U.S. DEPARTMENT OF ENERGY | Office of Science

Office of Science / Office of Workforce Development for Teachers and Scientists (WDTS)

2014 Summer Term Opportunities for Undergraduates and Faculty at DOE Laboratories

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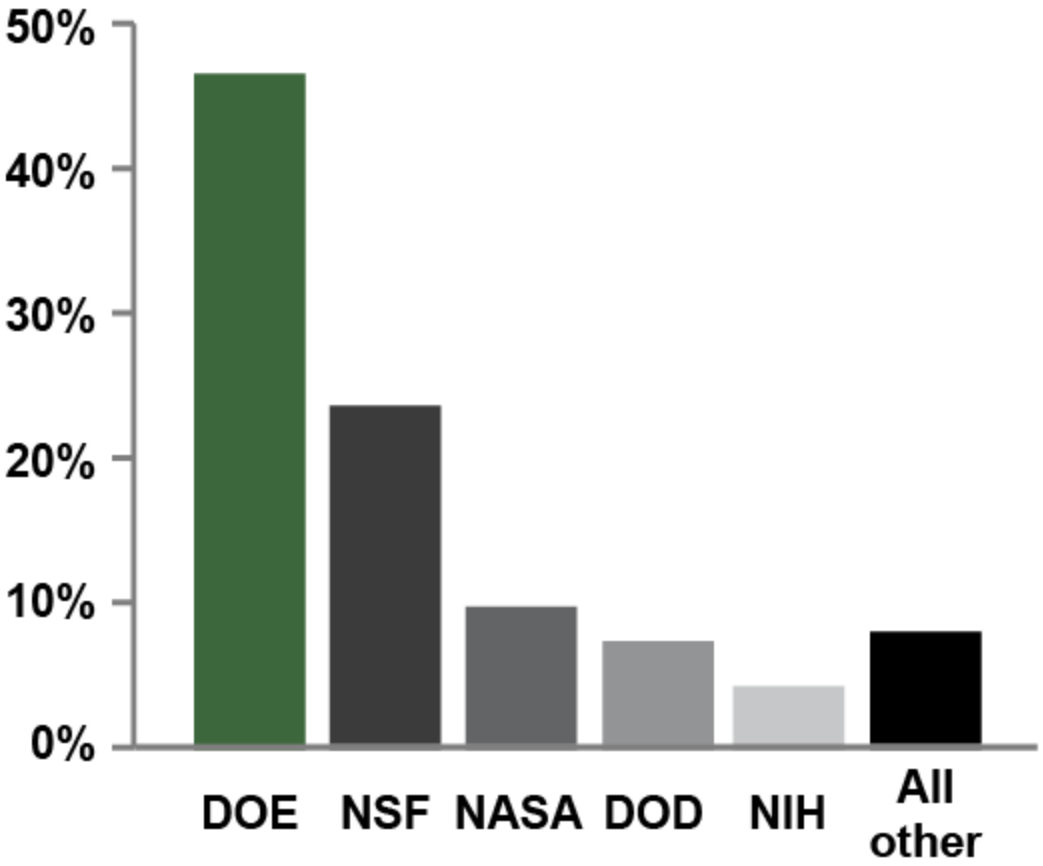
www.science.energy.gov

The Office of Science (SC)

http://www.science.energy.gov

First, some background on SC….

SC is the Largest Federal Supporter of Basic Research in the Physical Sciences



Source: NSF data tables on Federal Funds for Research and Development: Fiscal Year 2010.

The Office of Science Research Portfolio

Advanced Scientific Computing Research	• **Delivering world leading computational and networking capabilities to extend the frontiers of science and technology**
Basic Energy Sciences	• **Understanding, predicting, and ultimately controlling matter and energy flow at the electronic, atomic, and molecular levels**
Biological and Environmental Research	• **Understanding complex biological, climatic, and environmental systems**
Fusion Energy Sciences	• **Building the scientific foundations for a fusion energy source**
High Energy Physics	• **Understanding how the universe works at its most fundamental level**
Nuclear Physics	• **Discovering, exploring, and understanding all forms of nuclear matter**

Advanced Scientific Computing Research

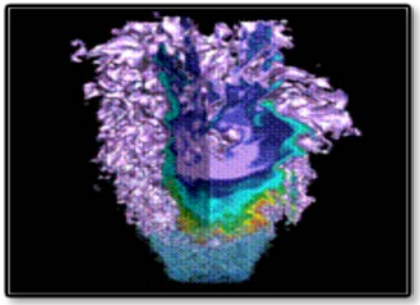
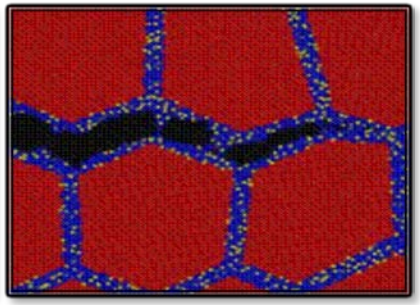
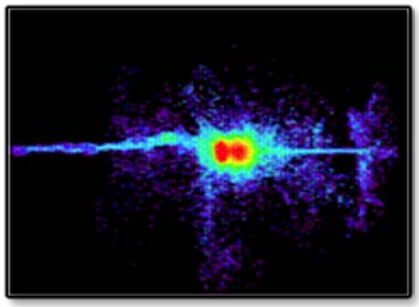
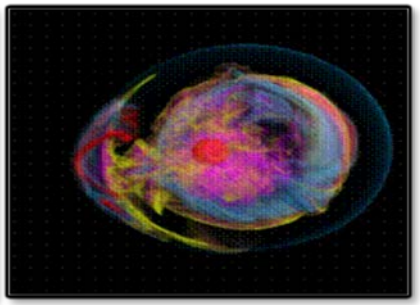
Delivering world leading computational and networking capabilities to extend the frontiers of science and technology

The Scientific Challenges:

- Deliver next-generation scientific and energy applications on multi-petaflop computers.
- Discover, develop and deploy exascale computing and networking capabilities.
- Partner with U.S. industry to develop the next generation computing hardware and tools for science.
- Discover new applied mathematics, computer science, and networking tools for the ultra-low power, multicore-computing future and data-intensive science.
- Provide technological innovations for U.S. leadership in Information Technology to advance competitiveness.

FY 2013 Highlights:

- Co-design centers to deliver next generation scientific applications.
- Investments with U.S. industry to address critical challenges on the path to exascale.
- Operation of a 10 petaflop low-power IBM Blue Gene/Q at the Argonne Leadership Computing Facility and installation and early science access to a hybrid, multi-core computer at the Oak Ridge Leadership Computing Facility.
- Research efforts across the portfolio in support of data-intensive science including the massive data produced by Scientific User Facilities.

Basic Energy Sciences

Understanding, predicting, and ultimately controlling matter and energy flow at the electronic, atomic, and molecular levels

The Program:

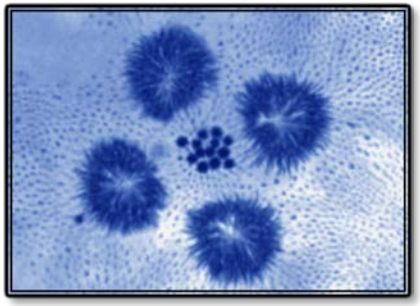
Materials sciences & engineering—exploring macroscopic and microscopic material behaviors and their connections to various energy technologies

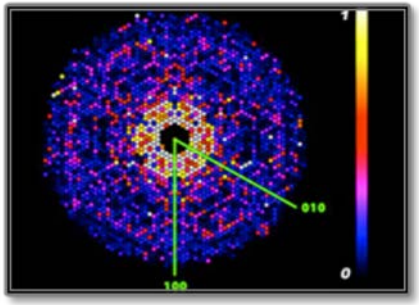
Chemical sciences, geosciences, and energy biosciences—exploring the fundamental aspects of chemical reactivity and energy transduction over wide ranges of scale and complexity and their applications to energy technologies

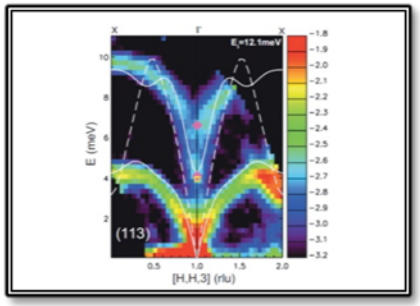
Scientific User Facilities—supporting the largest collection of facilities for electron, x-ray, and neutron scattering in the world

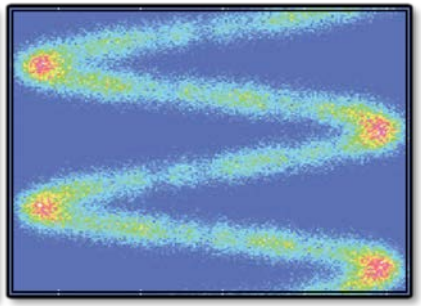
FY 2013 Highlights:

- Science for clean energy
  - Science-based chemical and materials discovery to enable manufacturing innovations
  - R&D for next-generation clean energy applications jointly funded with EERE
- Materials and chemistry by design: discovery grounded in theory and modeling
- National Synchrotron Light Source-II construction and early operations
- User facilities at near optimum operations; facility upgrades and enhancements
  - LCLS expansion (LCLS-II); NSLS-II EXperimental Tools (NEXT); APS Upgrade (APS-U)









Biological and Environmental Research

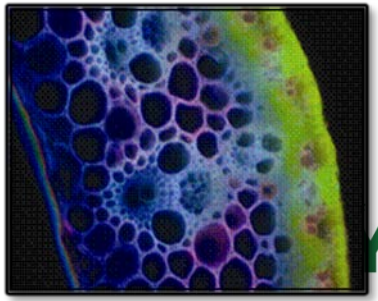
Understanding complex biological, climatic, and environmental systems across vast spatial and temporal scales

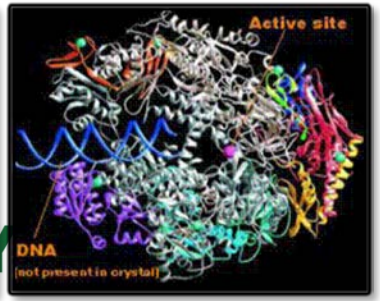
The Scientific Challenges:

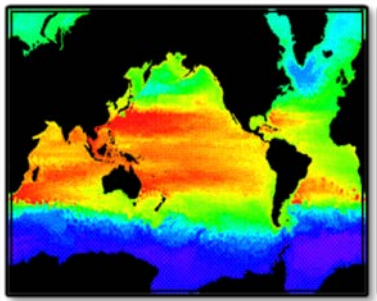
- Understand how genomic information is translated to functional capabilities, enabling more confident redesign of microbes and plants for sustainable biofuel production, improved carbon storage, or contaminant remediation.
- Understand the roles of Earth's biogeochemical systems (atmosphere, land, oceans, sea ice, subsurface) in determining climate so we can predict climate decades or centuries into the future, information needed to plan for future energy and resource needs.

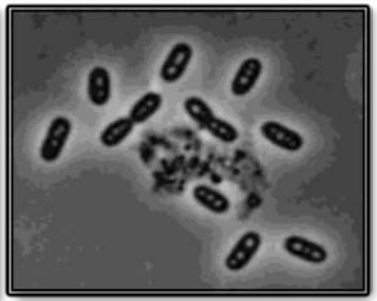
FY 2013 Highlights:

- Clean energy biodesign on plant and microbial systems through development of new molecular toolkits for systems and synthetic biology research.
- Research and new capabilities to develop comprehensive environmental system models in the Arctic and tropics, regions especially vulnerable to rapid climate change.
- Continue support for the three DOE Bioenergy Research Centers, and operations of the Joint Genome Institute, the Environmental Molecular Sciences Laboratory, and the Atmospheric Radiation Measurement Climate Research Facility.









Fusion Energy Sciences

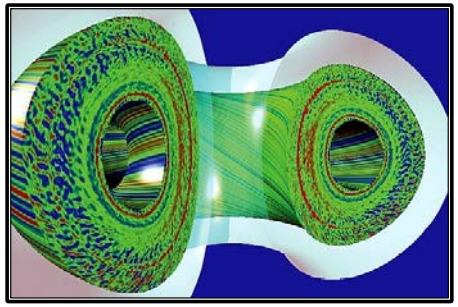
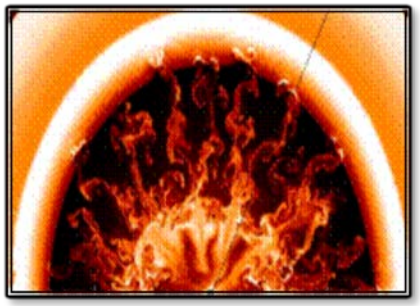
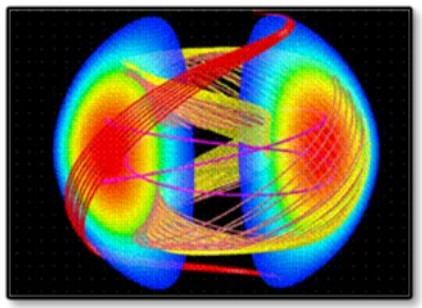
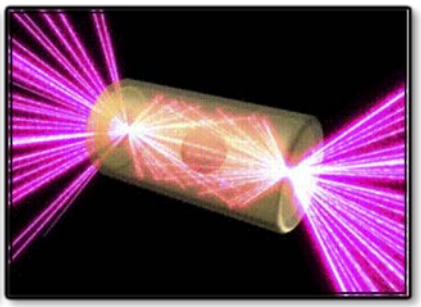
Understanding matter at very high temperatures and densities and building the scientific foundations for a fusion energy source

The Scientific Challenges:

- Control a burning plasma state to form the basis for fusion energy.
- Develop materials that can withstand the harsh heat and neutron irradiation in fusion facilities.
- Manipulate and control intense transient flows of energy and particles.
- Control the interaction of matter under extreme conditions for enabling practical inertial fusion energy.

FY 2013 Highlights:

- ITER construction is advancing.
- DIII-D investigates predictive science for ITER; NSTX undergoes performance upgrade; and Alcator C-Mod is closed.
- Matter in Extreme Condition Instrument begins operation at LCLS to study high-energy-density laboratory physics.
- New SciDAC high-performance computing projects are selected, in partnership with ASCR, to advance scientific discovery.
- International activities on experiments with world-leading technologies are increased.
- Fusion materials research is enhanced.

High Energy Physics

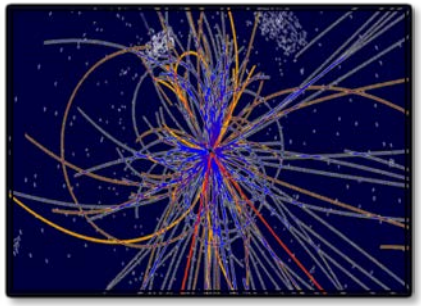
Understanding how the universe works at its most fundamental level

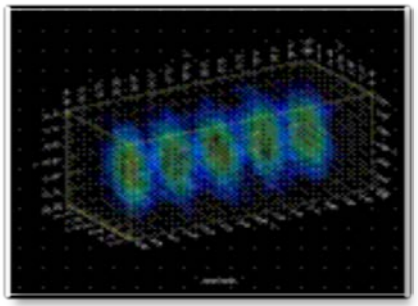
The Scientific Challenges:

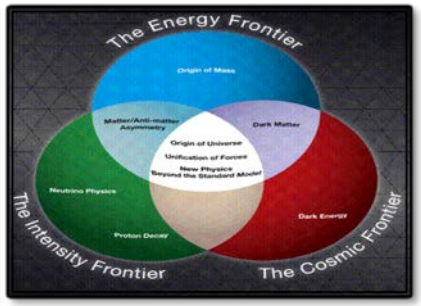
- Determine the origins of mass in terms of the fundamental particles and their properties
- Exploit the unique properties of neutrinos to discover new ways to explain the diversity of particles
- Discover new principles of nature, such as new symmetries, new physical laws, or unseen extra dimensions of space-time
- Explore the “dark” sector that is 95% of the Universe (Dark Matter and Dark Energy)
- Invent better and cheaper accelerator and detector technologies to extend the frontiers of science and benefit society

FY 2013 Highlights:

- Energy Frontier: Continued support for U.S. researchers at the LHC. The number of researchers is constant with FY 2012
- Intensity Frontier: Research, design, and construction for NOvA, LBNE neutrino experiments, and Mu2e muon experiments. The Reactor Neutrino Experiment in China begins operations in FY 2012
- Cosmic Frontier: U.S. participation in international collaborations pursuing dark matter, dark energy. The Dark Energy Survey in Chile begins operations in FY 2012
- Research in accelerator technologies including superconducting radio frequency and plasma wakefield acceleration







Nuclear Physics

Discovering, exploring, and understanding all forms of nuclear matter

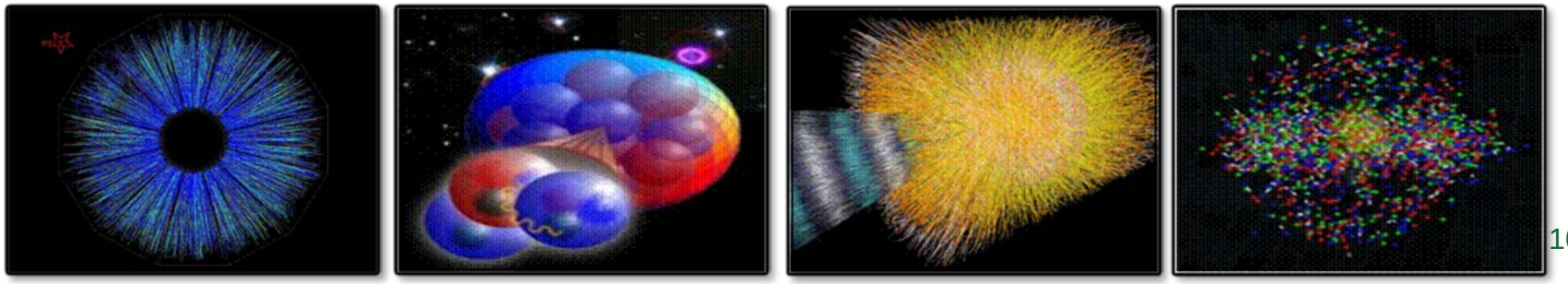
The Scientific Challenges:

Understand:

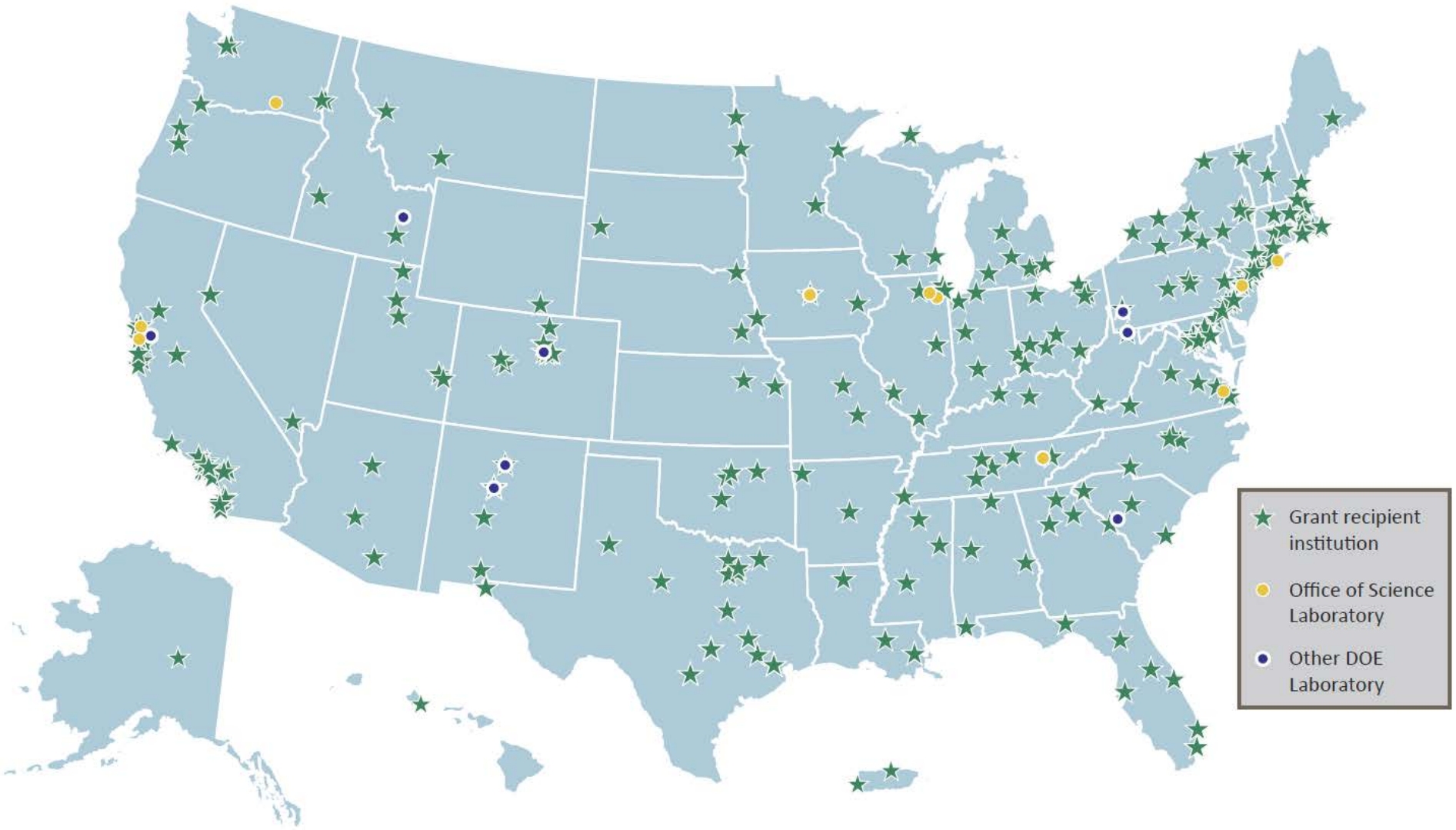
- The existence and properties of nuclear matter under extreme conditions, including that which existed at the beginning of the universe
- The exotic and excited bound states of quarks and gluons, including new tests of the Standard Model
- The ultimate limits of existence of bound systems of protons and neutrons
- Nuclear processes that power stars and supernovae, and synthesize the elements
- The nature and fundamental properties of neutrinos and neutrons and their role in the matter-antimatter asymmetry of the universe

FY 2013 Highlights:

- Operations and research at three nuclear science user facilities (RHIC, CEBAF, ATLAS)
- 12 GeV CEBAF Upgrade to study systems of quarks and gluons and the force that creates protons and neutrons.
- Continued preparation for construction of the Facility for Rare Isotope Beams to study the limits of nuclear existence.
- Research, development, and production of stable and radioactive isotopes for science, medicine, industry, and national security.



FY 2011 Funding Recipient Institutions



The DOE Office of Science (~$5B/year)

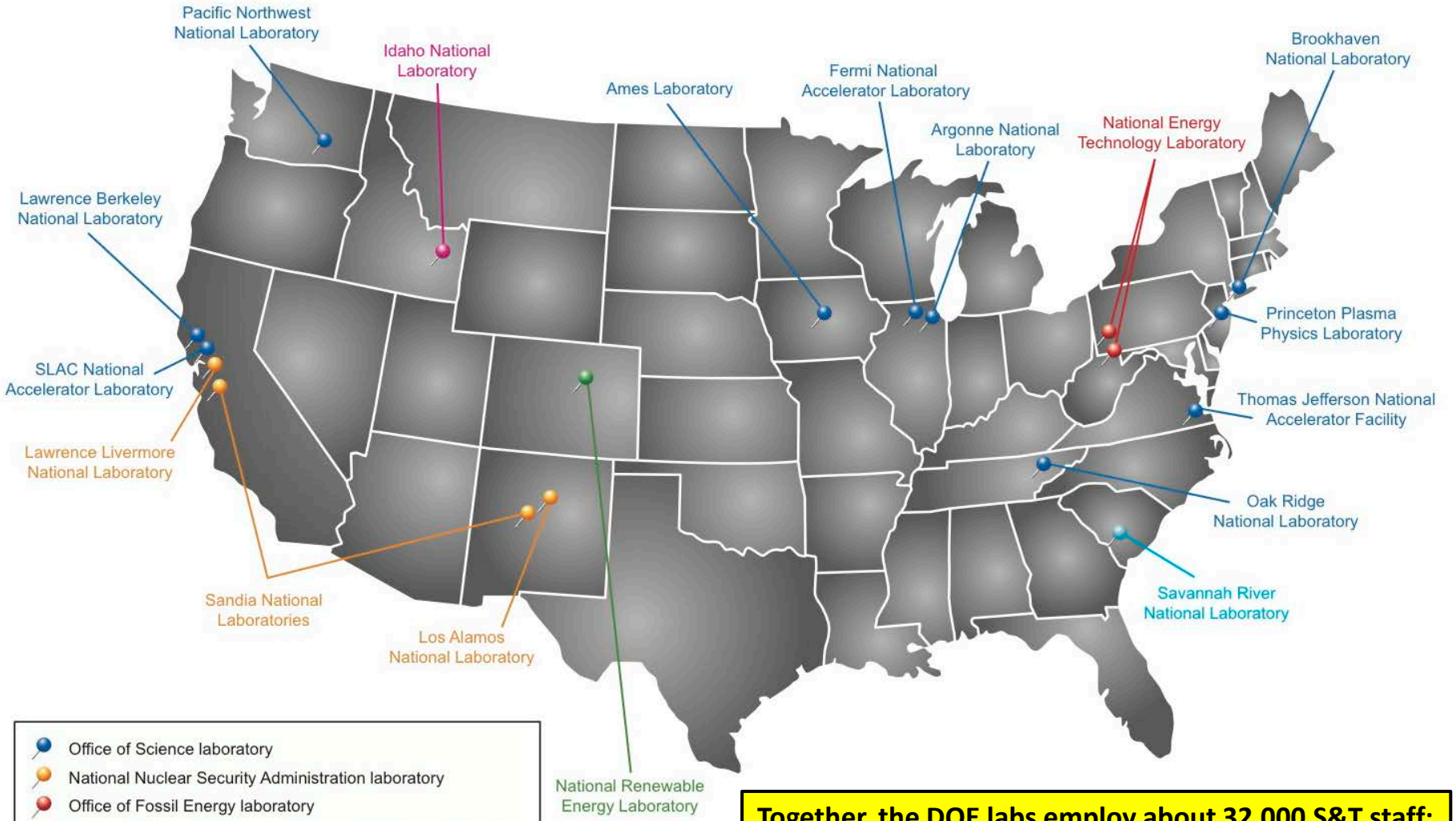
The undulator hall at the Linac Coherent Light Source (LCLS) , SLAC, 2011.

- Funds 25,000 Ph.D. scientists, graduate students, undergraduates, engineers, and technical staff supported at more than 300 institutions in all 50 States and DC through competitive awards
- 31 national user facilities serving more than 29,000 users each year
- 100 Nobel Prizes during the past 6 decades—more than 20 in the past 10 years

Where the user facilities are: DOE Laboratories (mostly)

★ SC is the steward of these ten DOE laboratories

DOE Labs Employ >32,000 Scientists and Engineers



Together, the DOE labs employ about 32,000 S&T staff; SC labs employ about 14,000 S&T staff; many at the Ph.D. level.

Why Office of Science (SC) sponsored internships?

In a word… **WORKFORCE**

From the DOE Strategic Plan, May 2011:

SUSTAIN A WORLD-LEADING TECHNICAL WORKFORCE

"Excellent scientists, technologists, and engineers are the creative engine of the Department. The Department and its national laboratories must cooperate to create conditions that allow today's researchers to be as productive as possible, as well as to ensure an adequate supply of tomorrow's researchers. Investments will help develop the next generation of scientists and engineers to support Department missions, administer its programs, and conduct the research that will realize the nation's science and innovation agenda. These investments will enrich the diversity of the STEM pipeline so that it is more inclusive of women, minorities, and persons with disabilities while mentoring the next generation of scientists, technologists, and engineers. …"

SC funds these programs to help sustain the DOE's scientific and technical workforce pipeline

Who manages these programs?

Office of Workforce Development for Teachers and Scientists (WDTS)

Mission: WDTS program mission is to ensure that DOE has a sustained pipeline of highly skilled and diverse science, technology, engineering, and mathematics (STEM) workers.

Current WDTS programs:

- At the DOE laboratories: Undergraduate student intern programs (one for 2/4-yr institutions and one for community colleges) and a visiting faculty program:
  - Science Undergraduate Laboratory Internship (SULI) - ~700/year
  - Community College Internship (CCI) - ~70/year
  - Visiting Faculty Program (VFP) - ~(50/25)/year
- Office of Science Graduate Fellowship
- Albert Einstein Distinguished Educator Fellowship
- National Science Bowl

SULI, CCI, & VFP:

- *WDTS funds these programs, provides oversight, manages their national application systems, and ensures that a common set of core program elements are delivered.*

- *Host labs operate these programs locally - identify mentors and projects according to their mission overlap, review , select, and candidates, and execute professional development activities.*

Science Undergraduate Laboratory Internship (SULI)

The SULI program places undergraduate students(from 2 or 4 year institutions) in paid internships in science and engineering research activities at DOE Laboratories. Students work with laboratory staff scientists or engineers on projects related to ongoing research programs. This, or its predecessor programs, have been in operation since the early '90s.

- Appointments are for:
  - 10 weeks during the Summer Term (May through August) or 16 weeks during the Fall Term (August through December) and Spring Term (January through May).
  - Application process for the 2014 Summer Term closes on Jan. 10, 2014 at 5:00 PM ET.
- All interns have defined research projects that must be within the DOE mission space.
- All interns have required deliverables: A research report, an oral or poster presentation, a peer review, a general audience abstract, and pre- and post- participation surveys.
- Interns receive a $500 weekly stipend, travel to and from the laboratory, and possibility for a housing allowance.
- Laboratories also provide an array of seminars and professional development opportunities.
- Undergraduates from 2 or 4 year colleges, in their sophomore through senior year or recent graduates are eligible to apply.
- Must be at least 18 years old; and a U.S. citizen or PRA.
- Must have a minimum cumulative GPA of 3.0.
- May participate as an intern a maximum of two times; May apply a maximum of three times.
- WDTS sponsors ~700 participants per year, majority (~535) in the Summer Term.

Please visit http://science.energy.gov/wdts/suli/ for full details and how to apply.

SULI Participant becomes Investigator on LCLS Experiment

Stephanie Mack, right, in the control room at LCLS, taking data for her experiment.

- Stephanie Mack, 20, a Nebraska native and now a senior at the University of Ottawa, is the youngest person to serve as an investigator in an experiment at the Linac Coherent Light Source.
- Mack was a SULI participant for the past two summers at SLAC. Last summer she observed an LCLS experiment for the first time and helped write a proposal for an LCLS experiment, which was successful.
- She credits her SULI experience, the mentorship of LCLS instrument scientist Joshua Turner, and guidance from members of the Soft X-ray Materials Science (SXR) instrument team in preparing her for the LCLS experiment.
- As part of an international collaboration, she studied manganite, one of a class of complex manganese-oxide compounds that has many desirable electronic and magnetic properties and that could ultimately lead to extremely fast, low-energy, non-volatile computer memory chips or data-switching devices.

Community College Internship (CCI)

The Community College Internship (CCI) places students from community colleges in paid internships in technology based projects supporting laboratory work under the supervision of a laboratory technician or researcher. This, or its predecessor program, have been in operation since 1999.

- Operates during a 10-week Summer Term (May through August)
- Application process for the 2014 Summer Term closes on Jan. 10, 2014 at 5:00 PM ET
- All interns have defined technical projects that are within the DOE mission space.
- All interns have required deliverables: A research report, an oral or poster presentation, and pre- and post- participation surveys.
- Interns are compensated as follows: $500 weekly stipend, travel to and from the laboratory, and a housing allowance.
- Laboratories also provide an array of seminars and professional development opportunities.
- Must be at least 18 years old; and a U.S. citizen or PRA.
- May participate as an intern a maximum of two times; May apply a maximum of three times.
- Must have a minimum cumulative GPA of 3.0.
- WDTS supports ~70 participants each Summer Term.

Please visit http://science.energy.gov/wdts/cci/ for full details and how to apply.

Visiting Faculty Program (VFP)

Opportunities for faculty from academic institutions that are typically underrepresented in the DOE research community to engage in a jointly developed research project at a DOE laboratory during the Summer Term. The scope of the projects should be robustly connected to ongoing host lab research project activities. This, or its predecessor program, have been in operation since 2003.

- Faculty may optionally invite up to two students to participate, one of whom may be a graduate student. VFP- Students must meet SULI requirements, apply separately, and only if invited.
  - Students must have a minimum cumulative GPA of 3.0.
  - Student interns have required deliverables matching those for SULI: A research report, an oral or poster presentation, a peer review, general audience abstract, and pre- and post- participation surveys.
- Operates during a 10-week Summer Term (May through August) - Application process for the 2014 Summer Term closes on Jan. 10, 2014 at 5:00 PM ET.
- Faculty receive stipend of $13,000 for 10 week term, undergraduates receive stipend of $500/week; all participants are provided travel to and from the laboratory, and possibility for a housing allowance.

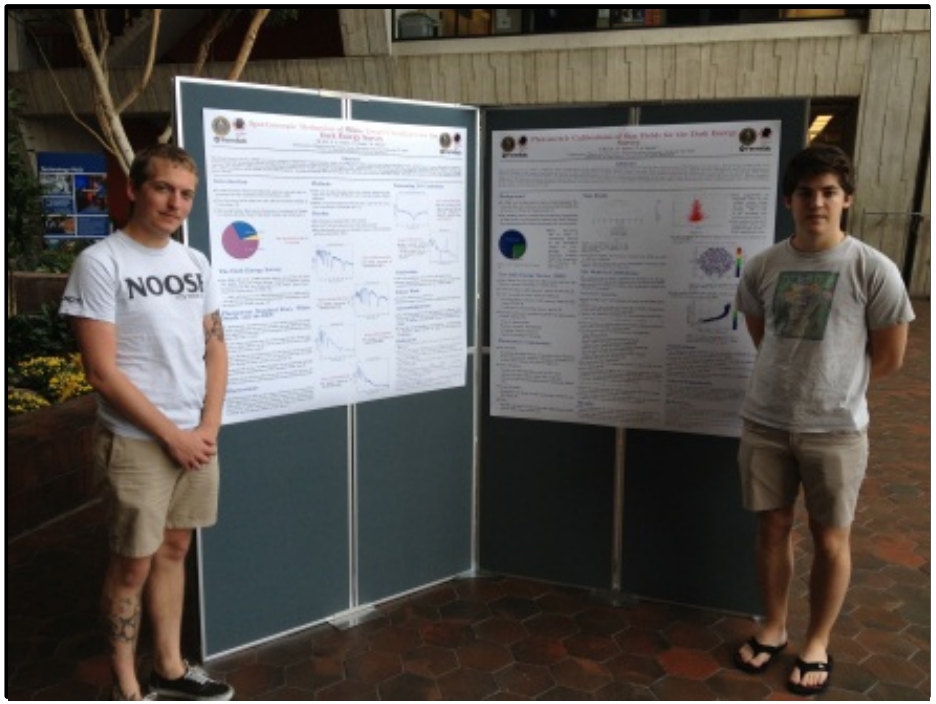
Please visit http://science.energy.gov/wdts/vfp/ for full details and how to apply.

Visiting Faculty Program (VFP), *cont.*

- Must be a full-time faculty member at an accredited U.S. degree granting, postsecondary, institution of higher education historically underrepresented in the U.S. research community, in an area of physics, chemistry, biology (non-medical), mathematics, engineering, environmental sciences, materials sciences, or computer / computational sciences (link to list of ineligible institutions from VFP webpages).
- Must be a U.S. citizen or PRA. Faculty may participate up to three terms.
- Faculty must, through their own efforts, establish a collaboration with a laboratory scientist to co-develop a 6-page research project proposal prior to applying to the program.
  - Faculty can contact host labs by using the POCs listed at: http://science.energy.gov/wdts/vfp/how-to-apply/selecting-a-host-doe-laboratory/
  - Proposal requirements are posted at: http://science.energy.gov/wdts/vfp/how-to-apply/submitting-a-proposal-to-doe/
- Students may only apply after receiving an invitation through the online system
  - Faculty, in their application, must list student(s) to receive system-generated invitation(s)
  - If a student had already applied to CCI or SULI, they must first "un-submit" this application
- WDTS supports ~ 50 faculty and ~25 students each Summer Term (this ratio is not prescribed).

Please visit http://science.energy.gov/wdts/vfp/ for full details and how to apply.

VFP Student Participant Discovers New Star while working on the Dark Energy Survey



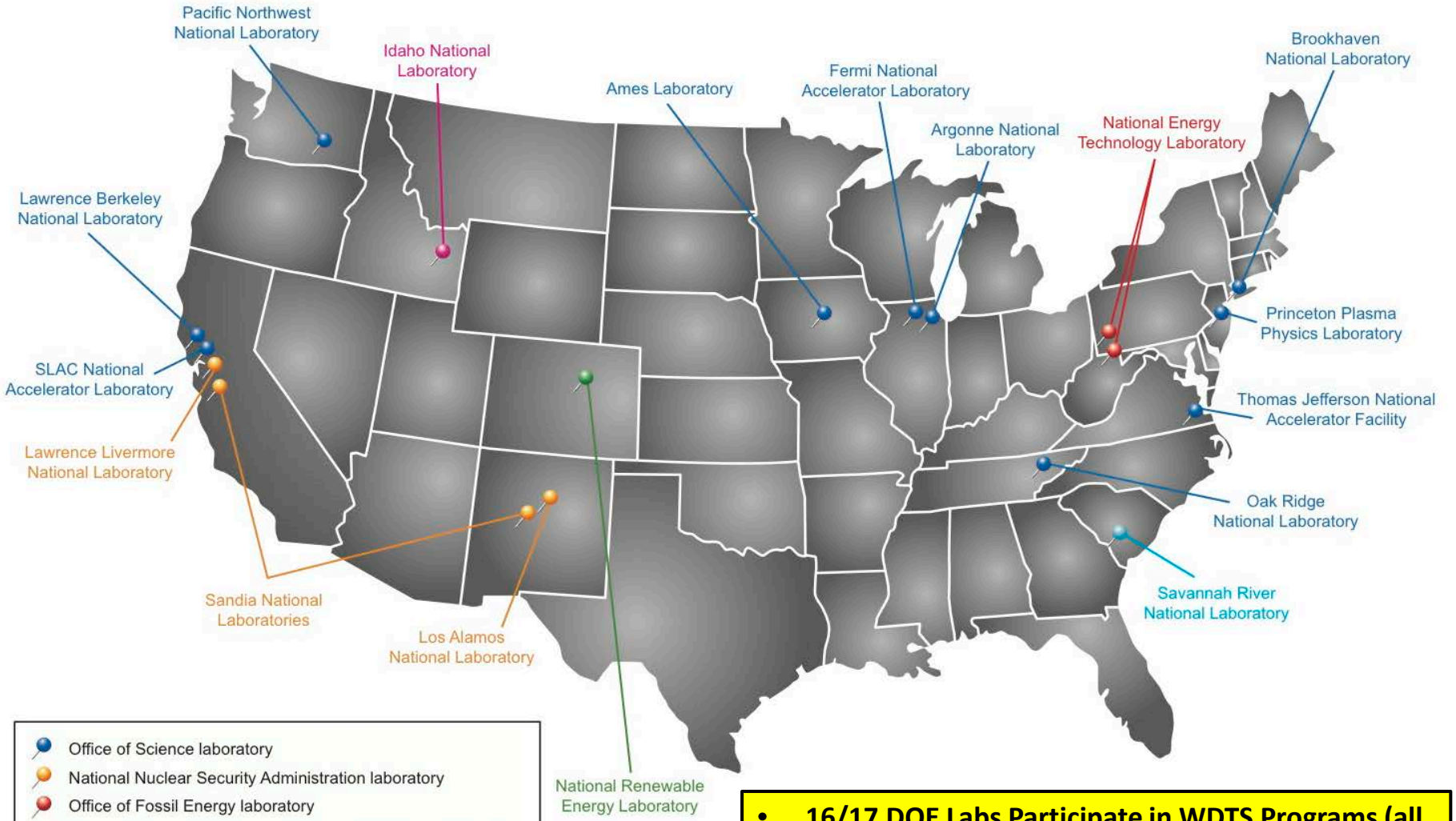
Mees Fix, left, and Sam Wyatt, presenting their project results at Fermi National Accelerator Laboratory. A presentation is one required VFP-Student participant deliverable, in addition to a research report, a peer review, and a general audience abstract. These deliverables are intended to help prepare interns for future STEM professional careers.

- Fermilab scientists Douglas Tucker and William Wester collaborated with visiting Professor J. Allyn Smith and student interns Samuel Wyatt and Mees Fix (all from Austin Peay State University) in a research project using Fermilab's unique "the cosmos as a laboratory" capability. This research directly supports ongoing Dark Energy Survey calibration studies, an experiment with the potential of discovering the nature of dark energy.
- Spectrographic data from many dozens of a certain type of star were collected and analyzed, where data from one star revealed a surprise when Mees Fix discovered that the emission spectrum had two components . . . one from the parent DA white dwarf and another component likely due to material from an unseen object falling into the white dwarf.
- The spectral data classifies the newly identified star as being a rare "cataclysmic variable star" — an object that warrants further studies.

Navigating the Online Application System

- Applications, and all required materials, must be submitted using the WDTS online application system:
  - Account creation is required for access and simply accomplished using links on WDTS program pages
  - When completing (students) an application, have available pdf copies of your most recent transcripts (and from any other institutions attended)
  - Have available names and email addresses for at least 2, but no more than 3, individuals able to complete a recommendation form on your behalf (the first two received recommendations by the online system fulfill this requirement)
  - The system sends a recommendation request email to your recommender with a link to its form
- The application, aside from general information about you, includes:
  - Numerous elements that tie directly to the eligibility requirements
  - Inquires about your areas of STEM studies, specialization, and interests
  - Inquires about your skills and experience
  - Includes four short essay questions
- **You** select a 1st and 2nd choice host DOE lab
  - Only these labs will view your application
  - Host labs do not all offer the same STEM specialization areas
  - Information on specific project opportunities may be available from host labs
  - Host labs do all offer similar professional development activities

DOE Laboratories (16/17 are WDTS Host Labs)



- **16/17 DOE Labs Participate in WDTS Programs (all except NETL)**
- **Project areas vary by stewardship and mission**

SULI, CCI, and VFP Information Resources

- Review the program web pages, including the FAQs:
  - The left-hand navigation items provide navigation to information related to eligibility, compensation, obligation, applying, selecting a host lab, recommendations, key dates, notification, and FAQs

    Science Undergraduate Laboratory Internships (SULI)
    http://science.energy.gov/wdts/suli/

    Community College Internships (CCI)
    http://science.energy.gov/wdts/cci/

    Visiting Faculty Program (VFP)
    http://science.energy.gov/wdts/vfp/

- Visit the WDTS Outreach page for additional presentations and recorded webinars:

  http://science.energy.gov/wdts/outreach/

WDTS Points-of-Contact

Jim Glownia – james.glownia@science.doe.gov; (301) 903 2411

http://www.science.energy.gov/wdts

- SULI:
  - **Cindy White**, Program Manager: cindy.white@science.doe.gov
  - http://science.energy.gov/wdts/suli/contact/
  - sc.suli@science.doe.gov
- CCI:
  - **Cindy White**, Program Manager: cindy.white@science.doe.gov
  - http://science.energy.gov/wdts/cci/contact/
  - sc.cci@science.doe.gov
- VFP:
  - **Brian O'Donnell**, Program Manager: brian.o'donnell@science.doe.gov
  - http://science.energy.gov/wdts/vfp/contact/
  - sc.vfp@science.doe.gov

Closing Words and Tips

Application deadline (including receipt of recommendations) is Jan. 10, 2014, at 5:00 PM ET (**no exceptions!**)

- Don't wait until the last minute, especially for requesting recommendations
- Host labs offer additional information resources regarding their programs and opportunities - visit their websites listed on our program pages or ask us for their contact information
- Ask us any questions using the provided resources
- Technical support for the online system is available during regular business hours
- One application per program, per term (see eligibility information for other limitations)
- When measuring the one-year SULI completion requirement, we only count credits earned while enrolled as a matriculating student
- Only complete, compliant, and eligible applications are released to host labs
- Note that Sandia National Laboratory now has SULI opportunities (at their Combustion Research Facility in Livermore, CA)
- Email your webinar related questions to:
  - sc.suli@science.doe.gov
  - sc.cci@science.doe.gov
  - sc.vfp@science.doe.gov