

CSES 2016 Call for Proposals

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Reiner Friedel - Center for Space and Earth Science (CSES)
National Science Education Center (NSEC) - LANL



1 Announcing the Center for Space and Earth Science (CSES)

Formerly the Institute of Geophysics, Planetary Physics and Signatures (IGPPS)

New website at <http://www.lanl.gov/projects/national-security-education-center/space-earth-center/index.php>

The Institute of Geophysics and Planetary Physics and Signatures (IGPPS) has had a long and proud tradition involving Los Alamos National Laboratory. With the appointment of a new Center Director in FY16 (Reinhard Friedel, rfriedel@lanl.gov), the IGPPS is being transformed into *the Center for Space and Earth Science (CSES)*.

The CSES will focus on attracting and retaining a quality workforce through student, postdoc and university collaborations; support seminars, workshops and conferences; while remaining strategically relevant to a breadth of scientific challenges and objectives that support the Science Pillars. CSES will act as an integrating partner for LANL program development efforts.

CSES will for now continue supporting the existing four core science disciplines with the following Focus Team members:

Astrophysics: Hui Li (hli@lanl.gov)
Geophysics: David Coblentz (coblentz@lanl.gov)
Climate: Keeley Costigan (krc@lanl.gov)
Space: Geoff Reeves (reeves@lanl.gov)

History: Originally formed as IGP (Institute for Geophysics) at the University of California Los Angeles in 1946, the Institute eventually expanded to include Los Alamos and Lawrence Livermore National Laboratories, and a number of UC System Schools (UC Los Angeles, UC San Diego, UC Santa Cruz, UC Riverside, UC Irvine). This system-wide IGPP was headquartered at UC Los Angeles and supported a large number (~9) of faculty at UCLA.

IGPP started at Los Alamos with its first director, Paul Coleman, in October 1981, followed by Chick Keller (1986-2001), Gary Geernaert (2002-2010) and Harald Dogliani (2010-2015). Under Harald Dogliani the IGPP at Los Alamos expanded to include support for the Lab's Science of Signature Pillar (SoS) and was renamed IGPPS.

The core IGPP at UCLA closed its doors in 2011.

Student Fellow

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2 Introduction

The Center for Space and Earth Science (CSES) at Los Alamos National Laboratory (LANL) is one of the Science Institutes in the Lab's National Science Education Center (NSEC). It covers four specific science disciplines, each directed by a focus leader (identified in parenthesis):

- Astrophysics and Cosmology (Hui Li; hli@lanl.gov)
- Space Science (Geoffrey Reeves; reeves@lanl.gov)
- Geophysics (David Coblenz; coblenz@lanl.gov)
- Climate (Keeley Costigan; krc@lanl.gov)

The mission of the CSES is to promote and coordinate research on the understanding of the origin, structure and evolution of the Earth, the Solar System, and the Universe, to contribute to the science base to predict future changes as they affect habitat Earth. The science goals for the CSES disciplines are in support of the broader strategic goals of the Laboratory (“Proud Legacy, Bold Future”) and the Science Pillars that map to it. While the CSES discipline areas contribute to many of the 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.

Each CSES call for proposals highlights a small set of focused science topics for each of the four 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 (See Section 3).

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

CSES Science Discipline Portfolio:

1. **Astrophysics, and cosmology** - with the goal of advancing theoretical, modeling, computational and experimental sciences that map to capabilities needed 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 weather).
2. **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.
3. **Solid Earth geoscience** - with the goal of advancing theoretical, experimental, modeling, and simulation studies that address fundamental issues in basic earth processes as well as promoting capabilities needed for a better understanding of applied problems including natural hazards, repository science, natural resources, global climate change, and nuclear monitoring. We include terrestrial planets and similar solar system objects under “solid earth geoscience.”
4. **Climate science** - with the goal of advancing and integrating theoretical, modeling, and simulation with sensing and observational and experimental sciences that push the frontiers of predictability of weather/climate variability and its response to anthropogenic forcings, and to understand how to strengthen the resilience of interdependent infrastructure, both in today's and in future climate states.

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 LANL funding.

3 CSES Focused Science Topics

Proposals for Program Elements 4.1 (CSES Student Fellow Program) and 4.2 (CSES Postdoctoral Fellow Program) need to address the focused topics in their science discipline area as outlined below.

3.1 Astrophysics and Cosmology

Astrophysics and Cosmology in CSES is closely aligned with the two of the focus areas of the Nuclear and Particle Futures (NPF) Pillar - *Nuclear, particle, Astrophysics and Cosmology (NPAC) and High energy density physics and fluids (HEPF&F)*.

See http://www.lanl.gov/science-innovation/capabilities/_assets/docs/nuclear-and-particle-futures-10-25-2013.pdf for details.

Furthermore, Astrophysics and Cosmology are relevant to some of the goals described in the Science of Signatures Pillar as well, including space situational awareness and space environment and impacts areas.

Refer to http://www.lanl.gov/projects/national-security-education-center/space-earth-center/_assets/docs/science-of-signatures-science-pillar-2014.pdf for details.

Focus area. We emphasize advanced research in observation, theory, simulation, and instrumentation that strives to achieve fundamental understanding of the universe. In addition, this focus area benefits from and in turn strengthens its strong overlap with many on-going Laboratory programs in areas such as nuclear physics, particle physics, weapon physics, plasma physics, and condensed matter physics. It further utilizes and leverages the facilities and observatories both inside and outside of the Laboratory. We are interested in proposals that are innovative and forward-looking, especially those with strong potential leading to new capabilities and research directions.

It is strongly encouraged that proposals exploit unique resources at Los Alamos National Laboratory which include:

1. Facilities such as the HAWC gamma-ray observatory.
2. Computational techniques, simulation codes and resources.
3. Broad knowledge base in a full range of physics that tie together theory, simulation, experiments, and observations.

Specific Topics for FY17:

1. **Understanding Astrophysical Transients.** Bursty and explosive events produced by different types of stars and black holes are providing very useful clues on understanding the origin and evolution of such objects and their feedback on their surroundings. These include (but not limited to) stellar flares, bursts from neutron stars, supernovae, gamma-ray bursts, tidal disruption events, gravitational wave events, flares from jets and outflows of black holes, formation of first stars,

- etc. Studies utilizing observational, theoretical and numerical approaches to improve our understanding of such systems are encouraged.
2. **Developing New Astronomical Instrumentation.** New techniques in astronomical instruments are essential for discoveries. Feasibility studies of exploratory ideas and concepts for both ground-based and space-borne instruments are also encouraged.
 3. **Probing Fundamental Physics.** Astronomical observations can provide important constraints on understanding the fundamental physics problems such as dark matter, dark energy, neutrino physics and nucleosynthesis. Advancement in interdisciplinary areas will be especially critical in making progress on these challenging problems. Observational tests of theoretical ideas are encouraged as well.

3.2 Space Science

Space is one of the six leadership areas of the SoS 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/projects/national-security-education-center/space-earth-center/assets/docs/science-of-signatures-science-pillar-2014.pdf> 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 support the Laboratory's Responsive and Agile Space objectives. The terms responsive space and agile space (sometimes used interchangeably) refer to technologies and scientific understanding that enable rapid and innovative execution of space missions or that helps operators anticipate and mitigate threats to their space assets. Space is increasingly important for national and global security. Therefore there is an increasing need to understand and predict the space environment, to anticipate and respond to changing threats in space, and to rapidly deploy space systems tailored to meet evolving national security needs.

Specific Topics for FY17:

1. **Novel techniques.** Understand complex, heterogenous observations from or about space.
2. **Cube/Nano-sats.** Research utilizing cubesats, nano-sats, and satellite constellations or research enabling design of such missions.

3. **Instruments/Measurements.** Development of novel instrument and/or measurement techniques for space science or of systems that help characterize objects in space
4. **Modeling.** Development of numerical models that predict and help mitigate threats in space.

Proposals are solicited for theoretical, computational, and/or observational research. It is strongly encouraged that proposals exploit unique resources at Los Alamos National Laboratory which include:

- a. LANL satellite experiments
- b. LANL satellite data
- c. LANL space science computer simulation codes, and algorithms.

3.3 Geophysics

The Geophysics Focus Area is grounded in two of the lab's science pillars - *Integrating information, science, and technology for prediction (IS&T)*, see http://www.lanl.gov/science-innovation/capabilities/_assets/docs/ist-implementation-plan-2014.pdf for details; and *Science of Signatures (SoS)*, refer to http://www.lanl.gov/projects/national-security-education-center/space-earth-center/_assets/docs/science-of-signatures-science-pillar-2014.pdf for details.

Broader Challenge. Earth sciences face a twofold challenge, as increasingly complex problems are addressed: scale and integration. As with many of the physical sciences, solid earth geophysics deals with the coupling of processes across spatial and temporal scales that span many orders of magnitude (from millions of years and 1000s of kilometers). Furthermore, “small” processes rates and impacts are often dependent and influenced by the “large” processes and rates. While the physics and chemistry of these individual systems is fairly well understood, it is only very recently that sufficient computing resources have become available to model how these systems and processes across spatial and temporal scales. It is the challenge of the geophysics focus area to advance our understanding of these coupled systems and processes within the IS&T and SoS Pillars.

Focus Area. In general, the geophysics focus area supports basic and applied research concerning planetary surfaces and interiors, including numerical, experimental, and field studies of the structure, properties, processes, and dynamics of terrestrial planets. It is strongly encouraged that proposals exploit unique resources at Los Alamos National Laboratory which include:

- a. Los Alamos National Laboratory high-performance computing resources
- b. The Los Alamos Neutron Science Center (LANSCE)
- c. Geochemical analyses facilities resident in EES and C divisions
- d. Sensor technology capabilities resident in C, EES, ISR, and N divisions

We are particularly interested in innovative and collaborative research projects in areas of current, strong international scientific interest.

Specific Topics for FY17:

1. **Geodynamics.** The state of stress in the crust, earthquake seismology and seismotectonics, including rupture processes, rheology and friction of fault zones, and earthquake clustering. Understanding critically stressed faults and their use for mitigating seismic hazard.
2. **Geomaterials.** Strain localization, dynamics and elasticity of Earth geomaterials, Exploiting low-temperature thermal evolution of geomaterials or effects of ionizing radiation on geomaterials.
3. **Fracture and Flow.** Dynamic subsurface processes in porous and fractured media. Transient and steady-state behavior in geologic and hydrologic processes, including multi-phase fluid flow in porous and fractured media.
4. **Quantitative Geomorphology.** Dynamic interactions between climate, tectonics, and surficial and/or atmospheric processes. Quantitative geomorphology - including mechanics of erosion, biogeochemistry of permafrost thaw, and ecological feedbacks to climate change on all time and space scales. New techniques in passive (imaging) or active (e.g., lidar, radar) remote sensing and digital data analysis that can be used to quantify the geomorphology and aid in the construction of geologic frame work models for use in numerical modeling.

3.4 Climate

Climate is one of the six leadership areas of the Science of Signatures pillar. Additionally, Energy-Climate Impact and Energy Infrastructure is one of the application areas of the Integrating Information, Science, and Technology for Prediction pillar. See http://www.lanl.gov/science-innovation/capabilities/_assets/docs/ist-implementation-plan-2014.pdf and http://www.lanl.gov/projects/national-security-education-center/space-earth-center/_assets/docs/science-of-signatures-science-pillar-2014.pdf for details.

Focus Area. The Climate focus area emphasizes process to predictive level understanding of the coupled atmosphere, ocean, hydrosphere, terrestrial, biogeosphere, and anthroposphere of planet Earth by studies at multiple scales. This focus area examines fundamental climate processes, monitoring to detect gradual and abrupt climate change, and the impacts of climate change. We sponsor innovative, multi-disciplinary, and collaborative research proposals to develop capabilities that support the Science of Signatures pillar and that appeal to multiple sponsoring agencies. We finance projects that improve our fundamental understanding of physical, chemical, and biological mechanisms from microbe to plant, aerosol to cloud, eddy to global circulation scale, including targeted laboratory and field studies of processes at plant, microbe, and aerosol scales and aimed toward the improvement of parameterizations in models. Integration of measurements and models to fill outstanding gaps, particularly in sensitive regimes and high impact regions of our climate system (e.g. Arctic, tropics, coastal areas, climate adaptation and management) are encouraged.

It is recommended that proposals exploit unique Los Alamos National Laboratory resources, which include:

- a. High performance computing
- b. DOE sponsored process-resolving to global scale models (e.g. COSIM, ACME, and CESM) and data sets (e.g. ARM, ASR, NGEE/GoAmazon, and future campaigns and instruments)
- c. Climate monitoring systems and sites in the arctic, tropics, and southwest
- d. Models and data of climate change impacts on human systems

Specific Topics for FY17:

1. **Polar Climate.** Fundamental understanding of processes that lead to hydrological, land, and ocean changes and rapid retreat of sea ice, glaciers, and permafrost in Polar Regions. Arctic and Antarctic monitoring, including the release of CO₂ and CH₄ from tundra and ocean warming, for early detection and simulations to forecast tipping points. Studies that enable enhanced, high-resolution, coupled ocean-atmosphere-cryosphere-land models that are informed by observations, coupled physical-human system models, or increased predictability.
2. **Impacts of Climate Change.**
 - a. **Disturbance.** Impacts of climate change on disturbances, such as drought, fire, floods, insects, and pathogens on ecosystems and feedbacks back to the climate system by landscape disturbances. The impacts of ecosystem response to climate change on water, carbon, and volatile organic aerosol precursor fluxes and the atmospheric feedbacks they trigger in the climate system. Development of coupled climate-carbon models in the tropics, including multi-scale observations (ground to satellite) of the tropical forests, greenhouse gases, and aerosol fluxes as well as shifts in the hydrological state.
 - b. **Coastal Zone.** Assessments of impacts of climate change and sea level rise on shoreline erosion, sediment transport, storm surges, and waves, fall in this focus area. Studies of climate change impacts on habitat, ecosystems, water quality, ocean circulation, and ocean biogeochemistry. Next generation sensors, networks and platforms for climate change signal and process discovery and analysis. Forecasts of regional sea level rise and changes in storm and hurricane frequency and intensity in the coastal zone.
 - c. **Infrastructure.** Impacts of regional and local climate change on people, natural resources, and transportation, energy, water, and other critical infrastructures. Resilience and adaptation to climate change, including the relationships between adaptation, economics, and climate uncertainty. Studies of remote sensing of infrastructure networks and vulnerabilities and studies of data fusion, including addressing disparities of spatial and

temporal scales. Coupling of infrastructure to human and natural systems in models and the simulation of active climate adaptation strategies.

3. **Greenhouse Gas Monitoring for Emissions and Climate Feedback**

Verification. Development or deployment of next generation sensors, networks, and platforms for emissions and fate of greenhouse gasses, including novel signature discovery for source attribution, new instrument capability (e.g. isotopes in the field), data analysis, and data fusion and reconciliation from diverse observation systems. Proposals to understand the sources, sinks, transport, and evolution of GHG and aerosols in the atmosphere or better represent them in models. Transport modeling to infer fluxes from atmospheric observations, direct flux measurements and uncertainty quantification studies of greenhouse gas fluxes. Crosscutting themes that connect topic area (3) with focus areas (1) and (2) are encouraged.

4 CSES PROGRAM ELEMENTS

CSES offers several program elements. New to CSES is a more flexible proposal schedule - not all program elements are offered in each call, and some program elements have calls more than once per year, depending on available budget. See details listed with each program element.

Current CSES program elements:

1. **CSES Student Fellow program.** Needs to address the CSES Focused Science Topics for this call. See section 4.1 for details on this program.
2. **CSES Postdoctoral Fellow Program.** Needs to address the CSES Focused Science Topics for this call. One to two calls per year. See section 4.2 for details on this program.
3. **CSES Emerging Ideas Program.** While alignment to the CSES Focused Science Topics is encouraged, this program element is program is open to all emerging scientific ideas. Up to 4 calls per year. See section 4.3 for details on this program.
4. **CSES Special Large Program.** Needs to address the broad science focus of one of the CSES disciplines as outlined in the underlying CSES LDRD-DR project. One call every three years. *Not offered in this call (next competition will be in the 2017 call, for program starts in FY18).* See section 4.4 for details on this program.

Each program element 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.

4.1 CSES Student Fellow Program

University and LANL collaborative research program

(Note: This program replaces the past IGPPS University Mini-Grant Program.)

Frequency of call: Once a year.

CSES Submission: April 4th, 2016

CSES Selections: June 6th, 2016

Program New Starts: October 1st, 2016

Program duration: 1 year, 2 year or 3 year.

Program Outline

- Each proposal is required to have a University Student Researcher, a University Principal Investigator (PI) and a Los Alamos National Laboratory PI.

- The University Postgraduate Student Researcher needs to be enrolled in a Ph.D. program.
- 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 is any Los Alamos Technical Staff Member.
- The collaborative University-LANL research project will typically consist of a jointly agreed Ph.D. thesis research project.

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

The funding profile for this program consists of three parts:

1. Support for the University Student Researcher to spend a significant fraction of the year at Los Alamos. GRA Support for a typical 12-week summer stay at LANL cost ~\$25K. Note that the student can be at LANL at any time(s) during the year, although the summer period is typical.
2. Support for the Los Alamos PI to devote a significant fraction of his time to the collaborative research project (~\$15K).
3. Support to the University PI to visit LANL for periods of 1-2 weeks/year (~10K travel and subsistence).

The individual funding items are negotiable with a total cap for this program not to exceed \$60K/year.

No direct funding support to a University is envisaged under this program. 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 ~3 months/year).
- b. LANL Graduate Assistant Student rates may be higher than many Universities' postgraduate salaries, helping to attract students to both the University and the CSES Student Fellow Program.
- c. Exposure of 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.

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

Proposals may be submitted for collaboration with any university. Collaborations with New Mexico universities are particularly encouraged and may qualify for supporting funds through The New Mexico Consortium.

The number of new starts anticipated in the CSES Student Fellow Program for FY17 is approximately 4-6 across all CSES discipline areas. Details of the proposal process are in Section 5.

Expectations

The CSES Junior Student Fellow 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) 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 summer schools (lectures only). The student is expected to present a technical seminar at LANL on his/her work once per year. The University PI should be encouraged to offer a lecture in a CSES summer school as part of his/her visit to LANL. The university PI should also be encouraged to give a topical seminar on his research area during his visit to LANL.

4.2 CSES Postdoctoral Fellow Program

LANL Postdoc support

(Note: same as the previously offered program under IGPPS.)

Frequency of call: Once or twice a year as funding allows. One call only for the 2016 call.

CSES Submission: April 4th, 2016

CSES Selections: June 6th, 2016

Program New Starts: October 1st, 2016

Program duration: 2-year maximum or 1 year for a 3rd year extension.

Program Outline

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 and/or second year of the postdoc. Third year support is limited to 25% of the postdoc's salary and is subject to a new proposal.
- Postdocs in their first, 2nd or 3rd year at Los Alamos are eligible. Preference will be given to new postdocs starting at Los Alamos.
- Funding is limited to two years for new postdocs, and one year for postdocs in their 2nd or 3rd year.
- The proposed work cannot be directly related to the research providing the balance of support to the postdoc.
- 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.

Approximately 2-4 CSES Postdoctoral Fellows can generally be funded each year, although this number will fluctuate as this program element is rolled out and with available funding. Details of the proposal process are in Section 5.

Expectations

The postdoc is expected to present a technical seminar at LANL on his/her CSES funded work once per year.

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%.

4.3 CSES Emerging Ideas Program

Frequency of call: Variable, 4 times a year at most. Announcements for subsequent calls will be made through LANL's R&D Central.

CSES Emerging Ideas Program Development (PD) Call (Type 1 proposal only, see below)

CSES Submission: March 11th, 2016

CSES Selections: March 25th, 2016

Program New Starts: April 1st, 2016

Program duration: 3 or 6 Months

Program Outline

CSES solicits proposals for three or six month studies that explore the technical feasibility of a new scientific concept that has the potential for further development into a Los Alamos National Laboratory LDRD proposal, CSES project proposal, CSES special large project (see below), or a proposal for external support (DOE Office of Science, NASA, DARPA, etc). 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. While proposals along the lines of this call's focuses science topics are encouraged, the program element is open to all new ideas relevant to the CSES discipline areas.

Funds are restricted to Los Alamos National Laboratory Technical Staff Members and/or Los Alamos National Laboratory postdocs.

Proposals may be of two distinct and separate types *that cannot be combined*:

1. Classical Program Development (PD). This is funded out of the CSES G&A budget and may not support technical work. Activities that can be supported here include proposal writing, white paper idea development, literature searches, small equipment purchases, publication costs, collaborative visits, and teaming activities such as support for team meetings. Funding maximums \$20K for a 3-month and \$40K for a 6-month study.
2. Research and Development (R&D). This is funded out of the CSES LDRD portfolio and can support technical work. Activities that can be supported here include preliminary data analysis studies, laboratory work and preliminary model development. Funding maximums are \$30K for a 3-month and \$60K for a 6-month study.

Note that one or both of these types of proposals may be solicited in any given quarter, and that for any given quarter the Emerging Ideas Program may be dedicated to a selected topic (such as the FY2015 cubesat proposal competition). We anticipate that up to 1-2 feasibility studies may be supported in each quarter, although this number will fluctuate as this program element is rolled out and depending on available funding. Details of the proposal process are in Section 5.

Expectations

Supported PI's are expected to present the results of their study in the form of a seminar on their topic, given to an audience of their peers and relevant lab management and program directors. CSES will be happy to help put together the audience for this talk. For projects supporting proposal writing CSES expects a copy of the proposal and an actual submission!

4.4 CSES Special Large Program

Frequency of call: Three yearly in step with CSES LDRD cycle

***This program element is not offered in the 2016 CSES Call.
Next opportunity will be in the 2017 call.***

Program Outline

The CSES research portfolio is funded by a single LDRD-DR sized proposal that is re-competed every three years. In each cycle, the overall scientific goals for the CSES science disciplines will be renewed, and the science areas themselves will be up to review with disciplines changing or being updated, new ones possibly being added and old ones possibly being deleted.

The start of a new CSES cycle offers the opportunity for new and exciting science thrust areas to be highlighted, in step with or ahead of the LANL strategic planning landscape.

Each CSES discipline will have the opportunity in this program to propose for a single, large three-year project that addresses the discipline science thrust area as identified in the CSES LDRD-DR proposal. This large program will be structured around 2-3 CSES Junior Student Fellow programs involving an intensive collaboration with a single university. Total budget is not to exceed 180K/year.

It is anticipated that at most 1-2 Special Large Programs will be awarded in each 3-year LDRD cycle, with at most one Special Large Program per CSES science discipline. Note that for the science discipline with a Special Large Program, the normal CSES Junior Student Fellow program will not be offered during that LDRD cycle.

Expectations

The main purpose for this program element is to establish a 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.

5 PROPOSAL PROCESS

5.1 Proposal Preparation

5.1.1 CSES Student Fellow Program

Cover Sheet, to include on one page:

1. Title of proposed project,
2. Name of University Campus
3. Identify relevant CSES discipline area(s) of proposal.
4. Proposed start date, and proposed duration of project.
5. Total cost by fiscal year
6. Name, title, address, email address, and phone number for PI(s).
7. Name and email of graduate student, if known.

Please use the fillable PDF cover sheet (http://www.lanl.gov/projects/national-security-education-center/space-earth-center/_assets/docs/cses-proposal-cover-sheet.pdf)

Main Body Use the following formatting outline for the main body; please limit to **five total pages** of text and figures (for Sections I through VIII), plus one budget page and biographical sketches:

- I. Theoretical, numerical, or experimental activity
- II. Methods used (describe comprehensively) History of problem, scientific debate, Hypotheses to test, why now.
- III. Any relevant leveraging or necessary coordination, e.g., other projects or facilities
- IV. Resources to be used in the project such as resources at Los Alamos National Laboratory, at the University, if relevant
- V. Statement of Work
 - i. Tasks to be performed
 - ii. Milestones
 - iii. Schedule of visits (and work performed) at Los Alamos National Laboratory
- VI. Proposing Team
 - i. Role of University Principal Investigator
 - ii. Role of LANL PI, including efforts at mentoring
 - iii. Role of graduate student
 - iv. Other participants
- VII. Significance and timeliness
 - i. How does this research support Los Alamos objectives?
 - ii. What is the significance of the project? One way of getting at this is to answer the question, “When this project is finished and published, who will use the results?”

- iii. Why should this project be funded now instead of, e.g., next year?
- VIII. References
- IX. Budget summary (1 page max). Totals by fiscal year and cumulative for multiyear projects. Not to exceed \$60K/year.
 - 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 his time to the collaborative research project.
 - iii. Support to the University PI to visit LANL
 - iv. Other Travel
 - v. Supplies & Equipment, including Computer usage costs
- X. Biographical sketches of PIs including already identified graduate student, ~1 page each. Note: Identification of a named student is desirable but not essential for top tier selection

5.1.2 CSES Postdoctoral Fellow Program

Cover Sheet, to include on one page:

1. Title of proposed project
2. Identify relevant CSES discipline area(s) of proposal.
3. Proposed start date, and proposed duration of project.
4. Total cost by fiscal year
5. Name, title, address, email address, and phone number for LANL PI.
6. Name and email of prospective postdoc, if known.

Please use the fillable PDF cover sheet (http://www.lanl.gov/projects/national-security-education-center/space-earth-center/_assets/docs/cses-proposal-cover-sheet.pdf)

Main Body Use the following formatting outline for the main body; please limit to **five total pages** of text and figures (for Sections I through VIII), plus one budget page and biographical sketches:

- I. Theoretical, numerical, or experimental activity
- II. Methods used (describe comprehensively). History of problem, scientific debate, Hypotheses to test, why now.
- III. Any relevant leveraging or necessary coordination, e.g., other projects or facilities
- IV. Resources to be used in the project such as resources at Los Alamos National Laboratory, at the University, if relevant
- V. Statement of Work
 - i. Tasks to be performed
 - ii. Milestones
- VI. Proposing team
 - i. Role of LANL PI, including efforts at mentoring
 - ii. Role of postdoc

- VII. Significance and timeliness
 - i. How does this research support Los Alamos objectives?
 - ii. What is the significance of the project? One way of getting at this is to answer the question, “When this project is finished and published, who will use the results?”
 - iii. Why should this project be funded now instead of, e.g., next year?
- VIII. References
- IX. Budget summary (1 page max). Totals by fiscal year and cumulative for multiyear projects.
 - i. 50% FTE support for Postdoc max
 - ii. Supplies & Equipment, including Computer usage costs
 - iii. Travel
- X. Biographical sketches of LANL PI including already identified postdoc, ~1 page each. Note: Identification of a named postdoc is desirable but not essential for top tier selection.

5.1.3 CSES Emerging Ideas Program

Cover Sheet, to include on one page:

1. Title of proposed project
2. Identify relevant CSES discipline area(s) of proposal.
3. Type of proposal (Classical PD or R&D).
4. Proposed start date, and proposed duration of project (3 or 6 months). Note that start/end cannot span a fiscal year boundary.
5. Total cost
6. Name, title, address, email address, and phone number for LANL PI.

Main Body Use the following formatting suggestions for the main body; please limit to **two total pages** of text and figures (for Sections I through IV), plus one page biographical sketches:

- I. Statement of problem to be addressed
- II. Statement of Work
- III. Significance and Timeliness
- IV. Which targeted funding opportunity does this work support

5.1.4 CSES Special Large Program

Not competed in this call.

5.1.5 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.

We encourage recommendation/identification of several technical subject matter reviewers with whom proposers do not closely work and have not published for at least two years.

5.2 Submission process

Proposals (title, abstract page, main body including budget) must be submitted by email from the email account of the Los Alamos National Laboratory PI, to be received by CSES by the proposal's program element deadline:

1. CSES Student Fellow program: April 4th, 2016
(For projects starting FY17)
2. CSES Postdoctoral Fellow Program: April 4th, 2016
(For projects starting FY17)
3. CSES Emerging Ideas Program: March 11th, 2016
(For projects starting and completing in FY16)
(Follow R&D Central for subsequent calls to this program element)
4. CSES Special Large Program: Not offered in this call

NOTE: All proposals must be submitted to CSES through the Los Alamos Principal Investigator.

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

Subject: CSES Student Fellow/Astro Proposal Submission

Send to: The CSES program administrator Georgia Sanchez (georgia@lanl.gov) with copies to the CSES Center lead Reinhard Friedel (rfriedel@lanl.gov) and the appropriate discipline leader:

- Astrophysics and Cosmology: Hui Li; hli@lanl.gov
- Space Science: Geoffrey Reeves; reeves@lanl.gov
- Geosciences: David Coblenz; coblenz@lanl.gov
- Climate: Keeley Costigan; krc@lanl.gov

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

5.3 Review Process

5.3.1 New Proposals

All new proposals undergo peer review. There is a separate review panel for each discipline area, which consists of the Focus Lead and his/her team (typically 2-3 LANL staff), and which is augmented by 2-3 external review members of subject matter experts primarily from academia (no external members for the Emerging Ideas program element).

Reviewers are given a set of questions to address, i.e., concerning scientific merit, balance of risk versus innovation or importance, depth of multi-institutional collaborations, growth potential of research topic, quality of participants, and budget.

In preparing proposals, PIs should be aware of the following reasons why some proposals are rejected:

1. The proposal was good but could not be funded because of insufficient CSES funds.
2. Objectives and background are unclear or inadequately argued.
3. Ideas are not innovative.
4. Methods are inadequately described or do not reflect state-of-the-art.
5. Approach is not convincing enough to satisfy the objectives.
6. For research proposals involving University-LANL collaborations, collaborations are weak.
7. Important and relevant Los Alamos National Laboratory facilities are not considered or exploited.
8. Lack of commitment by the Los Alamos National Laboratory Principal Investigator to the research or mentoring process.
9. Subject matter is not relevant to CSES's and Institutional scientific interests or Laboratory research priorities.

Notification of proposal award will be made according to the schedule for the program element as outlined in Section 4). For proposals utilizing the following fiscal years funding, please be aware of the budget caveats (Section 5.4).

5.3.2 Renewals

All multi-year proposals need to undergo a review process at the end of each fiscal year (typically in August/September). The review shall consist of a formal technical seminar given at LANL by the CSES student or postdoc, optionally together with their respective LANL and/or University PIs. The only restriction is that the CSES director and the respective focus leads are available to attend the Seminar.

Student renewal proposals going into their second year of work are generally approved, as it is often unrealistic to expect results early in the project.

Renewal is normally denied for the following reasons:

1. There are indications from the LANL PI or Discipline Focus Leader that collaborations are ineffective or little progress is being made.
2. Departure of student or postdoc from the project.
3. Departure of the University PI if no substitute can be found.
4. Departure of the LANL PI if no substitute can be found.
5. Funding cuts beyond CSES control (see section 5.4).

Notification of project renewal will be given within a week of the seminar. For proposals utilizing the following fiscal years funding, please be aware of the budget caveats (Section 5.4).

5.3.3 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 part of CSES proposals.
2. CSES External Advisory Committee (EAC) Members may not be external reviewers if their institution is a University partner on any of the CSES proposals in a given discipline area.

5.4 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.

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 month of the start of the fiscal year (October).

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.

5.5 Reporting

All projects are required to submit a written report each year. Projects in their final year are required to present the same formal technical seminar as is required for renewals (Section 5.3.2).

The written report shall consist of the seminar slides/materials, with slides covering the following items appended to the seminar presentation:

1. List of submitted and already published manuscripts
2. List of presentations.
3. List of patents and awards.
4. Documentation of visits to Los Alamos National Laboratory and/or to University, or other facilities/sites
5. Efforts or prospects to secure further funding from other agencies.
6. For students, a report on their PhD progress and prospective graduation date.
7. For postdocs, their planned onward career path, if known.

5.6 Miscellanea

5.6.1 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.

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 about two 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.

5.6.2 Security considerations

Classified work is not supported under the CSES Student Fellow Program or the CSES Special Large Program.

5.6.3 Policy regarding prejudice and bias

There is no prejudice based on race, gender, or nationality, for PI's, postdocs, and students.

5.6.4 Further information

CSES Center: <http://www.cses.lanl.gov/>

Georgia Sanchez, Professional Assistant: gelorgia@lanl.gov, 505-663-5291

Reiner Friedel, Director, rfriedel@lanl.gov, 505-695-8894