

Argonne: Overview and Opportunities

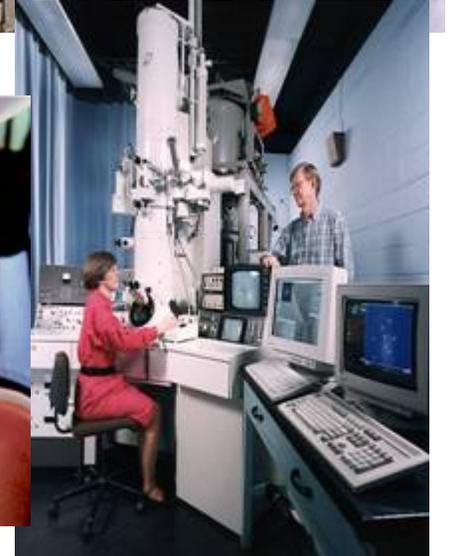
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***DOE/NSF ESPCoR Conference 2005
“Collaborative Research Opportunities for
Clean, Affordable, and Secure Energy”
June 14-16, 2005
Argonne National Laboratory***



About Argonne

- **Founded in 1943, designated a national laboratory in 1946**
- **Managed by The University of Chicago for the Department of Energy**
 - More than 2,700 employees and 5,000+ facility users
 - About \$475M budget
 - 1,500-acre, wooded site in DuPage County, Illinois
- **Broad R&D portfolio**
- **Numerous sponsors**



Argonne's Mission

- **Serve DOE & national security**
 - Advancing the frontiers of knowledge
 - Creating and operating forefront scientific user facilities (e.g., Advanced Photon Source, Intense Pulsed Neutron Source, Argonne Tandem-Linac Accelerator System)
 - Providing innovative and effective tools and solutions for energy and environmental challenges to national and global well-being, in the near and long term
- **In accomplishing its mission, Argonne partners with DOE, other federal labs, academia, and the private sector**



Forefront Science and Engineering

- **Basic and applied research**
 - Materials and chemical sciences and engineering
 - High energy, nuclear, and atomic physics
 - Multidisciplinary nanoscience and nanotechnology
 - Structural biology, functional genomics, and bioinformatics
 - Environmental science, technology, and assessment
 - Transportation technology
 - Computer science and applied mathematics
 - Computational science
- **Design, construction, and operation of accelerator-based user facilities**
- **Design, development, and evaluation of advanced nuclear energy systems and proliferation-resistant nuclear fuel-cycle technologies**



THE UNIVERSITY OF
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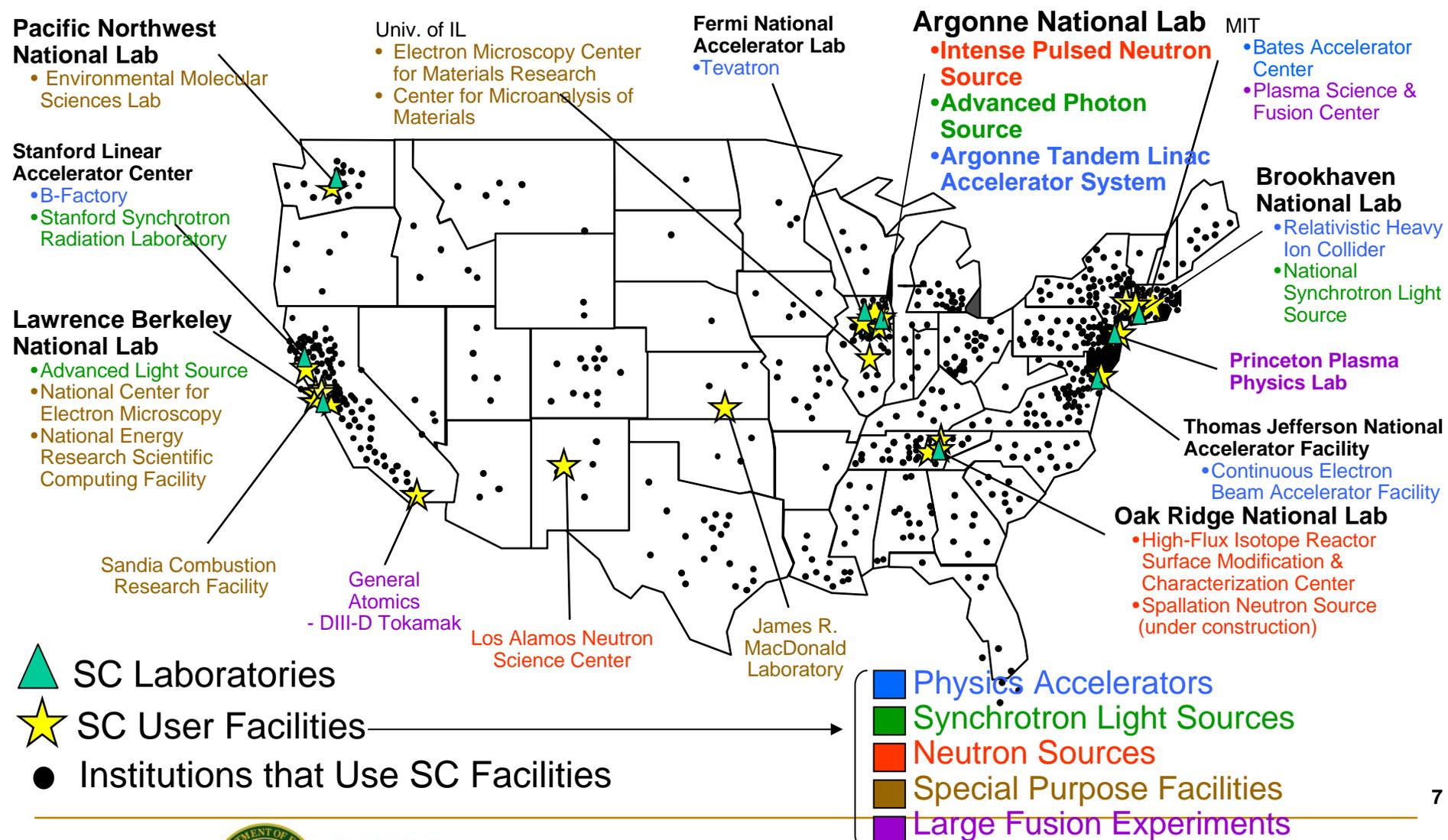
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Partnership Opportunities

- **User facility access**
 - Thesis/dissertation research
- **Major initiatives**
 - Participation; joint appointments
- **Topical workshops and ‘summer schools’**
- **Science and engineering collaborations on other projects of mutual interest**
 - Faculty and student research participation



DOE/Science Labs, User Facilities, and Their 16,000 Users' Institutions



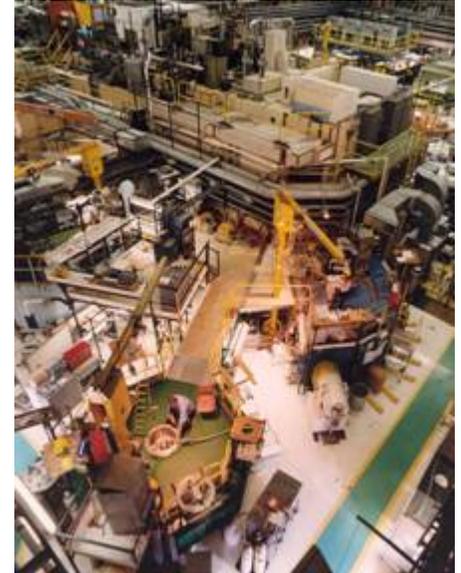
Advanced Photon Source

- Nation's most brilliant hard x-ray beams
- Materials science, chemistry, biology, protein crystallography, earth & environmental science, physics...
- 42 beamlines in operation
- Over 3000 users
- Operates year-round, 5000 hours/year
- Reliability over 95%
- Innovative X-ray instrumentation and operating modes
- www.aps.anl.gov/



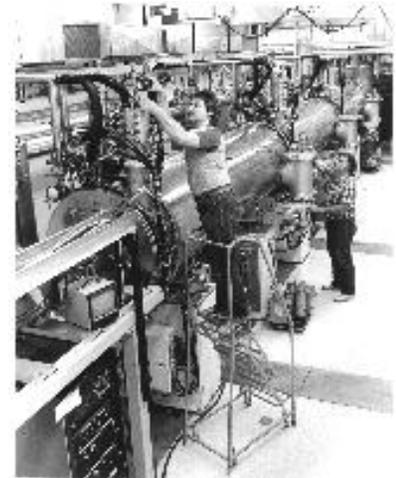
Intense Pulsed Neutron Source (IPNS)

- Pulsed thermal and cold neutron beams
- Materials science, chemistry, biology, physics, geology, nuclear science, engineering sciences
- 13 instruments
- 250+ users/visitors per year
- Reliability greater than 95%
- Instrument and technique innovation
- Instrumentation and user-community development for Spallation Neutron Source (SNS) being built at Oak Ridge
- www.pns.anl.gov/



Argonne Tandem-Linac Accelerator System (ATLAS)

- Low-energy, precision beams of any ion from protons to uranium
- Nuclear physics
- 8 experiment areas
- More than 150 active users
- Greater than 95% reliability
- Scientific and technical base for Rare Isotope Accelerator
- Low-beta superconducting accelerator technology
- www.phy.anl.gov/atlas/



Other Significant R&D Facilities

- Electron Microscopy Center
www.msd.anl.gov/groups/emcmr/
- Atmospheric Radiation Measurement (ARM) program www.arm.gov
- Transportation Technology R&D Center
www.transportation.anl.gov
- DOD approved Dilute Chemistry Facility
www.es.anl.gov/htmls/RDTE.html
- Alpha-Gamma Hot Cell Facility
www.et.anl.gov/sections/ip/facilities/aghcf.html
- Many more:
www.anl.gov/Science_and_Technology/programs.html



Argonne's Major Initiatives

Science

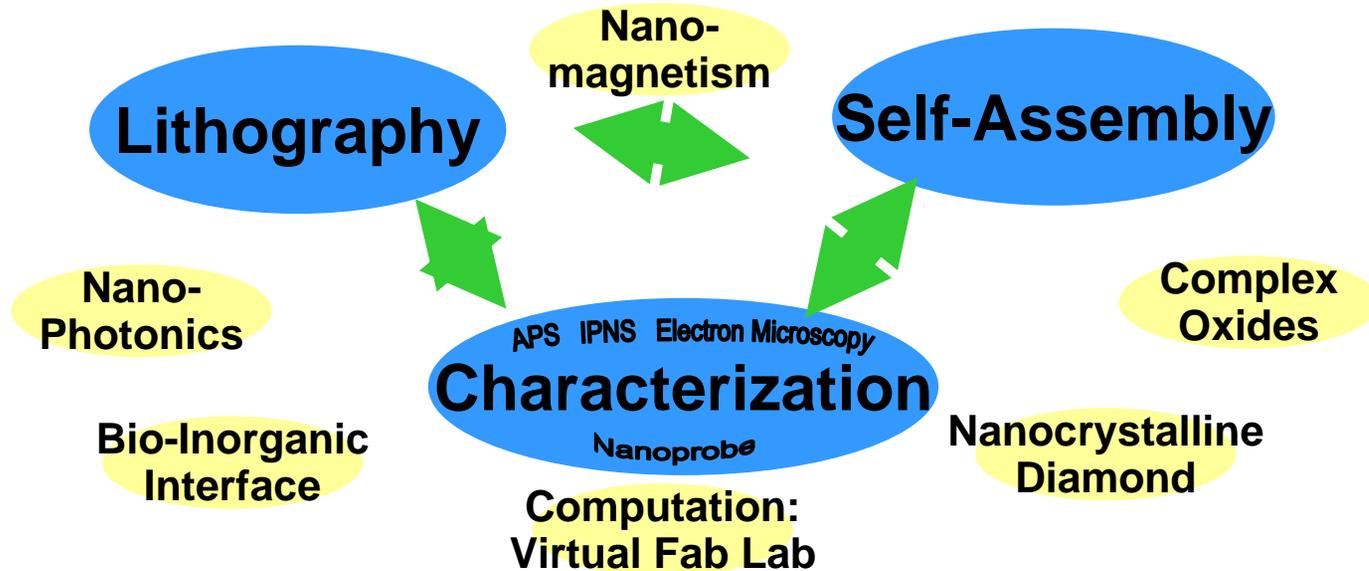
- **Nanoscience and Nanotechnology: Center for Nanoscale Materials**
- **Rare Isotope Accelerator**
- **Functional Genomics**
- **Petascale Computing and Computational Science**

Energy

- **Advanced Nuclear Energy Systems**
- **Hydrogen Research and Development**



Center for Nanoscale Materials



- One of DOE's five new Nanoscale Science Research Centers
- Forefront, interdisciplinary scientific themes
- State-of-the-art facilities and instrumentation; exploiting Advanced Photon Source and Intense Pulsed Neutron Source
- <http://nano.anl.gov/>



Advanced Computing

- **Strong ongoing programs with national impact**
 - Grid Computing: Globus, GridFTP
 - Scalable numerical tools: PETSc
 - Parallel computing: MPI, MPICH, Jumpshot
 - Advanced visualization: mMural, AccessGrid
- **Advanced Computing Initiative**
 - Data-intensive science/advanced Grid technologies
 - Bioinformatics, APS CATs, RIA/LHC, ...
 - Complex systems science
 - Whole-cell modeling
 - Virtual Fab Lab/nanoscience: self-assembly
 - Petaflop computing
 - TeraGrid update & TeraGrid facility (NSF)/DOE Computing Initiative
 - Maintaining momentum, and responding to the Japanese challenge
- www.mcs.anl.gov/



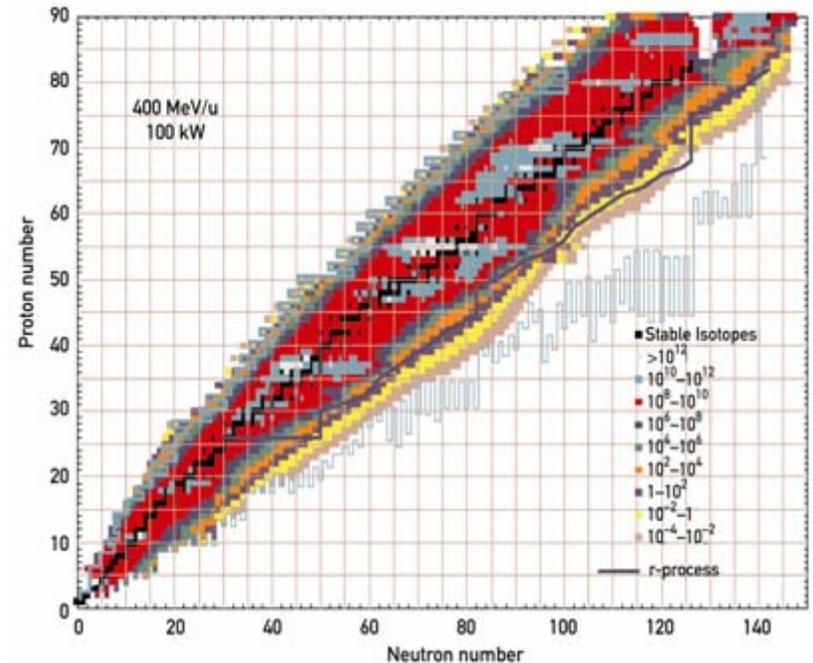
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Rare Isotope Accelerator (RIA)

- **Proposed new \$1 billion research facility is highest priority new construction for nuclear physics**
 - Beams from protons to uranium
- **Exciting science**
 - The nature of nucleonic matter
 - The origin of elements
 - Energy generation in stars
 - Tests of symmetries and fundamental conservation laws
- **Important applications**
 - Stockpile stewardship
 - Radioactive ion implantation
 - Medical isotope R&D
- **National team forming around Argonne, Michigan State Univ.**
- **www.anl.gov/ria/**



From NSAC Long Range Plan 2002



Bioscience

- **Major science foci:** structural biology, functional genomics, bioinformatics
- **Major facilities:**
 - Structural Biology Center at APS *Structure determination*
 - Midwest Center for Structural Genomics *High-throughput analyses*
 - APS, IPNS, ... *Neutrons and x-rays*
- **Technical capabilities**
 - Computing *Simulations and modeling*
 - Nanotechnology *Self-assembly, ...*
 - Robotics *High-throughput*
- **New directions: bioinformatics and functional genomics**
- www.bio.anl.gov/



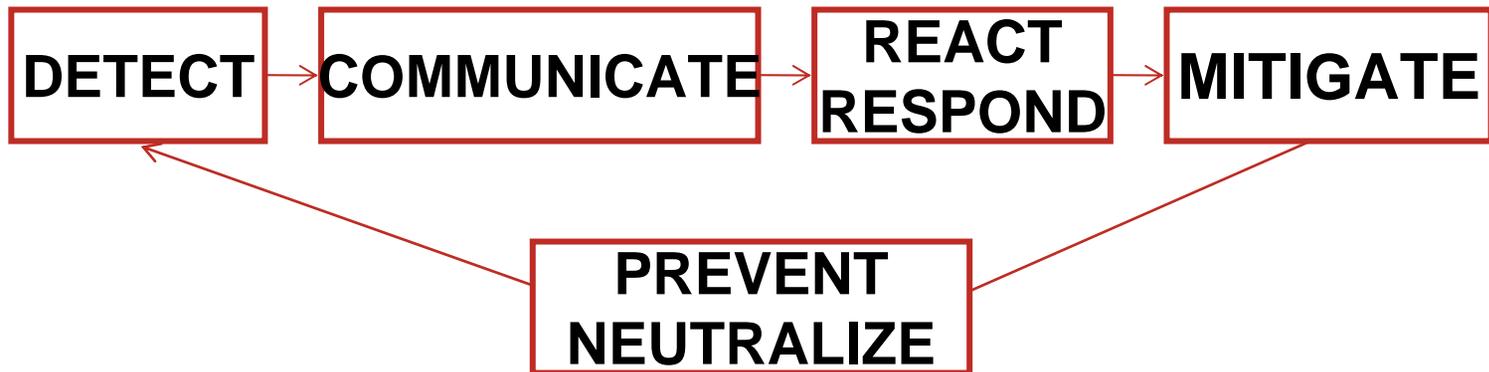
Advanced Nuclear Fuel Cycle

- **Demonstrate closed nuclear fuel cycle that consumes potential weapons material and simplifies nuclear waste storage requirements**
 - Treat spent nuclear fuel on a pilot-plant scale to extract remaining 98% of available energy
 - Separate short-lived fission products from spent fuel for geological repository
 - Recycle U, Pu, and minor actinides and consume in reactor fuel
- **Address key concerns of the public**
 - Ensure that the disposition and management of spent fuel and nuclear waste is safe and environmentally acceptable
 - Keep nuclear materials from diversion to weapons or terrorist use
- **Provide energy that is safe, greenhouse-gas-free, and economically competitive**
- **International partnership involving governments, industry, labs, and universities is forming now**
- **www.era.anl.gov/**



Argonne's Homeland Security Resources

- Expertise, knowledge, technologies, and specialized research facilities developed over decades for other purposes
 - Nuclear
 - Chemical and biological
 - Systems-level risk analyses
 - Emergency preparedness and response



Faculty and Student Participation

- Use of national user facilities
- Research collaboration
- Joint appointments
- Faculty summer/sabbatical research
- Student summer/thesis research
- Postdoctoral positions
- Topical schools & workshops
 - Neutron & X-ray summer school
 - RIA science school
 - Nanoscience, computing, etc
 - Annual Undergraduate Research Symposium
- www.dep.anl.gov



Explore Argonne's Opportunities

- Argonne welcomes growing collaborations with regional and national colleges and universities
- Argonne home page: www.anl.gov
- Student/faculty programs: www.dep.anl.gov

