science disciplines with all NASA's Science Mission Directorates, and CSES is interested in supporting capabilities that would enable LANL participation in the NASA mission arena. LANL's involvement with NASA is an invaluable recruiting tool, helps retain highly qualified staff, pushes LANL technology to perform in extreme environments, and provides a publicly visible outlet for LANL excellence not available in other programmatic areas. CSES also supports initiatives from the LANL Institutional Space Strategy, Space Science & Exploration Portfolio Action Plan.

While the CSES discipline areas contribute to many of the Los Alamos National Laboratory Science Pillars, they are particularly applicable to the Science of Signature (SoS) Mission:

"Characterize measures, signals and properties in or of complex systems. Detect or attribute change and predict behavior and impact across scales of space (subatomic to astronomic) and time (femtosecond to geologic)"

Signature Science addresses emerging challenges in the CSES disciplines by developing the scientific underpinning of signatures and backgrounds, new measurement techniques and strategies for signature identification, the discovery of alternate or nontraditional signatures, and new analysis and interpretation tools for development of knowledge from these signatures.

CSES also supports the Complex Natural and Engineered Systems (CNES) Pillar by:

"Addressing the science of complex systems requires science and technology innovation, as well as an integrated experiment, theory, and modeling and simulation approach that is the cornerstone of the Los Alamos problem-solving tradition."

Focus areas are rooted in the physical and life sciences with aims to support interdisciplinary research and development.

Each CSES call for proposals highlights a set of focused science topics for each of the six discipline areas, which will change from year to year. These topics are selected based on challenges facing the international scientific community as well as on the strategic need to extend scientific excellence supporting the Los Alamos National Laboratory mission.

We particularly encourage early career staff scientists to submit proposals that will help them build research programs and establish productive collaborations with universities.

In order to encourage highly creative and innovative ideas and concepts, CSES encourages revolutionary and moderate to high-risk research. CSES funds collaborative research involving Laboratory staff members, postdocs, university PI's and their students. A small amount of funding may be provided to conduct a technical feasibility analysis of a revolutionary concept. While many collaborative projects extend up to three years duration, funding in each successive year is contingent upon adequate progress in the previous year and the availability of funding.

1.2.1   Policy regarding inclusivity

CSES is committed to inclusivity and upholds the LANL statement, "diversity fuels our innovative, agile, and principled workforce that is essential to solving problems of global importance." We seek to create and uphold a positive, professional environment for all participants and support the Director's Annual Diversity Memo (official Laboratory Policy (PD712 and P712-3) as well as all levels of LANL policies intended to support diverse groups and eliminate bias against groups.

1.3   Updates for FY23

Please pay particular attention to the following new or changed items in this year's call.

1.3.1 Updates: R&D, IPD, Chick Keller, and Focused Science Topics

1. New Special Rapid Response topics (Section 2.8)
2. The *Chick Keller Postdoctoral Fellowship* (Section 3.2), will accept nominations at the December and May Postdoc Program Quarterlies.
3. Updates to the focused science topics (Sections 2.1 to 2.6).
4. Cross-center Pipelining Initiative for Space Applied Technology and Science (PI-SATS) added as a Focused Science Topic (Section 2.7).
5. IPD goes to a no due date model (Section 3.3.3).
6. CSES Scholars, funds for sabbaticals (Section 3.3.4).

2 Focused Science Topics

All CSES Proposals need to address the focused topics for FY23 in their science discipline area as outlined below.

Exception: for the Rapid Response Program. While proposals along the lines of this call's focused science topics are encouraged, the program element is open to all new ideas relevant to the CSES discipline areas.

Exception: for the Special Rapid Response Program. Proposals MUST address the relevant Special Rapid Response Topic as outlined in Section 2.8.

2.1 Astrophysics & Cosmology

The Astrophysics & Cosmology Focus Area in CSES is closely aligned with LANL's Nuclear and Particle Futures (NPF) Capability Pillar and in particular the two focus areas of "Nuclear, Particle, Astrophysics & Cosmology" (NPAC) and "High Energy Density Plasmas and Fluids" (HEDPF). Furthermore, research in the Astrophysics & Cosmology and Cosmology focus area is relevant to some of the goals described in the Science of Signatures Pillar; see https://www.lanl.gov/science-innovation/pillars/npf/index.php and http://www.lanl.gov/science-innovation/pillars/sos/index.php for further details.

The research in the Astrophysics & Cosmology Focus Area aims to advance our understanding of astrophysical phenomena throughout the universe by providing the necessary fundamental research and capability developments. Research in this Focus area entails theoretical modeling, data science, computational studies, and related experimental efforts with the goal to develop capabilities that map to needs in divisions involved in weapons research, national, and global security.

Focus area

We solicit proposals that aim to advance research in observation, theory, data analysis, simulation, and instrumentation and strive to achieve a fundamental understanding of the universe and its many exciting astrophysical processes. We particularly encourage proposals that emphasize interdisciplinary efforts combining the beforementioned fields or research at the boundaries of cosmology, astrophysics, nuclear physics, particle physics, plasma physics, computational physics, or general relativity.
This focus area benefits from and in turn strengthens its strong overlap with many on-going Laboratory programs in these and other areas such as weapons physics and condensed matter physics. It further utilizes and leverages unique LANL capabilities, and facilities and observatories both inside and outside of the Laboratory. We are interested in proposals that emphasize innovative, forward-looking, and interdisciplinary research and that have a strong potential to lead to the development of new capabilities and research directions.

It is strongly encouraged that proposals exploit LANL's broad knowledge base in a full range of physics and tie together unique and/or underutilized resources at Los Alamos National Laboratory, for example:

1. LANL's strength in theoretical modeling of extreme astrophysical conditions,
2. Facilities such as the HAWC, Raptor, ZTF, HET, LSST, LANSCE, NIF, Omega, etc.,
3. Computational techniques, codes, and resources, such as VPIC, FLAG, RAGE, Ristra, etc.

Specific Topics for new projects starting in FY23:

The overall theme is to conduct excellent cutting-edge research that enables breakthroughs in our fundamental understanding of Astrophysical Transients and their potential multi-messenger signatures. The likely engines for astrophysical transients are compact objects such as black holes or neutron stars, and stellar explosions and their signatures might include gravitational waves, electromagnetic radiation (e.g., gamma rays, x rays, optical and radio signals) or neutrinos. The nascent field of multi-messenger astrophysics uses the complimentary observations of more than one such "messenger" from a single object or event, potentially across a variety of wavelengths and particle types, to probe different aspects of the astrophysical system. Because these events are rich in physical phenomena that span most of physics' sub-disciplines, extracting multi-messenger information from these astrophysical transients is a complex task and requires innovative and cross-disciplinary uses of unique LANL observational, theoretical, numerical and experimental capabilities.

Since the discovery of gravitational waves from compact-object mergers, the area of Astrophysical Transients and their multi-messenger signals is a rapidly developing field in astrophysics and will likely remain important for at least the next decades. It attracts a large fraction of the workforce of the future, aiming to understand the many different aspects of these events and working on, e.g., ground- and space-based x-ray or gravitational-wave observations, theoretical modeling of dense matter and extreme astrophysical environments, computational simulations, data science, particle physics, atomic physics, instrumentation and experiments. Most of these subjects are tied closely to LANL expertise. Transients connect much of the natural phenomena observable in our universe to similar physical processes in LANL programmatic areas of the high temperature and pressure, often turbulent physical regimes, while being at the forefront of current astrophysical research, and having the capability of attracting and retaining the brightest minds to Los Alamos.

LANL is ideally suited to dominate this emerging astrophysics theme, especially with its existing capabilities and expertise in integrated systems (combining physics studies, experiment, computational work and detector development). This also ties well with multi-physics efforts within LANL's Advanced Simulation and Computing effort.

Relevant research in this Focus area includes applications to neutron stars, pulsar wind nebulae, supernovae, fast radio bursts, gamma-ray bursts, gravitational wave sources, black hole formation, jets and flares, signatures from exoplanetary systems and protoplanetary disks, etc. In particular, a huge potential for new discoveries might be realized due to the planned start of the next gravitational-wave observing run O4 in mid-December 2022. Hence, the following specific science topics are chosen for FY23:

1. **Developing Cross-Disciplinary Capabilities.** Projects that tie together two or more existing LANL capabilities, e.g., in theory, observation, instrumentation, simulation or

data science, to understand aspects of multi-messenger signals originating from astrophysical transients that cannot be elucidated by one discipline alone.

2. **Extending LANL's Unique Capability base.** Projects that advance existing or create new individual capabilities that contribute to new missions and facilities necessary to understand Astrophysical Transients, including but not limited to:
   a. Applications of ASC codes to problems focused on astrophysical transients, e.g., simulation codes that are suitable for Exascale Computing platforms to study complex astrophysical systems (e.g., including radiation magnetohydrodynamics, charge particle energization and transport connecting fluid and kinetic regimes).
   b. Data mining and machine learning for multi-messenger astrophysics.
   c. Optical, X-ray and gamma-ray transient detections (possible NASA missions).
   d. Theoretical studies of extreme astrophysical environments and data science applications to astrophysical transients.

3. **Electromagnetic Signatures of Multi-Messenger Transients.** Projects that focus on providing a better understanding of the engines behind electromagnetic signatures from astrophysical transients, which are crucial to answer fundamental questions about these events.

4. **Supporting upcoming NASA Astrophysical Mission participation**. Work that builds the capability for mission participation from either a theoretical or preferably an instrument development angle, for upcoming missions of interest to LANL (e.g., the All-sky Medium Energy Gamma-ray Observatory, the Transient Astrophysics Probe, the Lunar Occultation Explorer, or CubeSat missions through the NASA APRA or Pioneers programs). Applied projects in this area are encouraged to submit to PI-SATS (section 2.7).

Proposals that demonstrate strong cross-disciplinary collaborations and networking (both internally and externally) are particularly encouraged and will receive preferred funding and runtime.

2.2   Space Science

Space is one of the six leadership areas of the SoS pillar, and is also connected to the NPF pillar. The SoS strategy document lists goals for Space, and the topics chosen should relate to them. Space is also relevant to some of the goals of the Nuclear Event Characterization leadership area of the SoS pillar.
Refer to http://www.lanl.gov/science-innovation/pillars/sos/index.php for details.

The overarching research goals for this call in the Space Science focus area are to advance our understanding of the space environment (from the Sun to the Earth and beyond) and to advance our ability to operate systems in space that protect life and society. Space Science is distinct from other field, such as astrophysics or cosmology, in that Space Science utilizes in-situ measurements from high altitude rockets, balloons and spacecraft or ground-based measurements of objects and conditions in space.

Focus area
We particularly encourage proposals that: enhance LANL participation in future space science missions; make use of unique LANL datasets and modeling capabilities to enhance scientific

analyses of past and ongoing missions; and develop advanced cross-disciplinary capabilities that combine simulation, modeling, machine learning, data assimilation and data analysis concepts. The latter is particularly appropriate as some of the relevant models evolve toward exascale computing environments. The broad topic areas encompassing either existing or desired expertise at LANL in space science are: in-situ measurements and remote sensing capabilities, use of novel observing locations, active experiments in space, development of multi-scale modeling capabilities, exploration of short term (e.g. geomagnetic storms and substorms) and long-term (e.g. solar cycle) trends in LANL and other complementary datasets, and naturally and artificially disturbed ionospheres and magnetospheres.

It is strongly encouraged that proposals exploit unique resources at LANL which include:

    a. LANL satellite experiments and data
    b. LANL remote sensing experiments and data
    c. LANL space science computer simulation codes and algorithms.

Specific Topics for new projects starting in FY23:

The overall theme is to conduct cutting-edge research that enables fundamental breakthroughs in our understanding of the space environment through new missions, advanced cross-disciplinary modeling capabilities and innovative uses of unique LANL data or numerical modeling resources. From the above topic areas, the following focused science topics are chosen for FY23:

1. **Exploration and support for LANL participation in future space-based missions (including high altitude rockets, balloons and spacecraft):**
    a. Novel uses of LANL CubeSat technology.
    b. Remote sensing and in-situ measurements of the space environment, especially the low-energy particle populations.
    c. Applied projects in this area are encouraged to submit to PI-SATS (Section 2.7).

2. **Advance computational and data analysis capabilities for space plasmas:**
    a. Development of cross-scale data analysis and modeling capabilities.
    b. Development of cross-disciplinary capabilities (e.g., in-situ visualization, inference, AI, and communication modeling).

3. **Innovative uses of unique LANL data or numerical modeling resources:**
    a. Use of LANL energetic particle measurements and models to complement other scientific studies using NASA data.
    b. Use of LANL radio frequency or optical measurements to enhance scientific studies.

2.3   Planetary Science

Planetary Science is an interdisciplinary field that overlaps with many of the six leadership areas of the Science of Signatures (SoS) pillar, in particular Space Signatures and Chemical and Materials Signatures. The SoS strategy document lists goals for each of the six leadership areas, and the topics chosen should relate to them. Refer to http://www.lanl.gov/science-innovation/pillars/sos/index.php for details.

Planetary Science represents a high visibility area for LANL with high-profile ongoing and future NASA mission participation, and has been an exciting growth area at LANL. This focus area is a hybrid since the technology used is similar to the Space Focus area, while the scientific topics of planetary evolution and geology relate to the Geophysics Focus area.

The goal of the Planetary Science focus area is to advance our knowledge of planetary bodies beyond Earth, including surface properties and processes, internal structures, atmospheres, and evolution over time. Planetary Science utilizes data from a broad swath of platforms, including satellite, airborne, in situ, and laboratory measurements. Note that the PI-SATS topic area (section 2.7) now covers applied research, such as instrument development. Proposals seeking to advance our capabilities to design, build, and operate instrumentation in extreme environments may be submitted to PI-SATS with a Planetary Science focus.

Focus area

We encourage research in observation, measurement, and data analysis to understand planetary environments and processes. Projects should primarily address planetary bodies within the Solar System, although research on exoplanets will be considered. This focus area has significant overlap with other laboratory-relevant programs that may provide new techniques or novel applications of existing techniques for planetary problems. Although research that deals primarily with the Earth environment are not solicited, projects that utilize Earth analogs (including field studies) and laboratory experiments for planetary applications are encouraged. All NASA planetary missions make their data available to the public; projects that develop new analysis methods for these data are relevant to this focus area. Also of interest are projects that leverage unique Los Alamos facilities or capabilities. We strongly encourage proposals that pursue new, innovative scientific research and that enable future planetary missions.

Specific Topics for new projects starting in FY23:

1. Enabling planetary exploration. We invite teaming and strategy proposals that aim to partner LANL with other institutions to produce the technical basis to respond to upcoming NASA program calls. Proposed work may include laboratory, terrestrial analog, and/or data analysis projects. Also encouraged are proposals that would support research in areas related to upcoming NASA Participating Scientist solicitations. Proposals are encouraged in the following topics:

    a. Advanced computation techniques – this includes modeling of large-scale planetary processes as well as novel interface tools and uses of large planetary mission data sets to solve planet formation and evolution science questions, including chemical and physical states of planets. This also includes planetary dynamic processes, such as impacts.

    b. Analog studies – this includes fieldwork to planetary analog locations to collect and analyze materials that may be used for proof-of-concept studies or to valid remote sensing data. Development of Concept of Operations (ConOps) strategies using existing instrumentation are also relevant.

c. Experimental work – this includes fundamental laboratory experiments that address to outstanding planetary science objectives and unresolved questions.

d. Tool development – this includes software that enables fundamental research to be more efficiently and effectively accomplished.

2. **Support the Artemis lunar exploration program.** The Artemic program is a NASA-led initiative to return humans to the Moon by 2024. The goal is to establish a sustainable human presence on the Moon. Fundamental R&D that supports the goals of Artemis (e.g. studies on the lunar environment and/or resources relevant to the sustainment of human life on the Moon) should be submitted to Planetary Science while applied science (e.g. development of power supplies or additive manufacturing systems for In Situ Resource Utilization (ISRU)) should be submitted to PI-SATS. Due to the nature of the program, cross-collaboration with other CSES focus areas, e.g. Biological Systems, Geophysics, or Space Sciences are encouraged. See https://www.nasa.gov/specials/artemis/ for additional details on the Artemis program.

2.4   Geophysics

The Geophysics Focus Area is grounded in two of the lab's science pillars – *Integrating information, science, and technology for prediction (IS&T), and Science of Signatures (SoS).* The integration of information science and the evaluation of signatures provides an avenue for improving LANL's capability in *sensing* (improved extract of useful information from data and detection of small events in noisy data sets) and *predicting* (improved understand of the behavior of complex Engineered Natural Systems despite inherent uncertainty) - informed by observational efforts over variations in spatial or temporal scale.

See http://www.lanl.gov/science-innovation/pillars/ist/index.php for details; and *Science of Signatures (SoS),* refer to http://www.lanl.gov/science-innovation/pillars/sos/index.php for details.

The overall theme for the Geophysics Focus Area is research to help expand capabilities related to national security and energy security. Newly emerging interests among Federal agencies include next-generation AI and physics-informed machine learning (ML) techniques for proliferation detection and subsurface energy exploration, geophysical techniques to address border security, subsurface characterization for both near-surface and deep reservoir applications, robust data acquisition using remote methods in hazardous regions, and extending the footprint of our sensing capability by leveraging new sensor technology. Studies that integrate theoretical, observational, experimental, modeling and simulation efforts to address technical challenges in understanding the earth's surface and/or subsurface are of particular interest. Geoscience topics that play a fundamental role in supporting LANL's core mission include change detection for surface or subsurface signatures (temporal, chemical, biological, physical, geodetic), and anomaly detection for these signatures. Particularly important is building our capacity to integrate the independent signatures and apply their combined interpretation in novel environments to extend the reach of our models and detection capability.

Focus Area

The Geophysics focus area supports basic and applied research concerning the Earth's surface and lithosphere. This research includes numerical, experimental, and field studies of the structure, properties, processes, and dynamics of the Earth. It is strongly encouraged that proposals exploit unique resources at Los Alamos National Laboratory which include:

a) Sensor technology capabilities resident in C, EES, ISR, and N divisions
b) Los Alamos National Laboratory high-performance computing resources and/or innovative exploitation of LANL interfaces with modern cloud computing resources
c) Geochemical analyses facilities resident in EES and C divisions
d) Emerging field surveying advances such as UAV data acquisition

Specific Topics for new projects starting in FY23:

1. **Exploiting advances in robotics and automation for geophysical, geochemical or surface feature data**.
   a. New techniques in remote sensing, data acquisition and digital data analysis that provide information used in modeling of surface or subsurface characteristics.
   b. Extending our understanding of traditionally inaccessible areas as well as improving the efficiency and cost-effectiveness of surveys for dynamic change detection at multiple time scales. The Arctic is becoming particularly relevant through ongoing climate change and the new LANL participation in Arctic research centers. Seafloor geophysical research is also a critical area for development.
2. **New developments in subsurface energy science - particular emphasis in new R&D effort to address existing issues related to carbon sequestration & storage, geothermal energy exploration.** LANL has developed extensive capabilities for understanding the subsurface energy problems. That includes unique geophysical monitoring and imaging tools, predictive models of rock behavior, and surrogate models that can predict complex physics phenomena. The Lab has been adapting those capabilities to various applications of carbon sequestration & storage, geothermal resources. With recent advances in sensing and computing, and the availability of more and better geophysical data, we look for new innovations that would provide us with better solutions for addressing existing issues in subsurface energy science.
3. **Complementary or joint multiscale parameter evaluation** - exploitation of combined independent signatures to inform static and dynamic geophysical and geological models.
   a. Leveraging novel combinations of data types (for example, LIDAR images and subsurface resistivity derived from EM methods, combined to identify underground geological, anthropogenic or fluid-generated anomalies).
   b. Investigating both spatial and temporal relationships can inform new understanding of Earth processes.

2.5   Earth Systems

The Earth Systems focus area advances understanding and predictability of complex natural systems and the use and interaction of these systems by/with humans from the sub-surface to the

top of the atmosphere. It contributes to three of LANL's capability pillars: Science of Signatures (SoS), Complex Natural and Engineered Systems (CNES), and Information Science & Technology (IS&T). Within these pillars, Earth Systems addresses SoS Signatures of natural and anthropogenic phenomena impacting national security (SoS Challenge #3) with critical outcomes in Climate and Clean Energy, and CNES Non-Nuclear Threats (CNES challenge #3), with critical outcomes in Threat Reduction. Within IS&T, Earth Systems contributes to Computational Science and Data Science applied to subsurface networks, as well as acquisition, use, and modeling of large datasets for energy security, climate modeling, and terrestrial systems.

Focus Area

The Earth Systems focus area emphasizes invention promoting progress from understanding to predictive capability. Earth Systems focuses on process integration that allows up- and down-scaling within or between phenomena in complex natural systems. It promotes understanding of interactions between natural and human systems and developing capabilities to strengthen system security and resilience. Integration of experiments, data science, and modeling to fill outstanding gaps in prediction of environmental responses of sensitive and high-impact regions, or environmental responses affecting energy security, human health, security and resilience is encouraged.

It is encouraged that proposals exploit unique LANL and DOE resources such as:

a) LANL high performance computing
b) LANL developed or DOE-sponsored models such as HiGrad/FIRETEC, Amanzi-Advance Terrestrial Simulator, CICE and E3SM
c) LANL experimental, and user facilities such as LANSCE, the High Magnetic Field Laboratory, the Geochemistry and Geomaterials Research Laboratory (GGRL), radiological chemistry, and greenhouse capabilities
d) LANL 'omics capabilities and DOE-sponsored 'omics datasets
e) LANL and DOE-sponsored environmental datasets and monitoring systems such as NGEE Arctic, NGEE Tropics, ARM, SUMO, LTER-network and CAFÉ.

Specific topics for new projects starting in FY23:

1. **Managed systems**: Revolutionary approaches to identify signatures of change that allow 1) prediction of rate of change, 2) identification of potential system tipping points, 3) mitigation or evaluation of impacts of disasters in human regulated systems. These include urban areas, managed forests, grasslands or wetlands, and agricultural systems with particular focus on the water cycle, energy balance, and greenhouse gas emissions.
2. **Complex coupled processes:** Development of new methods or algorithms for scaling up and down, or integration of models, observations, and experimental studies to improve prediction of system responses to change, with an emphasis on climate change impacts on sensitive processes and regions, such as the Arctic, at multiple scales, and in response to catastrophic events such as drought, fire or epidemics.

3. **System security, resilience, and climate change mitigation**:
    a. New techniques to control and quantify climate change impacts including greenhouse gas emissions, flooding, food and water shortages, and erosion.
    b. Studies or new methods to evaluate the feasibility and long-term climate effects of new and existing climate change mitigation techniques, such as circular economy approaches, and alternate energy sources such as H_2.
    c. Emerging ideas for capture and mitigation of CO_2, CH_4 and N_2O emissions from natural and human-made systems

2.6   Biological Systems

The Biological Systems focus area advances the study of biological systems as part of complex natural systems. It transcends three of LANL's capability pillars: Science of Signatures (SoS), Complex Natural and Engineered Systems (CNES) and Information Science & Technology (IS&T) by addressing signatures of natural or human-induced phenomena on biological systems. This includes developing data-intensive computing approaches to advance a fundamental understanding of the behavior of microbial systems (across all scales) in response to environmental perturbations as well as their roles in bioenergy, bioremediation, carbon cycling, and the health of the human/environment interface. Many of the approaches rely on LANL's long-standing expertise and established strengths in microbiology, genomics, and bioinformatics. Furthermore, understanding the contribution of environmental reservoirs to the transmission of human disease could help to predict hot spots for emergence of microbial infections. For example, there is currently great interest in the survivability of viruses, such as the SARS-CoV2 virus, for understanding mechanisms of transmission and establishing disease detection methods in a community.

Focus Area

We emphasize approaches that integrate computation and experiment with independent data analysis approaches that can leverage advances in areas such as artificial intelligence and machine learning.

It is encouraged that proposals exploit unique LANL resources such as:

a. LANL high performance computing

b. DOE-sponsored climate models

c. LANL experimental capabilities in genomics and bioanalytical chemistry such as mass spectrometry, NMR etc.

d. Synthetic biology approaches to regulate biological systems for a re-directed purpose

Specific topics of interest for new projects starting in FY23:

1. **Multiomics and Bioinformatics:** new approaches to elucidate interspecies interactions.
    a. Between single or multicellular organisms in response to significant change in their environment. Identifying unique species-independent signatures.
    b. Algorithm development and novel data analysis routines and modeling

      c.   Soil ecology and patterns of microbial and biochemical processes

2. **Impacts and consequences:** approaches for understanding impacts of significant events or environmental change.

      a.   growth of harmful algal blooms as a result of adjacent agricultural practices or effluents; biofuel algal cultures and ponds as a result of microbial invasion.

      b.   extreme patterns or impacts of climate and environmental change on biological systems

3. **Disease dynamics at the human/environment interface:**

      a.   Establish methods of environmental testing to include highly complex environmental matrices. Understand persistence of pathogenic microbes in the environment and subsequent risks to the human population.

      b.   Visualizing, forecasting and understanding epidemic and outbreak dynamics.

2.7 PI-SATS

New for FY23, the Pipelining Initiative for Space Applied Technology and Science (PI-SATS) is a cross cutting NSEC topic that is also directly responsive to the LANL Institutional Space Strategy goals and objectives:

- IG-1. Enhance the effectiveness of LANL in serving national space interests.
  - IO-1.2. Increase attention to technology maturation and mission utility.
  - IO-1.4. Develop the current workforce of space professionals towards more effective service of national space interests.
- IG-2. Advance technical capabilities needed to overcome national space challenges.
  - IO-2.1. Advance fieldable data-to-information processing technologies.
  - IO-2.2. Advance sensing capabilities serving evolving national space interests.
  - IO-2.3. Advance capabilities to rapidly develop, demonstrate, and operationalize space technologies and systems.
- IG-3. Grow LANL contributions to national space endeavors.
  - IO-3.1. Increase the external visibility of LANL space contributions to promote recognition and future growth opportunities.
  - IO-3.2. Enhance the exploitation of broad and unique LANL capabilities towards future space growth opportunities.
  - IO-3.3. Grow the workforce of space professionals to enable increased LANL contribution to national space endeavors.

The Space Science & Exploration Portfolio Action Plan goals and objectives also relevant to PI-SATS are:

- PG-1. Pursue fundamental and applied R&D science and technology
  - PO-1.1. Workforce retention and professional development
  - PO-1.2. Strong foundation for mission development
- PG-2. Provide a clear pathway for sustainable Technology Readiness Level (TRL) development
- PG-3. Support and sustain space mission-related science and operations facilities critical to ongoing and future space missions

While fundamental R&D will remain within Focused Science Topics 2.1-2.6, the PI-SATS portfolio will contain applied projects from Focused Science Topics 2.1-2.6 (as well as topics below) relevant to enhancing our competitive advancement of TRL for space missions. All CSES program elements and calls may submit to PI-SATS. **Proposals must show a strong pipelining component and/or workforce development**, such as student or postdoc involvement, EC leadership, and/or engagement of LANL staff new to space technology development. The most competitive proposals will have excellent student and/or postdoc engagement.

Specific topics of interest for new projects starting in FY23:

Projects are sought that would leverage unique and emerging LANL space exploration capabilities (such as ISR's hand-launch balloon platform or use of accelerators in space), would strengthen LANL competitive advantage (such as concept studies for CubeSat/SmallSat science missions), and/or address national and global security concerns (such as competition in the cis-lunar environment). While any applied space-relevant project may be submitted from other Focus Areas (2.1-2.6), specific examples of topics appropriate and sought for PI-SATS are:

1. **Propulsion** – including development of new propellants, enhanced maneuverability of space craft, or new methods of impulse/thrust control
2. **Detectors** – including development of novel materials for detectors, data integration at the sensor, quantum sensing capabilities
3. **Advanced Manufacturing** – including production of needed components via In-Situ Resource Utilization (ISRU) of materials either on-orbit or on the lunar surface, or manufacturing processes in extreme environments
4. **Space Systems Engineering** – including development of technologies for autonomous spacecraft/space instrument operations, or new power sources that would enable new space science and exploration missions

2.8   Special Rapid Response Topics

For FY23 CSES has defined one Special Rapid Response (SRR) topic (see Section 3.3.2 for program description).

2.8.1   SRR Call for ML/AI in Complex Systems (MLAICS)

ML/AI is a data science, statistics and computer science research branch that can be used to learn about and simulate the behavior of a large variety of engineered and natural systems. It excels in finding complex connections between variables and parameters and using this information to predict system outcomes. Here we call for proposals that use ML/AI approaches to solve problems/challenges in and between complex systems relevant to all CSES focus areas. Cross-disciplinary studies that combine two or more focus areas are highly encouraged. **Cross-Division teaming of participants from 2 or more Divisions is required.**

Proposals of both ML/AI demonstrations on a new topic, and solutions for challenges where ML/AI has already been used are accepted.

The call is divided into these topical areas:

1. **Geophysics** - Development of ML and AI techniques to address subsurface security and energy problems within the Lab's global security and applied energy portfolios. Physics-informed AI/ML techniques for "decision support" in managing complex subsurface systems. Basic AI/ML research for better, faster, and more accurate geophysical modeling and characterization tools

2. **Earth Systems** - ML/AI methods for understanding climate change and impacts of climate change mitigation strategies including the human component.

3. **Planetary Science** - the remote exploration of planetary bodies requires advanced ML/AI systems to operate efficiently, and data collected by these missions can greatly benefit from such systems as well. Proposals that seek to advance operational capabilities for exploration platforms (e.g. satellite, rover, or airborne) using ML/AI techniques are encouraged as a *co-submission to PI-SATS*. Proposals that utilize existing planetary science datasets (e.g. those available on the NASA Planetary Data System (PDS)) to optimize data processing and/or data analysis and interpretation are also encouraged. These proposals must describe the advancements in understanding current science questions or new science enabled.

4. **Space Science** - ML/AI methods are fundamental for many regimes of space weather forecasting and are critical in improving the lead time of space weather predictions. We seek proposals that enable scientific discovery, deepen our scientific understanding, or advance operational space weather forecasting. *These proposals may also be co-submitted to PI-SATS*.

5. **Astrophysics and Cosmology** - ML/AI are innovative tools that can enable a better understanding of astrophysical transients and their multi-messenger emissions and decrease analysis times of observations. This can be important, e.g., for low-latency searches for counterparts to gravitational-wave signals. We seek proposals that use ML/AI techniques to facilitate a better modeling of the complex physics probed in astrophysical transients.

3 Program Elements

Updated in the FY23 call:

1. The *Rapid Response Program* (Section 3.3.1) has been extended to include Special Rapid Response Calls (3.3.2), and amended for a Round 2 call.
2. *Institutional Program Development* (RR-IPD) goes to no due date, Section 3.3.3.
3. The *Chick Keller Postdoctoral Fellowship* (Section 3.2), will accept nominations at the December 2021 and May 2022 quarterly, conditional on available funding.
4. *CSES Scholars* – supported by Rapid Response and/or Program Development, no due date, Section 3.3.4.

Current CSES program elements:

1. **Student Fellow Program**. Needs to address the CSES Focused Science Topics for this call. One call per year.
2. **Chick Keller Postdoctoral Fellow Program**. Needs to address the CSES Focused Science Topics for this call. Submissions through LANL Postdoc Program, up to two times a year.
3. **Rapid Response Program**. While alignment to the CSES Focused Science Topics is encouraged, this program element is open to all emerging scientific ideas in the CSES science disciplines. At least one selection during the FY, typically starting at the beginning of the new FY. A second round may be offered dedicated to supporting summer students. See the latest R&D Central Announcement for the most current information.
4. **Large University Program**. Needs to address the CSES Focused Science Topics. One call every three years**. (Not offered this year.)**

Each program element is described below and lists the typical maximum budget and the anticipated number of awards that can be made. Proposals requesting less than the maximum budget will have a competitive advantage.

All R&D programs described below are funded through a LDRD-DR project managed by CSES and are administered as tasks of this DR. As such, all work must adhere to LDRD rules as dictated by DOE Order 413.2C, particularly:

- All Tasks must be in the forefront areas of science and relevant to DOE/NNSA missions
- Tasks must not require the addition of non-LDRD funds to accomplish their goals – i.e. augmentation is not permitted

Details of the proposal writing and submission process are in Section 4.

3.1 Student Fellow Program

University and LANL collaborative research program. *Open to Graduate, PostBacc and PostMasters Students*. Frequency of call: Once a year. **Tentative timeline and dates below. See the latest R&D Central Announcement for the most current information.**

Submission: April, 2023
Selections: May, 2023
Program New Starts: at start of FY24

The number of new starts anticipated in the CSES Student Fellow Program is approximately 4-6 across all Student types and all CSES discipline areas.

CSES will organize a CSES Focus area symposia in the September/October timeframe for presentation of all projects in a given focus area. *Presentations, publications, and copies of any resulting proposals submitted should be sent to CSES.*

3.1.1 Graduate Program Outline

- Each proposal is required to have a University Student Researcher, a University Principal Investigator (PI) and a Los Alamos National Laboratory PI/Mentor.
- The University Graduate Student Researcher must be enrolled in a Graduate program, have an identified thesis topic and university mentor, and have passed their qualifiers if a Ph.D. student.
- The University PI may be any university scientist entitled by the university to be a Ph.D. program supervisor.
- Visiting scientists, adjunct faculty, and postdocs do not qualify as University PIs.
- A Los Alamos National Laboratory PI/Mentor is any Los Alamos Staff Member.
- The collaborative University-LANL research project will typically consist of a jointly agreed Ph.D. thesis research project.
- **Projects are typically 2-3 years in length.**
- **The Los Alamos National Laboratory PI/Mentor must submit the proposal.**

The objective of this program is to support a University Student Researcher to perform part of their thesis work at Los Alamos National Laboratory in close collaboration with their Los Alamos PI.

The funding profile for this program is flexible, but typically consists of four parts:

1. Support for the University Student Researcher to spend a significant fraction of the year at Los Alamos. GRA support and travel for a ~16-week stay at LANL cost ~$35-40K. Note that the student can be at LANL at any time(s) during the year, and while summers are typical, we encourage other times as much as possible. Preferred by CSES would be a spring or fall timeframe.
2. Support for the Los Alamos PI to devote a significant fraction of their time to the collaborative research project and student mentoring (~$10-15K).

3. Support for the Los Alamos PI to visit the university for periods of 1-2 weeks/year (~$10K travel).
4. Support to the University PI to visit LANL for periods of 1-2 weeks/year (~$10K travel).

The individual funding items are negotiable with a total cap for this program not to exceed $70K/year of LDRD-type funding.

This program element does not support direct university funding (i.e. no subcontracts are awarded) of any kind unless exceptional circumstances are met (see below as an example). Note that while no direct funds flow to a LANL university partner, there are benefits to the University PI and the student:

a. The University Student Researcher requires no university financial support during the time spent at LANL (typically ~4 months/year).
b. LANL GRA rates are typically higher than many Universities' graduate salaries, helping to attract students to both the university and the CSES Student Fellow Program.
c. Exposure of the student to an outside organization with many career opportunities for post-doctoral work and beyond.
d. University PI travel support for extended LANL visits.

Only under exceptional circumstances, when some of the required Ph.D. thesis work cannot be done at LANL (e.g. use of a unique university facility), will CSES be prepared to write a university subcontract for that part of the work. This must be clearly described in the proposal, with justification for why no alternatives are possible to complete the work.

Successful proposals need to include some form of matching support for the student from their universities or other institutions. Acceptable forms of matching support may be, but are not restricted to, those accepted by the National Science Foundation or other Federal research funding agencies.

Note that "matching support" here refers to university support (e.g., an assistantship provided by the university, waived or reduced academic fees, and travel or conference support) for the student at and from their university, to support the student outside of the time covered by the Student Fellow project at LANL. The Student Fellow award is not intended to cover a student's full annual university-related expenses.

Proposals may be submitted for collaboration with any national or international university. Collaborations with New Mexico universities are particularly encouraged and may qualify for support through the New Mexico Consortium, such as housing help, travel help, or sabbatical funds for the student's university mentor.

Expectations

The Graduate Program's aim is to build and foster new and/or long-term relationships with University Researchers. This program is to be viewed as a stepping-stone for both the student (as a prospective LANL postdoc or staff member) and the LANL and University PI to build a strong

relationship. The work performed here should be able to form the basis for a follow-on joint proposal by the LANL and University PI to a Lab internal or external funding source.

If offered and applicable, the student should be encouraged to participate in one of the CSES or other NSEC summer schools. The University PI is encouraged to offer a lecture in a NSEC summer school as part of their visit to LANL. The university PI is also encouraged to give a topical seminar on their research area during their visit to LANL.

3.1.2   PostBacc Program Outline

- Each proposal is required to have a Post Baccalaureate Student Researcher, and a Los Alamos National Laboratory PI/Mentor.
- The Post Baccalaureate Student is encouraged to continue with Graduate studies after their PostBacc or other career goals that align with LANL pipelining and external partnerships.
- The LANL PI / Mentor must be willing to use their academic and laboratory connections to help place the PostBacc into a downstream academic Graduate Program, assist on the path to conversion, and/or other career enhancing activities for the student.
- The LANL PI/Mentor and PostBacc student are encouraged to utilize other CSES programs for downstream Graduate work (e.g. the CSES Graduate program, Section 3.1.1)
- **Projects are typically 2 years in length.**
- **The Los Alamos National Laboratory PI/Mentor must submit the proposal.**

The objective of this program is to support a PostBacc Student Researcher and to help them be placed into a graduate program or staff career path of interest to LANL.

The funding profile for this program typically consists of two parts:

1. Support for the PostBacc Student Researcher for 50% of their annual cost (~$35-40K). A 50% cost sharing from line or program is required.
2. Support for the Los Alamos PI/Mentor to devote a significant fraction of their time to the collaborative research project and student mentoring (~$10-15K).

The total cap for this program is not to exceed $55K/year of LDRD-type funding.

Expectations

The PostBacc Program's aim is to build and foster long-term relationships with Students that have shown an interest in working at LANL. This program is to be viewed as a stepping-stone for both the student and the LANL PI/Mentor or a continuing relationship that follows the student through down-stream Graduate studies and possible downstream Postdoctoral or employment opportunities at LANL.

If offered and applicable, the student should be encouraged to participate in one of the CSES or other NSEC center's summer schools.

3.1.3 PostMasters Program Outline

- Each proposal is required to have a Post Masters Student Researcher, and a Los Alamos National Laboratory PI/Mentor.
- The Post Masters Student needs to have expressed a desire to continue with Ph.D. studies after their PostMasters at LANL or other career goals that align with LANL pipelining and external partnerships.
- The LANL PI / Mentor must be willing to use their academic and laboratory connections to help place the PostMasters into a downstream academic Graduate Program, assist on the path to conversion, and/or other career enhancing activities for the student.
- The LANL PI/Mentor and PostMasters student are encouraged to utilize other CSES programs for downstream Ph.D. work (e.g. the CSES Graduate program, Section 3.1.1)
- **Projects are typically 2 years in length.**
- **The Los Alamos National Laboratory PI/Mentor must submit the proposal.**

The objective of this program is to support a PostBacc Student Researcher and to help them be placed into a graduate program or staff career path of interest to LANL.

The funding profile for this program typically consists of two parts:

3. Support for the PostMasters Student Researcher for 50% of their annual cost (~$45-50K). A 50% cost sharing from line or program is required.
4. Support for the Los Alamos PI/Mentor to devote a significant fraction of their time to the collaborative research project and student mentoring (~$10-15K).

The total cap for this program is not to exceed $65K/year of LDRD-type funding.

Expectations

The PostMasters Program's aim is to build and foster long-term relationships with Students that have shown an interest in working at LANL. This program is to be viewed as a stepping-stone for both the student and the LANL PI/Mentor for a continuing relationship that follows the student through down-stream Graduate studies and possible downstream Postdoctoral or employment opportunities at LANL.

If offered and applicable, the student should be encouraged to participate in one of the CSES or other NSEC center's summer schools.

3.2 Postdoctoral Program

3.2.1 Chick Keller Postdoctoral Fellow

LANL Named Postdoctoral Fellow program. Frequency of call: Typically, twice per year; at the December and May LANL Postdoc program Quarterly meetings, dependent on funding. Prospective applicants are advised to check with the CSES Leader to confirm whether applications for postdoctoral fellows are being accepted for a particular call.

Submission: Conforming to the LANL Postdoc's Office Quarterly meeting schedule
> December Review - Submit early November, outcome mid-December, starts early in calendar year
> May Review - Submit early April, outcome mid-May, starts next FY
> http://www.lanl.gov/careers/career-options/postdoctoral-research/postdoc-program/postdoc-appointment-types.php

Selections: At the Quarterly meetings.
Program New Starts: As soon as both Postdoc Candidate is available and funding permits.
Program duration: 2-year maximum or 1 year for a 3rd year extension of an existing CK Fellow.

CSES may have a roster of up to 12 CK Fellows at any one time, about 1-2 per focus area. Approximately 2-4 new CSES Postdoctoral Fellows can generally be funded each year, although this number will fluctuate with available funding and number of applicants each year.

CSES will organize a CSES Focus area symposia in the September/October timeframe for presentation of all projects in a given focus area. Presentations, publications, and copies of any resulting proposals submitted must be sent to CSES.

Program Outline

This program is aligned with the Lab's prestigious named Postdoctoral Fellow Program (Director's, Distinguished, Agnew, Metropolis and now with the Chick Keller Fellows in Earth and Space Sciences). Candidates must meet the fellow's quality bar of the postdoctoral committee in order to be considered for the Chick Keller fellowship. CSES solicits postdoctoral research proposals from Los Alamos National Laboratory mentors for postdoctoral research on a new, independent, revolutionary scientific idea in the CSES focus areas. The emphasis here is on supporting new, emerging scientific areas rather than supporting postdocs in ongoing research areas.

- **Support is limited to 50% of the postdoc's salary in the first two years of the postdoc appointment. Third year support is limited to 25% of the postdoc's salary and is subject to a new proposal.**
- New postdocs or postdocs in their first year at Los Alamos are eligible. Preference will be given to new postdocs starting at Los Alamos.
- *While the proposed CSES work can be related to the research funding providing the balance of support to the postdoc, it cannot directly support tasks from the statement of work of that research funding.*
- **A Los Alamos National Laboratory Mentor must submit the proposal**. It is expected that the named postdoc provides a significant contribution to the writing of the proposal.

Expectations

The CSES postdoc program is designed to strongly align with LANL mission and downstream employability of the postdoc is a strong consideration.

The LANL mentor is expected to have identified funding from other program resources prior to submission to the CSES Postdoctoral Fellow Program. For 3rd year postdocs a viable path to conversion is expected to be in place, with strong programmatic support, which is why the CSES support level drops to 25%.

Eligibility

The CK fellows follow the general eligibility rules for Fellows as set out by the LANL postdoc program (https://int.lanl.gov/employees/postdoc-program/package-requirements/index.shtml).

Note that while CK Fellow applications can be submitted for a current LANL Postdoc within one year of hiring on at LANL, for Fellow application the Postdoc Office Package submission deadline must still be within the 5-year limit of completing all requirements for the Ph.D.

3.2.2 Research Associate

All Chick Keller candidates submitted to the postdoc office undergo an additional review by an internal CSES panel. Candidates that pass the Postdoc Program's Fellow screening process and that are also selected by the CSES panel will be awarded Chick Keller Fellowships, candidates that do not pass the Postdoc program's Fellow screening process but are selected by the CSES panel will be awarded as CSES Research Associates (RAs).

The RA is awarded where there are strategic programmatic considerations for a given candidate that make that candidate a particularly good fit for CSES. The RA operates in an analogous fashion to the CK fellow program. There is no special application process for the RA position; candidates should apply through the normal CK Fellowship (Section 3.2.1).

3.3 R&D and IPD Programs

3.3.1 Rapid Response Program

Small LANL project support. Open to All LANL staff and Postdocs to propose as PIs, and can involve Graduate, PostBaccs, and PostMasters students. **Timing and dates below are tentative. See the latest R&D Central announcement for the most up to date information.**

Rapid Response Research & Development (RR-R&D)
Frequency of call: once or twice per year, at the end of the FY for a Q1 start and in February/March for a Q3 start.
FY23 Submissions:
> Round one - September, 2022 for October, 2022 Start
> Round two - March, 2023 for April, 2023 Start
> Round two supporting summer students - March, 2023 for April, 2023 Start

Special Rapid Response Research & Development (SRR-R&D)
Frequency of call: typically once per year.

FY23 Submissions:
                    September, 2022 for October, 2022 Start

Selections: Two weeks after submission. Projects must be completed in FY23.

At each selection date, proposals will be divided into three categories:

1. Fund Now – these will go forward immediately
2. Defer – these will remain on the books for this FY and be considered again at either the next selection date (together with any new proposals received), or if new funding becomes available. However, the PI is encouraged to resubmit the proposal at a new call, taking advantage of reviewer comments and discussion with the Focus Lead to strengthen the proposal. *The deferred status expires at the end of the fiscal year at which point the proposal must be resubmitted to the new FY call*.
3. Do not fund – proposal is denied and can only be submitted again after a significant re-write.

We anticipate that ~12 S/RR-R&D studies may be supported throughout the fiscal year across all focus areas, although this number will fluctuate depending on available funding and number of proposals submitted. If deemed of sufficient quality and promise, S/RR may be considered for follow-on funding in the next FY. Projects with great student/postdoc involvement will be given priority, particularly those that could transition to a Student Fellows.

CSES will organize CSES Focus Area Symposia in the September/October timeframe for presentation of all projects in a given focus area. Presentations and copies of any resulting proposals submitted need to be sent to CSES.

While proposals along the lines of this call's focused science topics are encouraged, the program element is open to all new ideas relevant to the CSES discipline areas.

The Rapid Response Research and Development Program (RR-R&D) is funded out of the CSES LDRD (Funding type: LDRD) portfolio and <u>***can***</u> be used to support technical work.

Program Outline

CSES solicits proposals for "~three or six-month" studies that support small but crucial projects in support of new, high-risk ideas, feasibility studies or other basic R&D in support of upcoming proposal opportunities across the spectrum of LANL programs, and in the CSES Focus Areas. Scientific feasibility analyses are reserved for revolutionary scientific ideas that are mission relevant, at their early stage of development, and involve a multi-disciplinary approach.

Funding maximums for both RR and SRR are $35K for a 3-month and $70K for a 6-month study (as guideline examples of timeframe – projects are conducted throughout the FY), and the program is open to Los Alamos National Laboratory Technical Staff Members and/or Los Alamos National Laboratory postdocs.

We encourage new ideas and high-risk concepts – and here failure (showing what will not work) is considered a success. Work should be aimed at upcoming new proposal opportunities and other LANL mission or strategic initiatives.

CSES will organize a CSES Focus area symposia in the September/October timeframe for presentation of all projects in a given focus area and for each RR and SRR-R&D topic. If desired by CSES Seminar Series Leads, PIs will also be asked to present their work in topical Seminar areas. Presentations and copies of any resulting proposals submitted need to be sent to CSES.

3.3.2 Special Rapid Response R&D

The Special Rapid Response Research and Development Program (SRR-R&D) is funded out of the CSES LDRD (Funding type: LDRD) portfolio and **_can_** be used to support technical work.

Program Outline

This is a special subset of the normal RR-R&D program designed to address special topical and strategic opportunities for which there is a desire to nucleate LANL capability. Topics are more narrowly defined typically multi-disciplinary and straddling more than one of the CSES science disciplines or related disciplines, if not multi-Center across NSEC.

CSES will define a few SRR-R&D topics in each call for proposals, but is open for new SRR topics that may arise throughout the FY and for which new funding can be identified.

All projects in an SRR-R&D topic are eligible for follow on support if they demonstrate sufficient progress on their project and the benefits of follow on support to advancing the project, subject to available funding. Projects are formally evaluated at the end of year Symposia and by the CSES leadership team. The form of follow on funding is flexible, but student involvement is particularly encouraged and conversion to a Student Fellows award is an option. The intent is to support new and promising research topics/ideas to the point of maturity that makes them eligible for other, larger funding opportunities and programmatic support outside of CSES.

3.3.3 Institutional Program Development

The Institutional Program Development Program (IPD) is funded out of the CSES G&A (Funding type: Indirect) portfolio and **_cannot_** be used to support technical R&D work.

Program Outline

CSES solicits proposals for appropriate indirect support. We further invite proposals that meet the requirements laid out in the TED (Technology Evaluation and demonstration) Fund Call, specifically projects that catalyze innovation in the CSES Science discipline areas. This includes technology assessments; activities performed to evaluate and assess the applicability of capabilities and existing technologies for institutional or multi-program use. Exploring whether

known scientific or engineering technologies, approaches or techniques are applicable to current and emerging needs:

1. Analysis of practicality
2. Technology evaluation – assessing capabilities of existing technology, including reuse in new applications or at extended scales
3. Demonstrations where the cost and benefits of a system are being validated for a specific use case.
4. Other activities appropriate for indirect funding such as workshops, as proposal writing, white paper idea development, literature searches, publication costs, and collaborative visits, etc.

Again, no research development can be undertaken in these projects, as the objective is to demonstrate performance for existing technologies, not to develop new technologies.

Funding maximum is up to $45K, though projects are typically funded in the $5-$10K range. The program is open to Los Alamos National Laboratory Technical Staff Members and/or Los Alamos National Laboratory postdocs. Requests are evaluated as received throughout the FY, with no due date.

Expectations

The PD work is expected to be strongly aligned with upcoming proposals opportunities or other LANL strategic initiatives.

3.3.4   CSES Scholars

This work may be funded by a combination of R&D and/or Indirect funds, depending on the work to be performed (see sections 3.3.1 - 3.3.3)

Program Outline

CSES in its previous incarnations as CSES and IGPP historically supported an occasional visiting scientist. This element is now formalized for FY 23 as "CSES Scholars," supporting either academic visitors on sabbatical to LANL or LANL staff extended visits to universities. Priority will be given to LANL staff or university researchers who have or are seeking Joint Appointments.

Funding maximum is defined in Rapid Response and Program Development sections (3.2.3 and 3.2.4). Cost sharing outside of CSES required.

Expectations

The Scholar's work is expected to be strongly aligned with upcoming proposals opportunities or other LANL strategic initiatives, and should pave the way for expanded collaborative opportunities.

3.3.5   NASA Mission teaming and planning

CSES received a small windfall in the form of donated prize money from Michelle Thomsen's (ISR-1, retired, Lab fellow) 2019 National Academy of Sciences (NAS) Arctowski Medal. Award. Michelle set up the following statement of work for these funds:

"The incoming funds from the National Academy of Sciences will be used to support conference, workshop and seminar travel for scientists and instrument engineers in the field of Space and Planetary Science, with the aim of fostering new and existing collaborations to eminent research universities and institutions. The funds will be administered through NSEC at the Center for Space and Earth Science supporting CSES workshops, conferences, and seminar series."

We invite here special Program Development (PD, see Section 3.3.1) proposals specifically aimed at teaming and brainstorming activities with outside institutions with the aim of positioning and partnering LANL for new opportunities in NASA Missions.

The NAS funds can be used for inviting and supporting travel by external SME's to LANL, particularly for small workshop attendance.
RR-IPD funds can be used to support the organizational activities by the LANL proposer/team.

Proposers are asked to prepare a normal PD proposal in which they specifically list and cost the set of external SME's supported by NAS funds.

3.4   Large University Program (not offered in this call)

Frequency of call: dependent on funding.

PI's are encouraged to plan ahead for a submission to this program element by building new relationships with prospective university partners through the Student Fellow Program.

Program Outline

Each CSES discipline will have the opportunity in this program to propose for a single, large three-year project that addresses a discipline science thrust area as identified in Sections 2.1-2.7. This large program will be structured around 2-3 Student Fellow PostGrad Programs (Section 3.1) involving an intensive collaboration with a single university. Total budget is not to exceed 180K/year. This project can involve up to three LANL Investigators (one of them identified as Project Lead, PL) and up to three University Investigators.

It is anticipated that at most 1-2 Large University Programs will be awarded in each 3-year cycle, with at most one Large University Program per CSES focus area.

Expectations

The main purpose for this program element is to establish new and significant university partnerships in new areas of research that LANL wants to develop. The goal is to provide access

to LANL to areas of scientific expertise that are weak or lacking at the lab but for which there is a clear strategic need.

The Project Lead is expected to present progress in the form of a presentation per year, given as part of the Focus Area Symposium, typically held in October. Talks presented by the Student Fellows are preferred and depending on the scope of the project more than a single talk is encouraged.

The seminar presentation needs to be submitted to CSES and serve as the technical report on the project.

4 Proposal Process

4.1 Proposal Preparation

Each program has unique proposal requirements described below. Please refer to your specific program element to be sure your proposal is in compliance, particularly within page limits. Proposals not in compliance with the requirements may be returned without review. PIs are strongly encouraged to read the review criteria in order to enhance the potential success of their submissions.

4.1.1 Student Fellow Program

Cover Sheet. Please use the CSES fillable PDF cover sheet, available on the CSES website, CSES.lanl.gov. To ensure receipt of the proposal, please send completed package to CSES@lanl.gov and the Focus Area Lead(s) relevant to your topic.

Proposal Package. Use the following formatting outline for the proposal, with a **five page** limit for sections I-VI, no page limit for references (VII), **one page** limit for VIII (budget), and **one page** per staff/PI bio sketch (IX).

I.   Theoretical, numerical, or experimental activity. Methods used, history of problem, scientific debate, hypotheses to test
II. Any relevant leveraging or necessary coordination, e.g., other projects or facilities
  i.   Building upon previous CSES RR/SRR projects
III. Resources to be used in the project such as resources at Los Alamos National Laboratory, at the university, if relevant
IV. Statement of Work (Tasks to be performed, Milestones)
V.   Proposing Team
  ii.   Role of LANL PI, including efforts at mentoring
  iii. Role of University Principal Investigator, if applicable
  iv.   Role of student
  v.   Other participants
  vi.   If applying to PI-SATS, pipelining and/or workforce development components
VI. Significance and timeliness
  i.   How does this research support the CSES focused science topics?
  ii. What is the significance of the project? Why Now? Who will use the results?
VII. References
VIII. Budget summary (1 page max). *PEM sheets not required*. Totals by fiscal year and cumulative for multiyear projects. See Appendix A: Scientist/Researcher Student Salary Structure and Appendix B: Indirect and LDRD Salary Rates for budget information to help you estimate your T&E on your project.
  i.   Support for the University Student Researcher to spend a significant fraction of the year at Los Alamos.

    ii.   Support for the Los Alamos PI to devote a significant fraction of their time to the collaborative research project.
    iii.   Support to the University PI to visit LANL, if applicable
    iv.   Other Travel
    v.   Supplies & Equipment
  IX.   Biographical sketches of PIs including already identified student, ~1 page each. Note: Identification of a named student is desirable but not essential for top tier selection.

4.1.2   Chick Keller Postdoctoral Fellow Program

New CK Fellow Applications

New Chick Keller Fellowship application will be administered through the Los Alamos Postdoc Program in an analogous manner to the already existing named Postdoctoral Fellow programs (Director's, Agnew, Metropolis). Please prepare a normal Postdoc Named Fellows package as outlined by LANL's PostDoc program.

https://www.lanl.gov/careers/career-options/postdoctoral-research/postdoc-program/postdoc-application-process.php

A LANL mentor needs to submit the package, together with the CSES memo (see below).

CSES memo

As part of your submission you are required to submit a one-page CSES justification memo. This memo needs to address the following:

- How the proposed research contributes to the focused science topics of CSES (includes PI-SATS)
- How the proposed CSES 50% work differs from the main Postdoc Research proposal
- What the envisaged funding mix is for the postdoc

Because of the 50% CK / 50% Other dual funding nature of the CK Fellowship Proposers MUST exercise care in differentiating the work scope between the work performed for the two funding sources. In the required CK memo, the distinct work scope of the CSES related work must be clearly identified and be distinct form the general Postdoctoral research statement. Topics may be related, but cannot have overlapping work statements.

As one of the objective of the CK Fellow Program is pipelining for staff conversion, CSES also looks at the particular mix of funding, which should be highlighted in the memo. The 50/50 funding objective is to have one half of the funding come from somewhat more programmatic and more long-term source at LANL, which ideally should help with conversion prospects for the PostDoc, while the CSES funding covers more basic research aspects. A double basic research funding split may be considered for exceptional PostDocs.

<u>Third year CK Fellow Applications:</u>

Follow the normal PostDoc program directions for submitting the third year extension memo (http://int.lanl.gov/employees/postdoc-program/mentors/extensions/third-year-extensions.shtml), and submit this memo to both the postdoc office and to CSES@lanl.gov.

In addition, a CSES memo as outlined above also needs to be submitted to CSES. Third Year CK funding is generally intended for PostDocs that have a clearly identified path towards conversion.

4.1.3   Rapid Response/Special Rapid Response R&D

4.1.3.1   R&D Program

Cover Sheet. Please use the CSES fillable PDF cover sheet, available at the CSES website, CSES.lanl.gov. To ensure receipt of the proposal, please send completed package to CSES@lanl.gov and the Focus Area Lead(s) relevant to your topic. Please download the PDF to fill in and submit, do not fill in on the browser.

Proposal Package. Use the following formatting suggestions for the main body, limited to **two pages** of text and figures (for Sections I through V), no page limit for references (VI), **one page budget justification for SRR only**, plus **one page** biographical sketches for each team member (VII).

I.   Statement of problem to be addressed (please indicate any time constraints, e.g. proposal deadlines).
II.   Statement of Work
III.   Significance and Timeliness
IV.   Description of follow on support and funding opportunities (beyond CSES) appropriate to the work with relevance to lab mission and future programmatic support
V.   If applying to PI-SATS, pipelining and/or workforce development components
VI.   Short budget justification, **included in the two page limit for RR, can be a full additional page for SRR**. *PEM sheets not required.* See Appendix A: Scientist/Researcher Student Salary Structure and Appendix B: Indirect and LDRD Salary Rates for budget information to help you estimate your T&E on your project. NOTE:
RR-R&D and SRR-R&D proposals should be priced with LDRD labor rates
RR-IPD proposals should be priced with Indirect labor rates
VII.   References
VIII.   Bio sketches. No more than 1 page per team member

4.1.3.2   IPD Program

Submissions to the IPD program will utilize the template common to Division and Program Offices. Please contact the CSES Program Coordinator for a copy of the template. See Section

3.3.3 for description of the IPD Program Element. To ensure receipt of the proposal, please send completed form to CSES@lanl.gov and the Focus Area Lead(s) relevant to your topic.

4.1.4 Large University Program

Since this program element consist of essentially three bundled Student Fellow Programs, the proposal guidelines are the same as for the Student Fellow Program, with the following changes / additions:

1. The main body of the proposal can be up to 10 pages.
2. Budget justification can be up to 2 pages
3. The project should have a LANL and University Lead PI but can include up to two additional LANL and two additional University Co-Is.
4. The LANL lead PI takes responsibility for the overall execution of the program and submits the proposal.

4.1.5 General Instructions

While CSES supports publication page charges, such charges are NOT to be included in the proposed budget. PI's are asked to send an email to the CSES Director requesting funds on an as needed basis to cover publication page charges.

4.2 Submission process

Proposals (cover page and completed proposal package) must be submitted by email to be received by the proposal's program element deadline. **See the latest R&D Central announcement for the most up to date deadline information.**

NOTE: All Student Fellow, Rapid Response, Special Rapid Response, and Large University proposals must be submitted to CSES through the Los Alamos Principal Investigator. Chick Keller Postdoc packages are submitted to the LANL postdoc office, including the required CK CSES memo.

Please mark the subject line of your email with the program element and science discipline area, for example:

Subject: CSES Graduate Student Fellow/Astro Proposal Submission

Send to: CSES@lanl.gov with copies to the appropriate discipline leader:

- Astrophysics & Cosmology   (Ingo Tews; itews@lanl.gov)
- Space Science   (Vania Jordanova; vania@lanl.gov)
- Planetary Science   (Ann Ollila; amo@lanl.gov)
- Geophysics   (Youzuo Lin; ylin@lanl.gov)
- Earth Systems   (Sanna Sevanto; sanna@lanl.gov)
- Biological Systems   (Jeanne Fair; jmfair@lanl.gov)

- PI-SATS   (Ann Ollila; amo@lanl.gov and Peter Bloser; pbloser@lanl.gov)

A confirmation of receipt will be sent by email to the Principal Investigators of each proposal.

4.3   Review Process

All proposals undergo peer review. There is a separate review panel for each discipline area or Special Rapid Response Call, which consists of the Focus Lead or SRR coordinator and their team, and which is augmented by external review members of subject matter experts primarily from academia when needed.

4.3.1   Review Criteria

For R&D proposals, we follow here a similar set of criteria in the spirit of the Laboratory's LDRD review process, scaled and adjusted to the size and scope of CSES projects and programs, see Table 1.

Table 1: RR-R&D Criteria

	Mission Agility (15%)	**Technical Vitality (50%)**	**Research Approach (15%)**	**Follow on and Development (20%)**
	Will the proposed work create new S&T approaches and capabilities that are relevant for Los Alamos emerging missions?	*Is the proposed work innovative and creative? Will it make an impact on its technical field as appropriate for the scale of the investment? Is the work high-risk, high return?*	*Does the proposal demonstrate sufficient background research and knowledge to conduct the work? How well conceived and organized is the proposed activity?*	*Is there a well identified and feasible sponsor for follow on proposals? Does the proposal provide opportunities for pipelining and/or leadership development?*
5	High quality in nearly all respects, should be supported if at all possible.	Potential for fundamental advance and/or a new approach to expanding our knowledge; and/or new methods, processes, tools or devices. **Work is truly innovative and high-risk.**	Clear and well-designed research approach. Background is well justified and clearly described.	Appropriate follow on sponsor identified, good chance of success. Excellent student/EC involvement and opportunities for growth.
3	Very Good proposal with important objectives	Work may need to be distinguished more clearly from previous	Research approach may be somewhat unclear, or of incompatible scope.	Some follow on sponsors mentioned, moderate chance of success. Some

| | | efforts. Innovation less than striking. | | pipelining/workforce development. |
| 1 | Lacking in one or more critical aspects. Lack of innovation, key issues not addressed, no follow on, no workforce development, unclear plan - rendering the proposal uninteresting. | | | |

For Institutional Program Development proposals we use the criteria as listed in Table 2 below, again using the 1-5 scale for ranking.

Table 2: IPD Criteria

	Overall	Application / Impact on Mission	Project Approach
5	Excellent with at most minor strategic weaknesses, deserves highest priority for support	Potential for high impact on mission, Targets an important opportunity	Clear and well-designed demonstration approach
3	Very Good proposal with important objectives	Potential impact clear but limited	Approach may be somewhat unclear, or of incompatible scope.
1	Lacking in one or more critical aspects. Approach not feasible, or impact lacking, rendering the proposal uninteresting.		

In particular, reviewers are asked to judge proposals on these additional points specific to CSES:

- This call establishes the Mission relevance of the CSES focused science topics, and the proposal must clearly address these topics and show relevance to CSES goals.
- **CSES programs are intended to be innovative and risk tolerant**. Proposals clearly need to address a new and innovative aspect, and while high-risk is encouraged, the proposal needs to justify these risks.
- CSES programs support NSEC's goals of growing university interactions, educating present and future scientists and engineers, and recruitment or retention of technical talent.
  - o **Student Graduate Fellow / Large University Proposals –** show how the project will be used to build university interactions and if there is a viable onward path for the students into LANL.
  - o **Student PostBacc and PostMasters Fellow –** show path towards into a downstream academic Graduate Program or as LANL staff
  - o **Rapid Response –** show how this project aides the career development of its PI.
  - o **Chick Keller Postdoc –** show that the Postdoc's work is in an area that could provide a "landing zone" for conversion.
  - o **All submissions to PI-SATS** – in addition to meeting criteria of an "applied" project, proposals must demonstrate strong student/postdoc involvement and/or workforce development
- While for Rapid Response program relevance to the CSES focused science topics *is desired, it is not required.* Highly innovative and new proposals that go beyond the specific topics identified in this call are encouraged, but have additional requirements:

o The proposal needs to outline why the proposed work is, or should be, mission and CSES relevant.
o The proposal needs to address "why LANL" and "why now".

Notification of proposal award will be made according to the schedule for the program element as outlined in Section 3. For proposals utilizing the following fiscal years funding, please be aware of the budget caveats (Section 4.4).

In preparing proposals, PIs should be aware of these factors that contribute to successful proposals:
- Proposals that are genuinely new, innovative, and not incremental.
- High-risk, with potentially high-reward down the road – even the answer "now we know we can't do it this way" is a successful outcome for our awards.
- Great university interaction as evidenced by significant student time at LANL, PI visits to the university (present seminar), university Mentor visits to LANL (present seminar).
- Good use of unique LANL facilities.
- Has strategic value to LANL.
- Identified follow on to the project in external proposal opportunities and/or internal programmatic support

4.3.2 Conflict of Interest

CSES is committed to a fair review process and will adopt guidelines similar to those used in the Lab's LDRD proposal review process. In addition:

1. CSES Director and Focus Leads are not allowed to submit or be PI of CSES proposals.
2. CSES External Review Committee Members may not be external reviewers if their institution is a University partner on any of the CSES proposals in a given discipline area.
3. LANL reviewers may not be PIs, Co-PIs on proposals they review.

4.3.3 Written Proposal Feedback

All CSES proposals will receive a short written email feedback within a few weeks of review. Unsuccessful PIs are encouraged to discuss their proposal with their respective Focus Lead to develop strategies that can lead to a successful future CSES submittal.

4.4 Budget Caveats

CSES will make every effort to honor the budget requests in the original proposal. However, CSES is dependent on budget resources that at most are known for the current fiscal year only. The CSES research portfolio is funded by the Lab's Laboratory Directed Research and Development Program (LDRD), which is subject to Congressional approval. Thus, CSES project funding will always be subject to available funding to the Institute.

New or renewal proposal awards will always be subject to some uncertainty on the available funding. This can lead to awards with a reduced budget, or in the worst-case award cancellation. CSES will inform awardees of final proposal budget as soon as the next year's budget is known,

typically within a few weeks of the start of the fiscal year (October). For multi-year or follow on awards, subsequent budget allocations will be based on previous year spending patterns. It's typical for PIs to start the FY at a lower than requested amount and then receive additional funds once their initial allocation is spent.

CSES assumes that the proposal cost is accurate and when a project is approved for funding CSES expects the out year budgets to be as originally proposed and approved. Requests for changes in funding must be well justified and will be considered on a case-by-case basis.

4.5 Miscellanea

4.5.1 Authority to start work

Because all CSES funding is dispersed at LANL, any work by a LANL PI or postdoc can only start once a valid program code has been established for the project. University student visits cannot commence before that time. Projects do not officially begin work until after the Project Kickoff Meeting has been held so the Institute Leader and PI may review the project for any special/safety considerations.

For the rare cases where a project involves a University subcontract, work cannot begin until the Los Alamos contracting officer formally authorizes the initiation of work. There will likely be a delay of a number of months (no earlier than December 1 of a given year) when the "start work" order is issued. Invoices submitted for work conducted prior to the "start work" order will not be reimbursed.

If your Student Fellow / Large University project involves a subcontract you are encouraged to start the subcontract process as soon as possible in order to have the subcontract in place at the beginning of the fiscal year.

4.5.2 Security considerations

Classified work is not supported under the Student Fellow Program nor the University Large Program.

4.5.3 Further information

CSES: http://CSES.lanl.gov
CSES general email: CSES@lanl.gov

Sarah Balkey, Professional Staff Assistant, slbalkey@lanl.gov, 505-667-8777
Lisa Danielson, Director, ldanielson@lanl.gov, 505-695-4514

Appendix A: Scientist/Researcher Student Salary Structure

This table is current as of February 2022 version can be found at
http://int.lanl.gov/employees/education/mentors-liaisons/index.shtml

Scientist/Researcher Salary Structure

High School Internship Program

		Annual	Hourly
High School/PostHigh School	High School Senior	$29,111	$14.00

Undergraduate Program: Students pursuing Associate's and/or Bachelor's Degrees

		Annual	Hourly
HS+0	HS Grad & Acceptance to College	$33,280	$16.00
HS+1	Completion of first academic year and a minimum of 24 semester hours	$35,360	$17.00
HS+2	Completion of second academic year and a minimum of 48 semester hours (salary cap for students pursuing an Associates Degree)	$39,811	$19.14
Post Associates 1	Post Associates 1 Completion of an Associate's Degree, not continuing onto a Bachelors program (Limited to a 2-year appointment)	$42,682	$20.52
Post Associates 2	Post Associates 2 Completion of an Associate's Degree, and one year as a LANL Post Associates Intern (Limited to a 2-year appointment)	$45,552	$21.90
HS+3	Completion of third academic year and a minimum of 72 semester hours (15 hours must be upper-division coursework)	$51,771	$24.89
HS+4	Completion of fourth academic year and a minimum of 96 semester hours	$57,990	$27.88
Post Baccalaureate 1	Bachelor's Degree Awarded (Limited to a 2-year appointment)	$60,278	$28.98
Post Baccalaureate 2	Bachelor's Degree Awarded and completion of one year as a LANL Post Baccalaureate Intern (Limited to a 2-year appointment)	$62,566	$30.08

Graduate Program: Students pursuing Masters and/or PhD Degrees

		Annual	Hourly
BS+0	Bachelors Degree Awarded Accepted/Enrolled in a Graduate Program	$64,854	$31.18
BS+1	Completion of first academic year and a minimum of 12 hours of Graduate coursework	$67,142	$32.28
BS+2	Completion of second academic year and a minimum of 24 hours of Graduate coursework (salary cap for students pursuing a Masters Degree)	$69,389	$33.36
Post Masters 1 BS+3 or MS+0	Master's Degree Awarded or completion of third year in a PhD program (Post Masters, limited to a 2-year appointment)	$72,800	$35.00
Post Masters 2	Master's Degree Awarded and completion of one year as a LANL Post Master's Intern (Post Masters limited to a 2-year appointment)	$76,960	$37.00
BS+4 or MS+1	Satisfactory progress towards doctoral degree (e.g. dissertation/thesis work - -1hr. minimum credit per semester)	$79,123	$38.04
BS+5 or MS+2	Satisfactory progress towards doctoral degree (e.g. dissertation/thesis work- - 1hr. minimum credit per semester) (Salary cap for PhD students)	$80,475	$38.69

PPO 2/14/22

Appendix B: Indirect and LDRD Salary Rates

This table is current as of February 2020. Indirect rates are used for the Rapid Response IPD program, LDRD are used for all other programs.

Use your salary and your student's / postdoc's salary from Appendix A to find the corresponding salary range in the "Funding Type" Column below. Read across to find the corresponding cost for indirect / LDRD projects.

Example: A postdoc that earns $90K a year puts in for a $70K RR R&D project, of which $40K is for the PostDoc. Their hourly rate on LDRD is $71.12 and they can thus spend 562 hours (~14 weeks) on the project.

FUNDING TYPE			INDIRECT		LDRD RAD/NON-RAD	
Resource Name	FTE	Hours	ANNUAL	PER HOUR	ANNUAL	PER HOUR
HS COOP 20000 - 34999.99	1.00	1,828	32,355.60	17.70	37,620.24	20.58
Student 20000 - 34999.99	1.00	1,828	40,874.08	22.36	47,509.72	25.99
Student 35000 - 49999.99	1.00	1,828	57,874.48	31.66	67,270.40	36.80
Student 50000 - 64999.99	1.00	1,828	77,324.40	42.30	89,882.76	49.17
Student 65000 - 79,999.99	1.00	1,828	91,363.44	49.98	106,206.80	58.10
Student - 80,000 - 94,999	1.00	1,828	109,040.20	59.65	126,753.52	69.34
Postdoc 65000 - 79999.99	1.00	1,828	103,592.76	56.67	120,428.64	65.88
Postdoc 80000 - 94999.99	1.00	1,828	111,837.04	61.18	130,007.36	71.12
Postdoc 95000 - 109999.99	1.00	1,828	129,038.52	70.59	150,005.68	82.06
Postdoc 110000 - 999999.99	1.00	1,828	150,608.92	82.39	175,085.84	95.78
35000 - 49999.99	1.00	1,757	72,739.80	41.40	138,504.31	78.83
50000 - 64999.99	1.00	1,757	89,290.74	50.82	170,007.32	96.76
65000 - 79999.99	1.00	1,750	110,565.00	63.18	210,507.50	120.29
80000 - 94999.99	1.00	1,750	132,947.50	75.97	253,137.50	144.65
95000 - 109999.99	1.00	1,750	154,735.00	88.42	294,612.50	168.35
110000 - 124999	1.00	1,750	178,167.50	101.81	339,237.50	193.85
125000 - 139999	1.00	1,737	199,581.30	114.90	380,003.49	218.77
140000 - 154999.99	1.00	1,737	222,058.08	127.84	422,803.17	243.41
155000 - 169999.99	1.00	1,737	245,594.43	141.39	467,617.77	269.21
170000 - 184999.99	1.00	1,737	267,741.18	154.14	509,774.76	293.48
185000 - 199999.99	1.00	1,737	291,138.57	167.61	554,328.81	319.13
200000 - 214999.99	1.00	1,737	305,920.44	176.12	582,468.21	335.33
215000 - 229999.99	1.00	1,737	327,268.17	188.41	623,114.01	358.73
230,000-244,999	1.00	1,750	352,747.50	201.57	671,632.50	383.79
Non manager >=245,000	1.00	1,750	412,090.00	235.48	740,932.50	423.39
Management >= 245,000	1.00	1,750	449,732.50	256.99	808,622.50	462.07