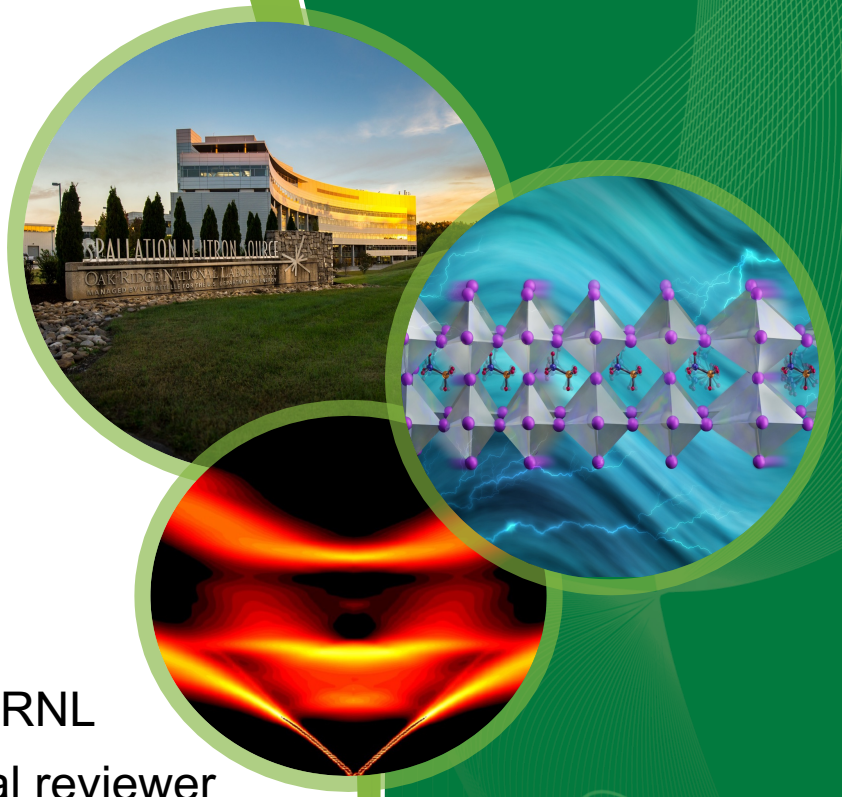
Proposal Writing



Michael Manley

Materials Science & Technology, ORNL

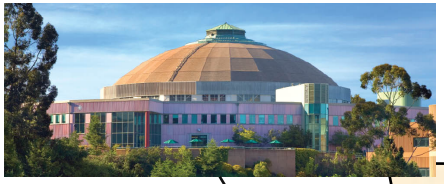
Facility User – Proposal writer – Proposal reviewer

ORNL is managed by UT-Battelle
for the US Department of Energy

OAK RIDGE National Laboratory

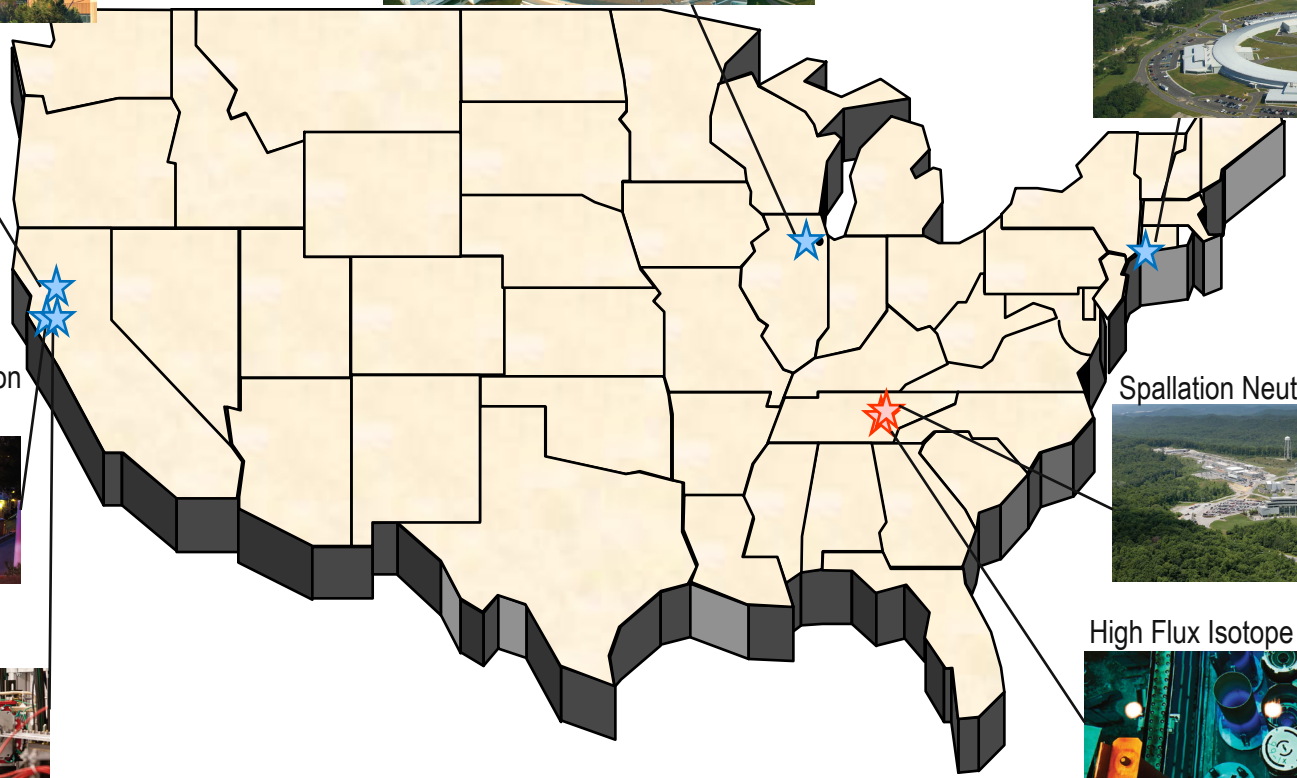
X-ray and Neutron Sources (most DOE-Basic Energy Sciences)

Advanced Light Source (ALS)

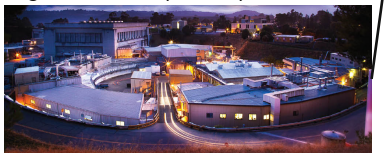


Advanced Photon Source (APS)

National Synchrotron Light Source II (NSLS-II)

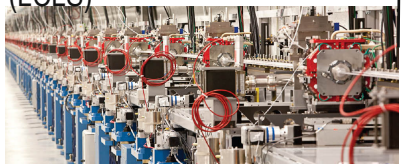


Stanford Synchrotron Radiation Light Source (SSRL)

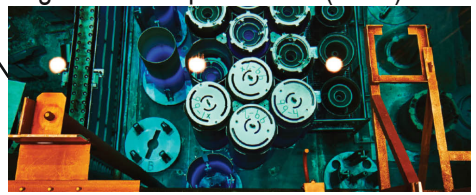


Spallation Neutron Source (SNS)

Linac Coherent Light Source (LCLS)

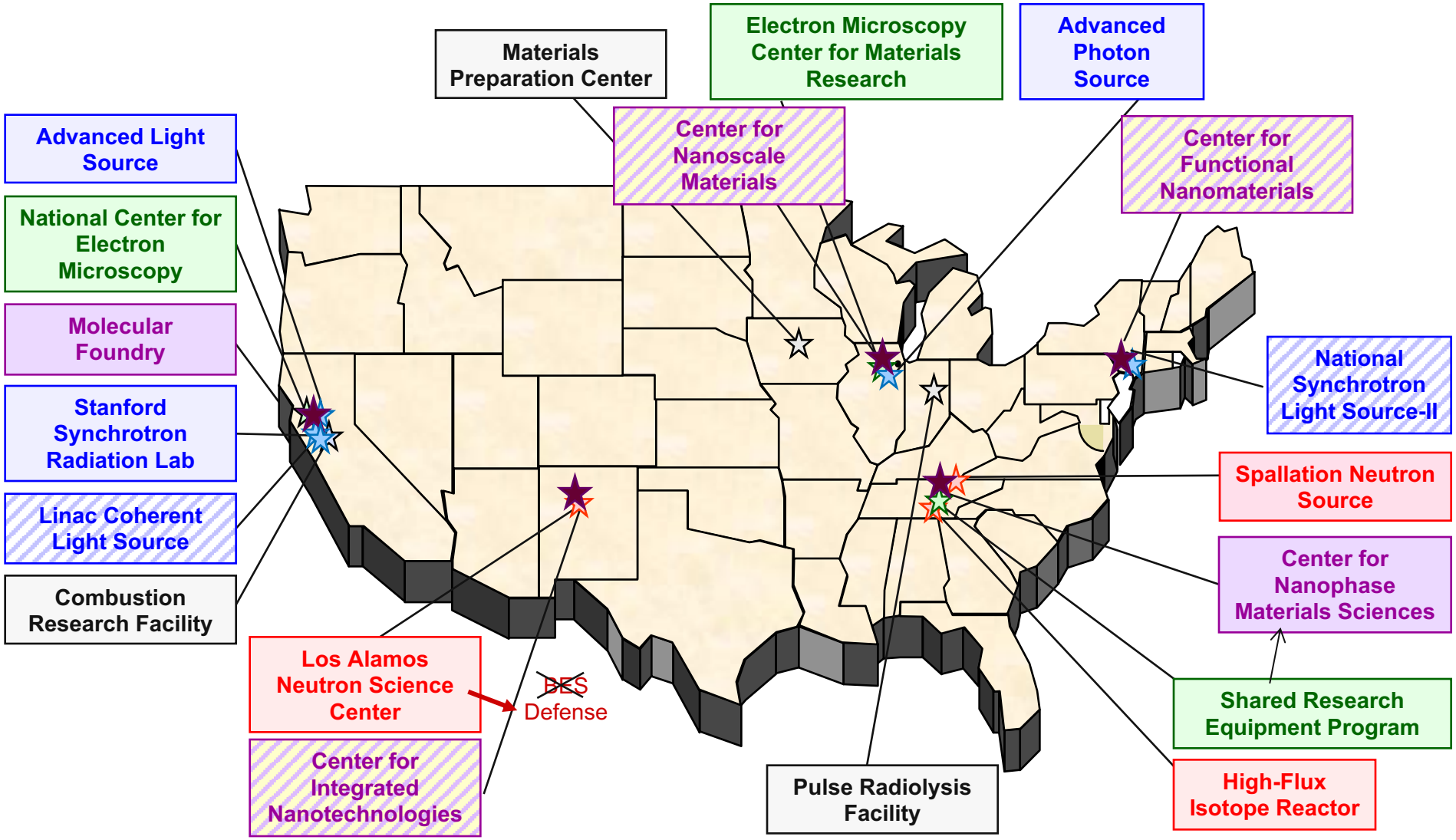


High Flux Isotope Reactor (HFIR)



Also 5 DOE Nanoscience Centers (BNL, SNL/LANL, ORNL, ANL, LBNL)
DOE Electron Microscopy Centers (ANL, LBNL, ORNL)

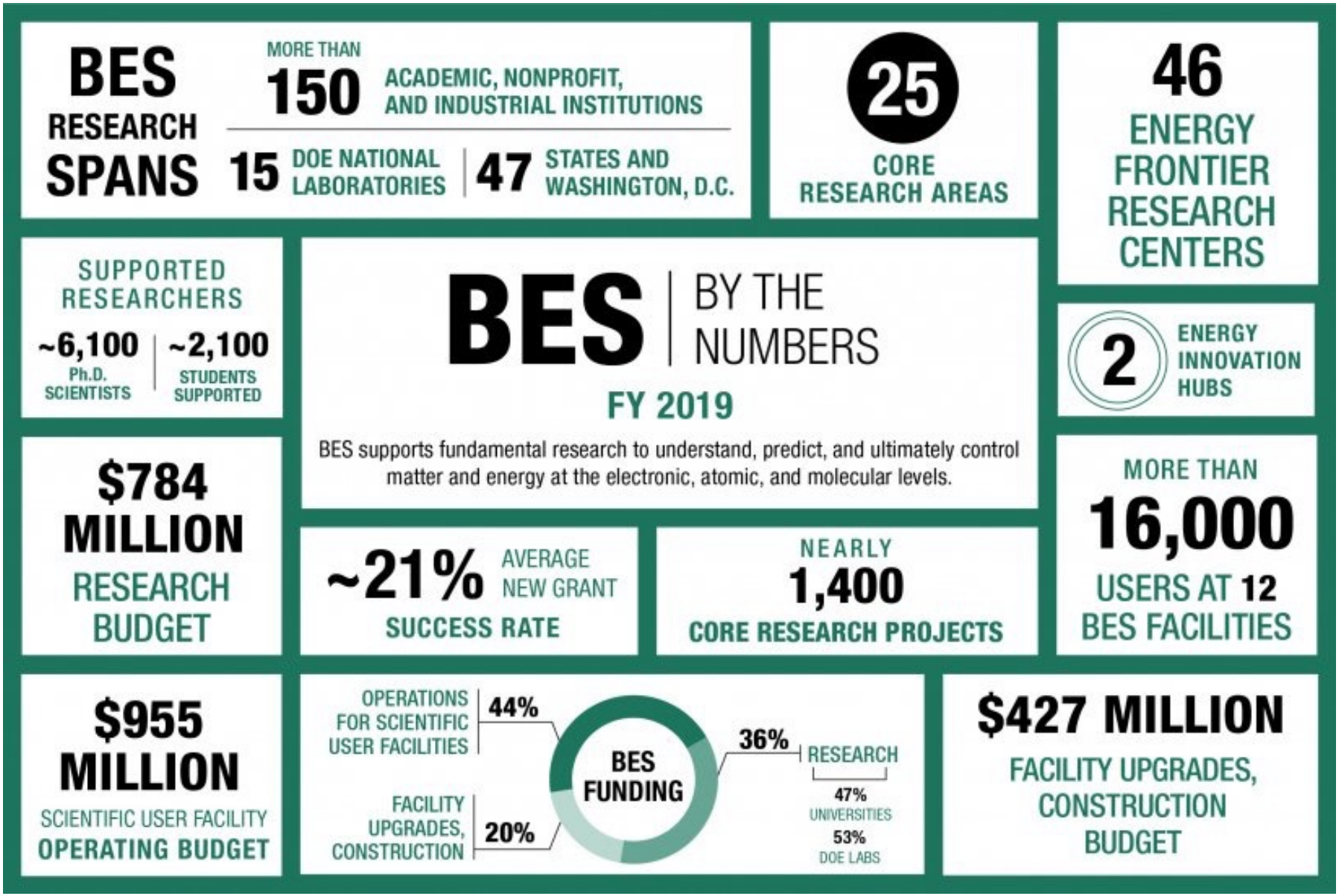
DOE-BES Scientific User Facilities



Also

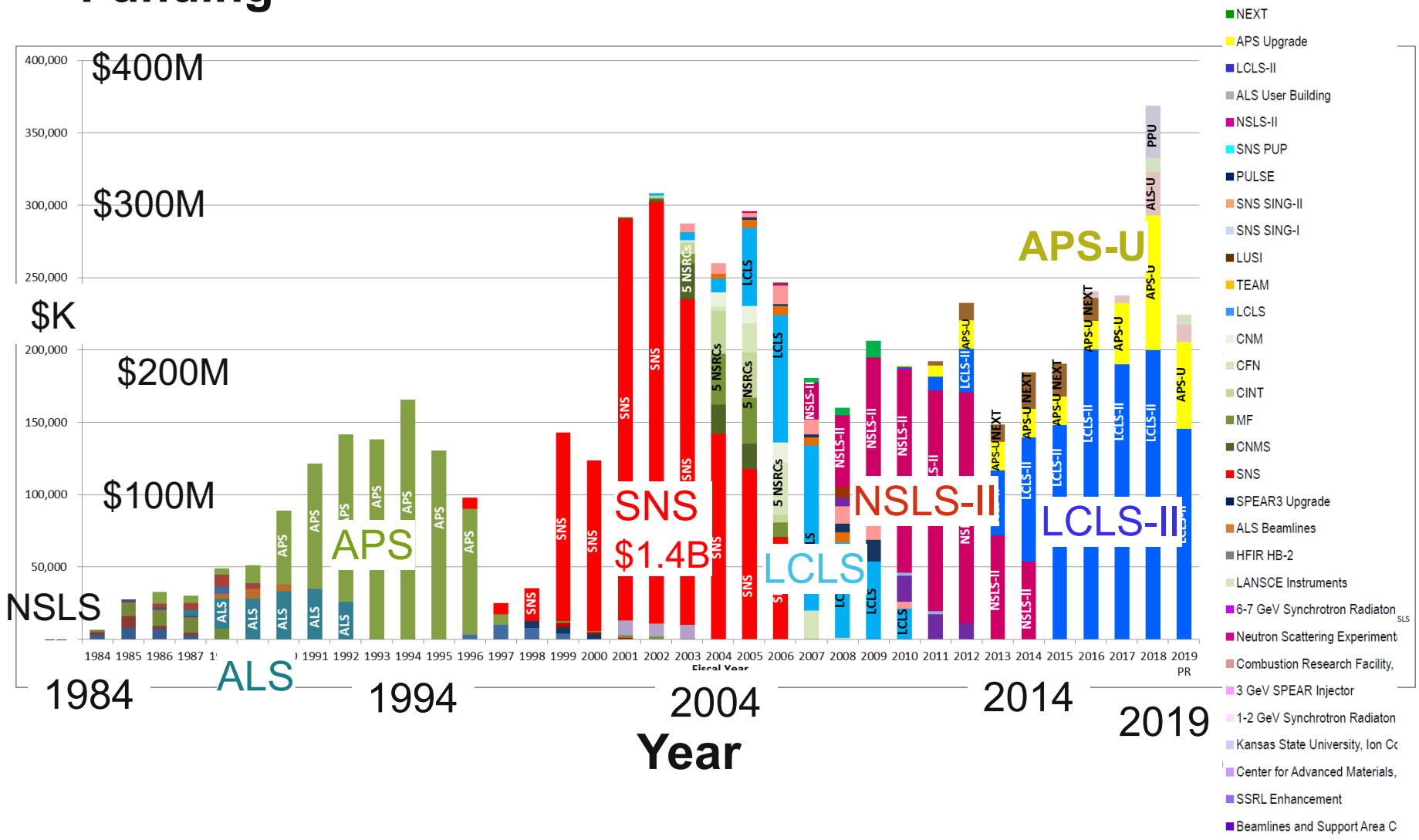
~46 EFRCs – Energy Frontier Research Centers, 2 HUBs
Advanced Scientific Computing Centers (e.g. NERSC)
NSF facilities (*e.g.* National High Magnetic Field Lab, CHESS, Nanotech)

DOE-BES By The Numbers



DOE-BES Facilities Construction ~35 Years

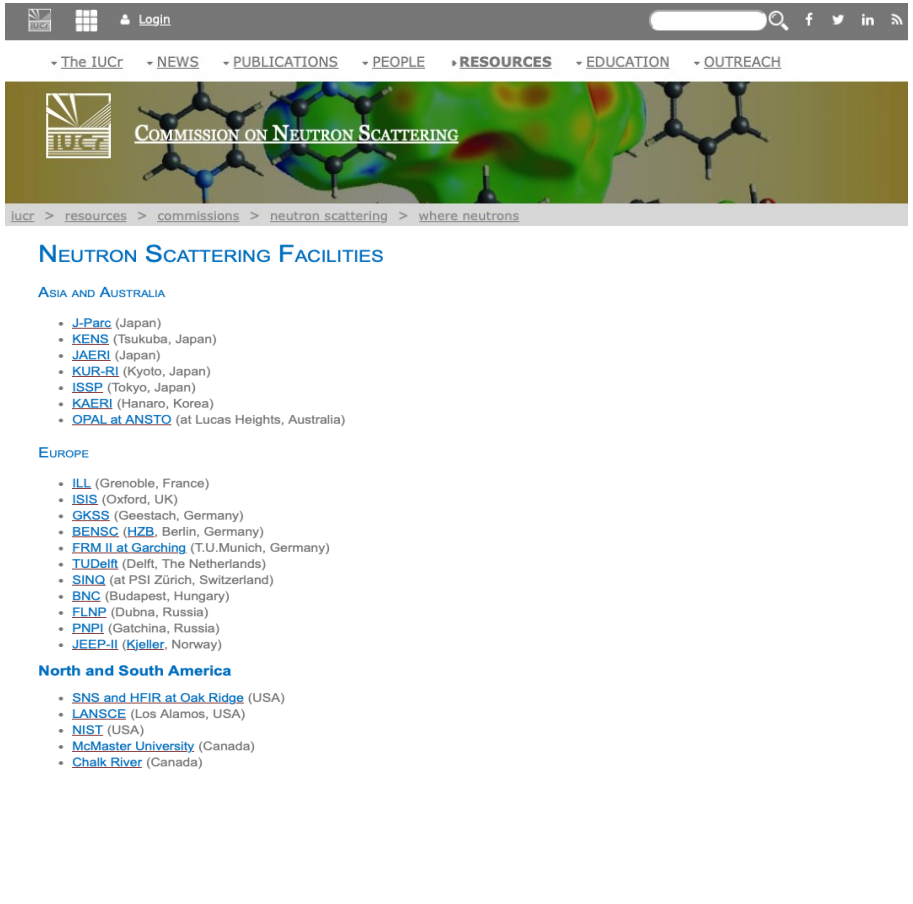
Funding



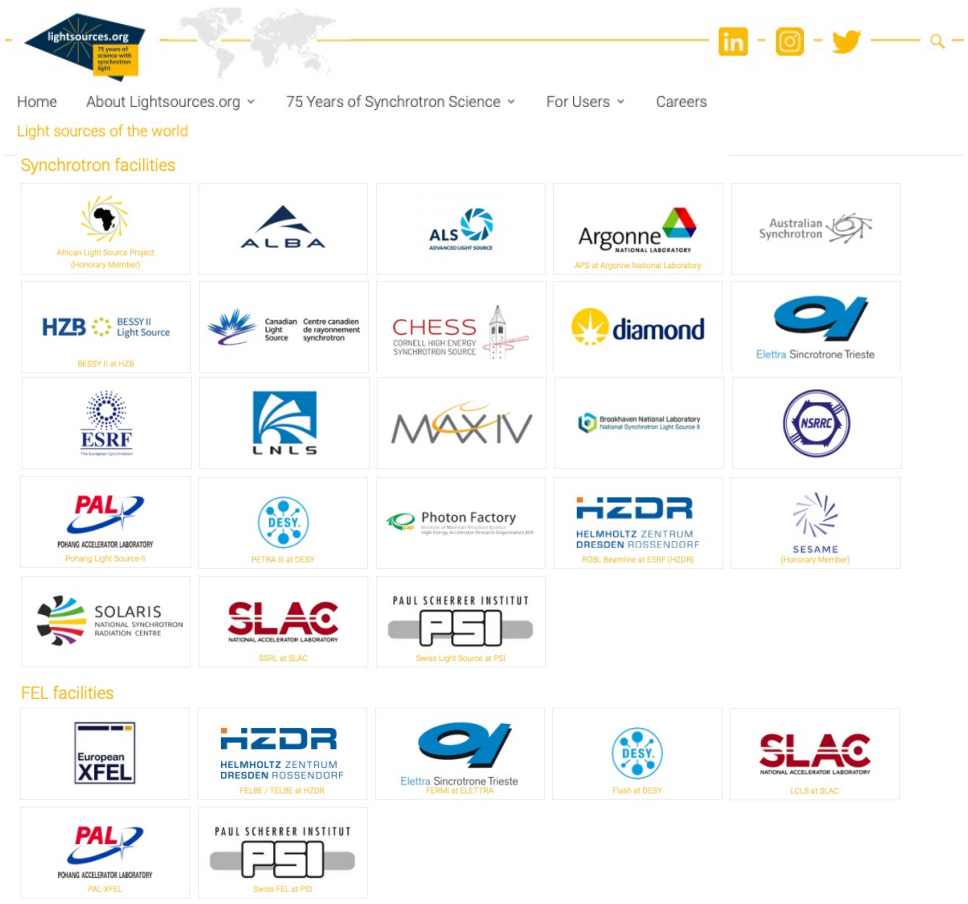
X-ray and Neutron Sources Available Worldwide

Scattering Science Goes Global – access varies

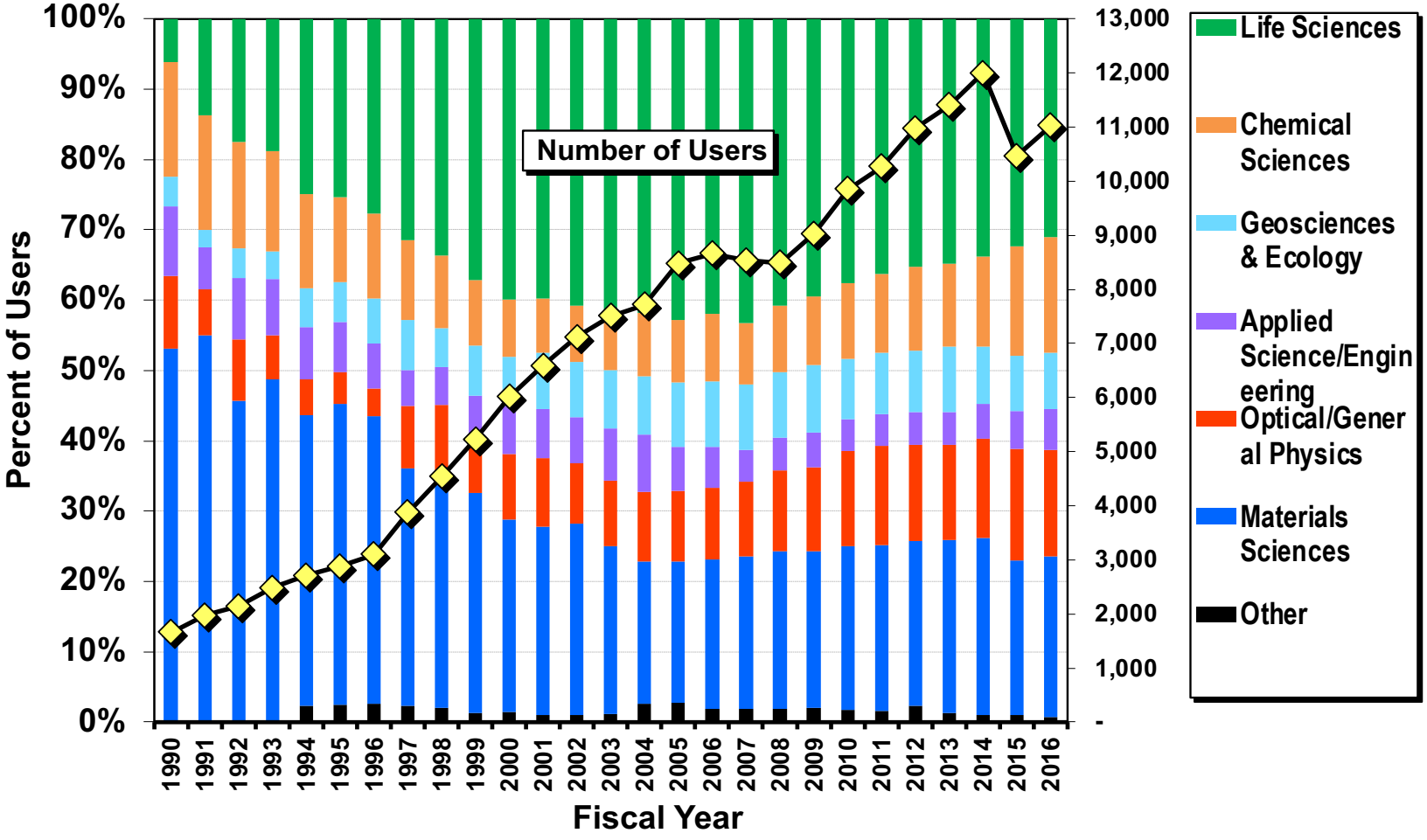
Neutron Sources at www.neutronsources.org



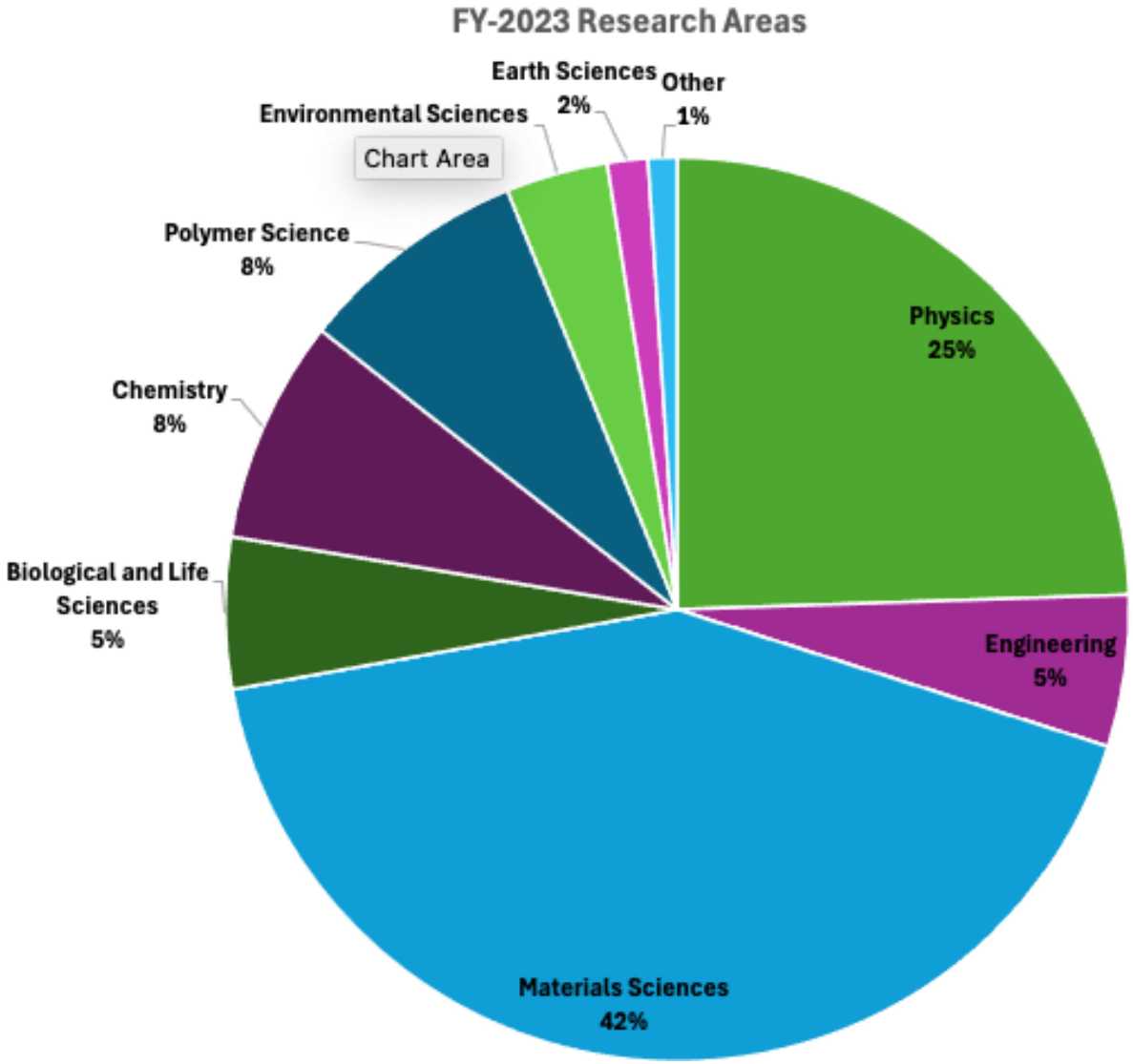
Light Sources at www.lightsources.org



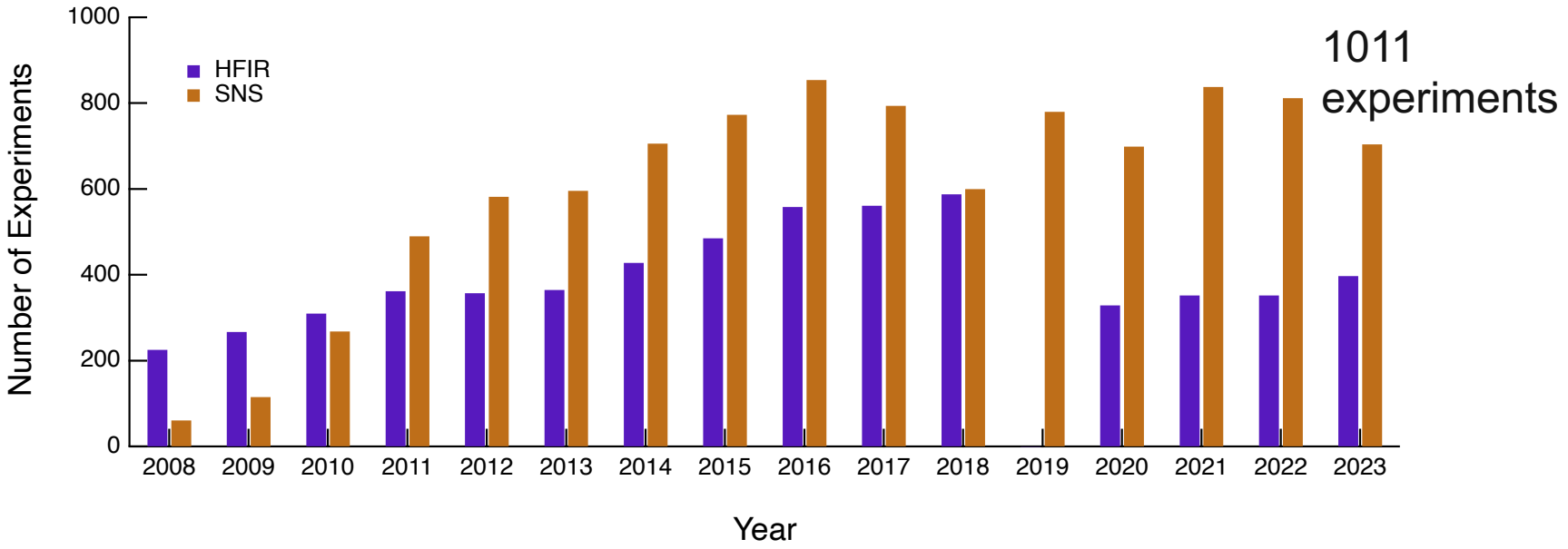
X-ray Source User Communities

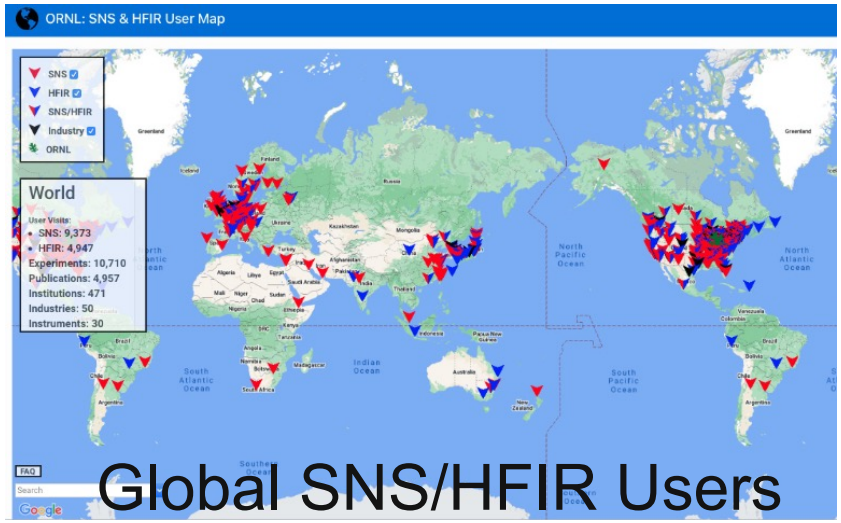


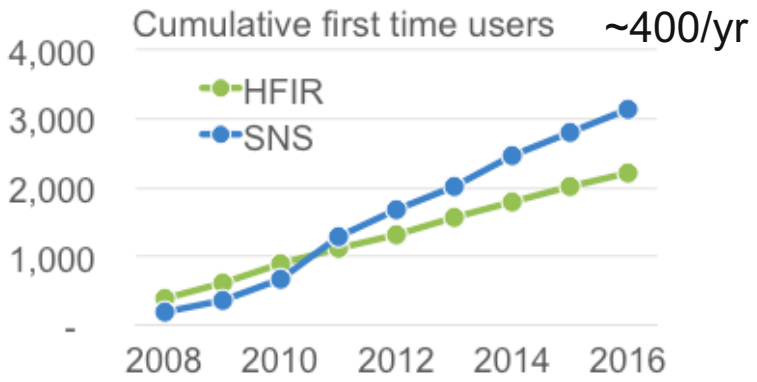
Neutron User Communities



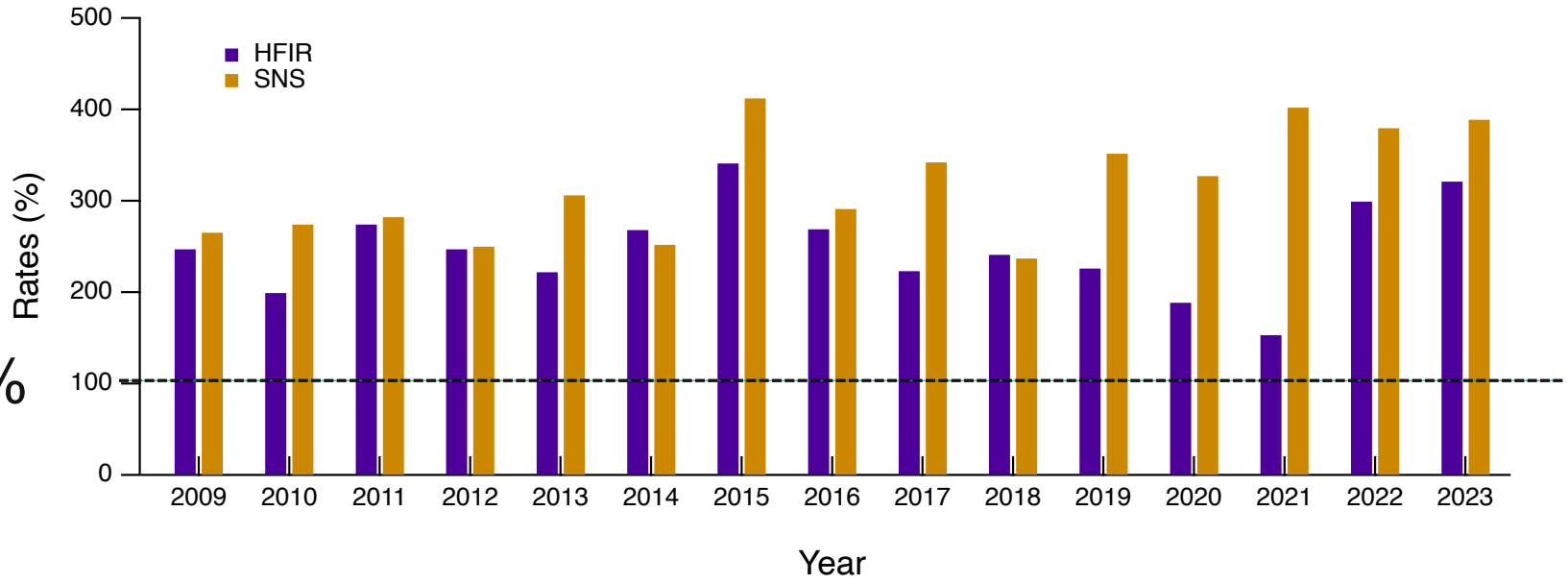
SNS and HFIR impact continues to grow







Overall subscription rates at HFIR/SNS remain high



100%

~30% receive beamtime

Basics of the facility proposal systems

All DOE (NIST & NSF) neutron and x-ray sources offer access to beam time through a proposal system.

- When and how often proposals are submitted varies by facility.
  - APS and NSLS-II three times (“cycles”) per year.
  - SNS/HFIR and ALS two times per year.
- All proposals are peer-reviewed and rated, and beam time is allocated using the scores. Once time has been allocated, beamline staff schedule the proposals.

Amount of general user time available

APS/NSLS/SSRL/ALS

- ✓ **All beamlines offer general user beam time.**
- ✓ **Most DOE/NSF funded beamlines provide 80-100% of their time to general users.**

SNS/HFIR

- ✓ **Amount varies by instrument.**
- ✓ **~75% of time will be for general users.**

For most, you can search facility websites by technique or by beamline. Quality of proposal websites varies.

Users Get Started with Assistance of the Instrument Scientists

Study instrument web pages

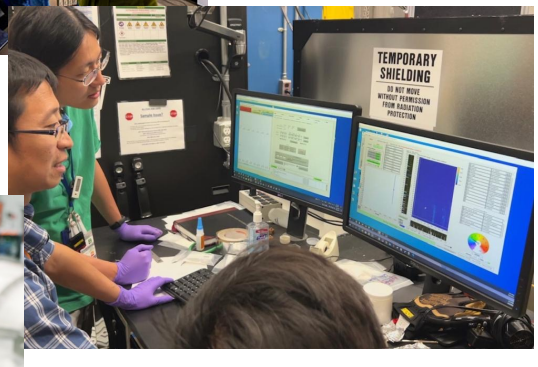
Contact an Instrument Scientist to discuss your research

- What is the research problem?
- Which instrument(s) are appropriate? (scores?)
- How mature is the research project (risk, size)?
- What is the material – sample composition, form, size, availability?
- What are the experimental conditions (temperature, pressure, magnetic field, etc)?
- What will be measured?
- Probability of success? Impact? Significance?
- How will results be presented and to whom?
- What is the timeline?

Instrument Scientists Assist First-time and Returning Users

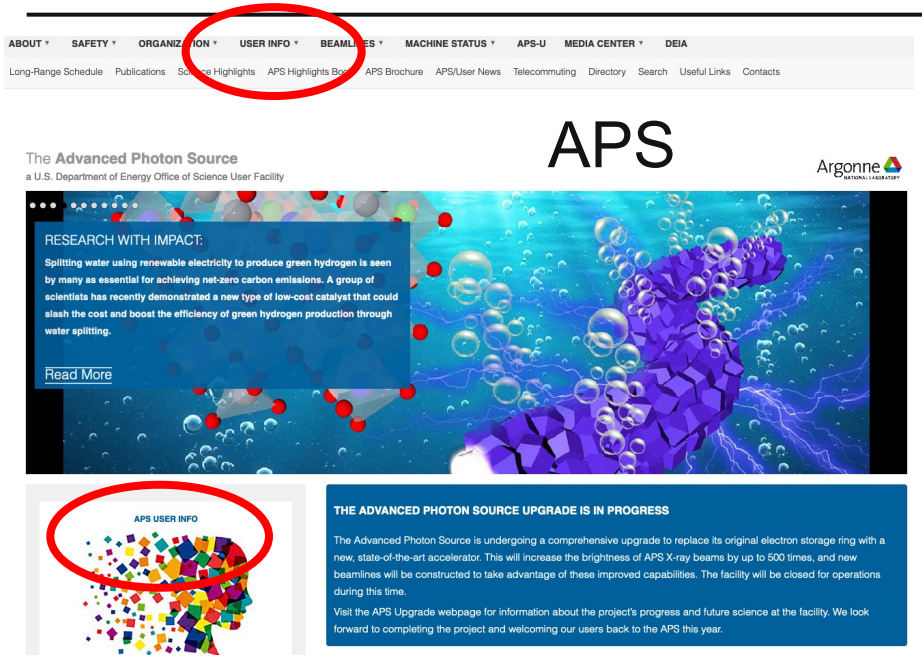
- Provide technical advice, guidance, and assistance
- Instrument options
- Sample and experiment preparation
- Number of experiment days
- Logistics (scheduling, transporting and storing samples)
- Proposal preparation tips and assistance
- Experiment team members
- Data analysis
- Publication considerations

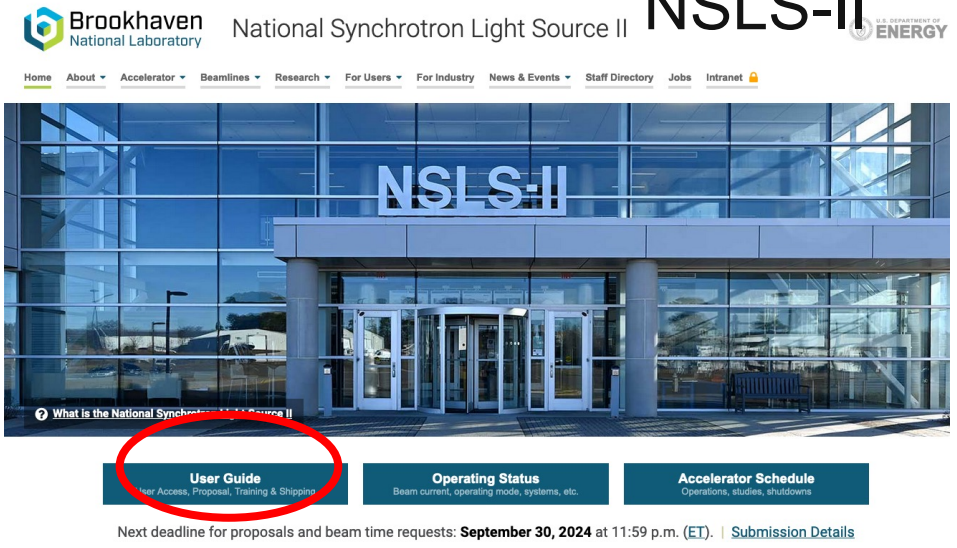
Consider beamline staff as collaborators, include as co-authors if appropriate.

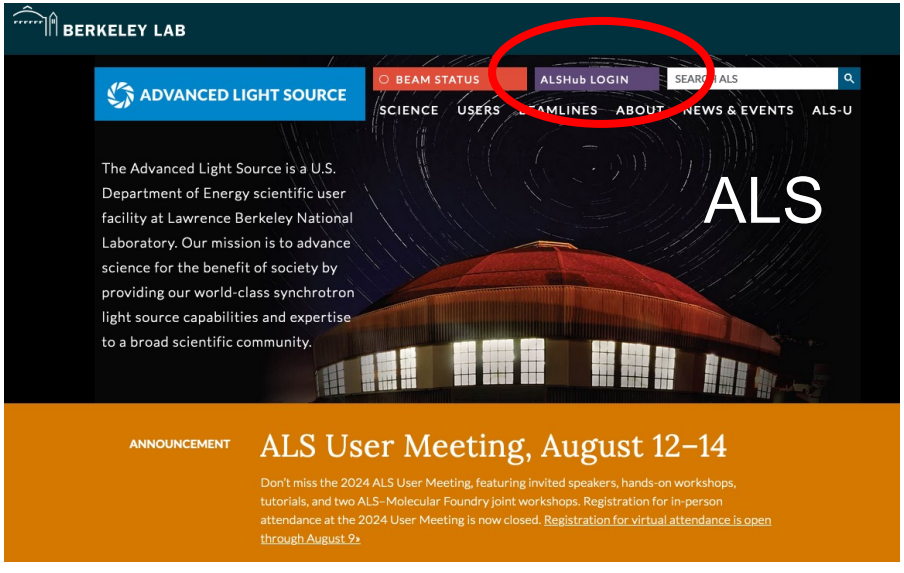


Submitting a proposal

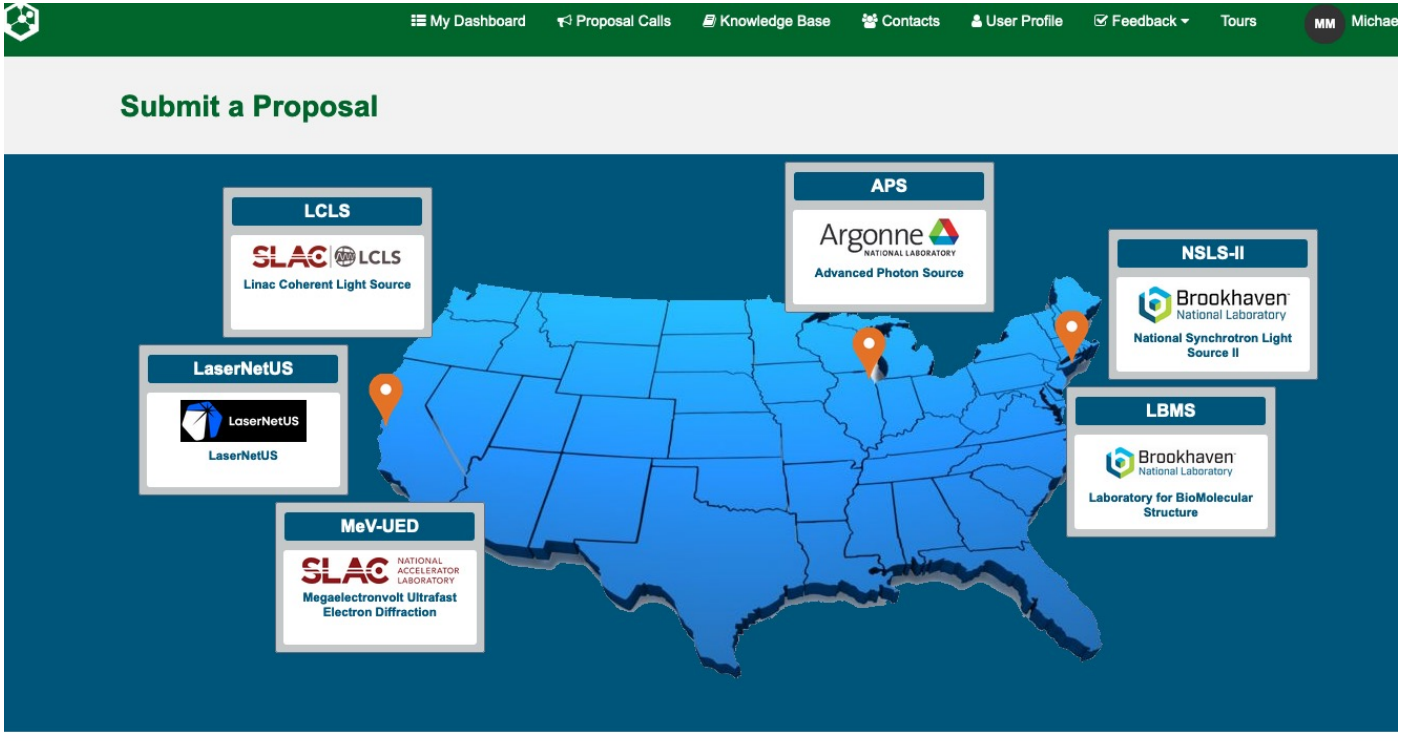
Facilities have link on home page

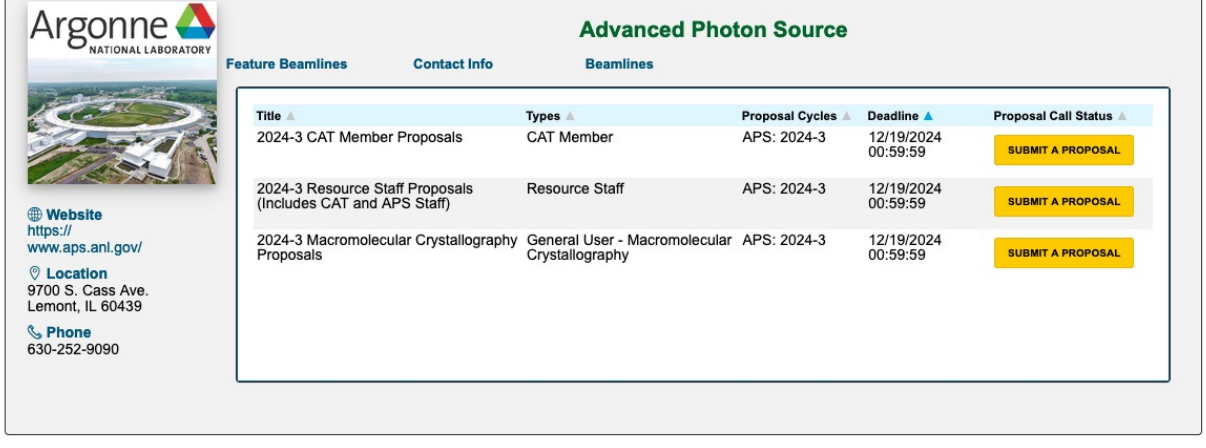






Light sources use a ”Universal Proposal System”





Different types of proposals allow facility flexibility – cont.

SNS HFIR
General User (majority of proposals – one cycle)
Programmatic (allows >1 cycle, e.g. your thesis)
Mail-in powder POWGEN, NOMAD, and VISION – New in 2024, ARCS, HYSPEC (powders)…
Proof of principle (feasibility – 1 day)
Sample alignment (add to other proposal) HFIR CG-1B Laue
Rapid Access - high impact, can be submitted anytime

NIST NCNR
MAIL-IN SAMPLES FOR POWDER DIFFRACTION
Accepts proposals for experiments on the BT1 powder diffractometer on "mail-in" samples. That is, samples may be mailed to NCNR staff, who will execute the data collection.

QUICK ACCESS PROPOSALS
If a user feels that beam time is required very soon to carry out important measurements that cannot be delayed, a proposal may be submitted requesting expedited access. The proposal will be reviewed by the BTAC, and held to a substantially higher standard than regular proposals.

Macromolecular Crystallography is often a separate, self-contained community

- A separate proposal system at APS.
- Highly automated for mail-in measurements.
- Beamtime relatively available.

Questions asked

General Info (Title, Experimenters, Funding source, etc.)

Abstract - What is the ***scientific importance*** of the proposed research?

Why do you need the facility to do this research?

- (Neutron vs. X-rays) or (Neutrons + X-rays)?
- Spallation source vs. reactor source
- Hard X-rays vs. Soft X-rays

Why do you need the beam line (and/or instrument)?

- Particular technique or sample environment

What previous experience / results do you have (pubs important)?

Describe the proposed experiment(s), including samples and procedures. Show that you're prepared.

Justification of the amount of time requested. Don't be greedy or unrealistic about time needed. Ask beamline staff.

Proposal: General information

Title should be specific and to the point, not vague.

- Good: “XAS study of Fe valence in $CaFe_2As_2$ under pressure ”
- Bad: “Understanding superconductivity in superconductors”

Is it thesis related? Is there a deadline?

- Will push your proposal up if scores are close

Fill in the abstract - This is where reviewer develops first impression.

Science impact in abstract is most important criteria for score.

Do upload a figure/publication from previous work.

- Shows you made good use of beam time.
- Do not upload a 20 pages of supplemental information (figures often help, couple of plots with text OK)

Experimental Details

- Give background information on why it is important.
  - Reviewer is not necessarily an expert on your subject. Try to capture imagination of reviewer with basic idea.
  - Each committee gets many proposals each cycle. Proposal needs to be clear.
- Clearly state what you want to measure and how.
  - Give some details. Temperature range, wavelength, sample geometry…
  - Sample characterization (XRD, SEM, etc.) and preliminary data important.
  - Reviewer and beamline need to judge if experiment is feasible
- Why use x-rays or neutrons?
  - Neutron vs. x-rays OR neutron + x-rays?
  - TEM, Mössbauer, Raman, etc. (Have you done your homework?)
- Justify the amount of beam time requested (ask instrument scientist!)
  - Be reasonable.

Ratings for APS Proposals

Review Criteria for General User Proposals

Criteria for reviewing general user proposals and for macromolecular crystallography general user proposals are shown below.

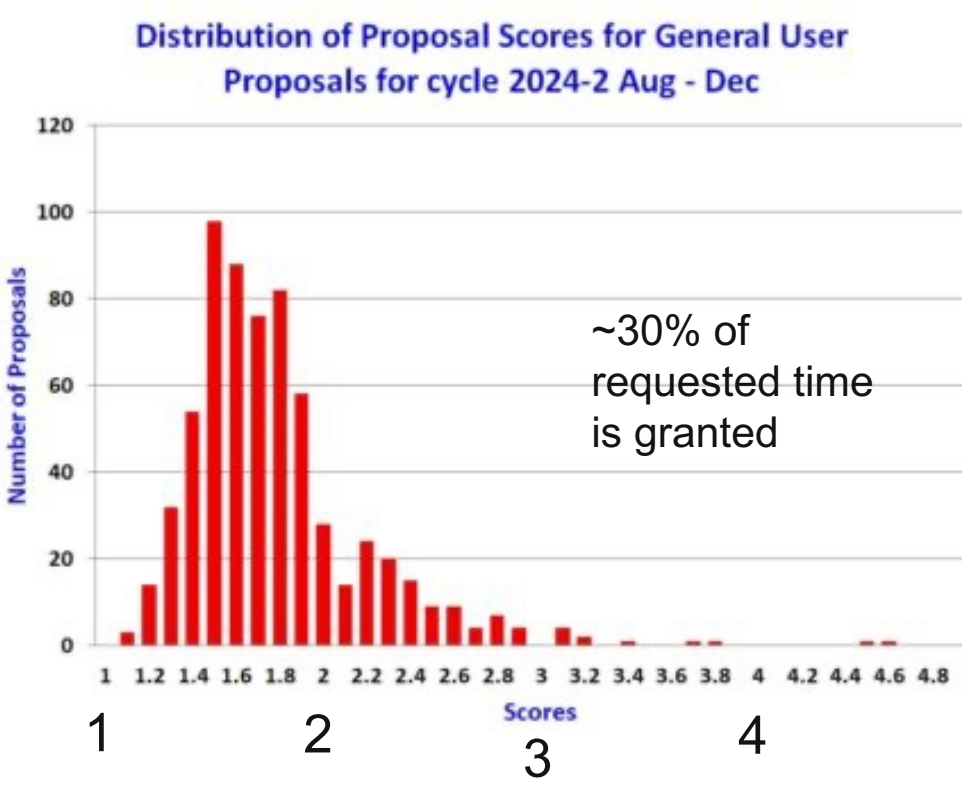
Rating Criteria for General User Proposals and Macromolecular Crystallography Proposals	
Impact of Research	◦ **Revolutionary**: Experiment results will significantly advance knowledge in a specific scientific/technology field. Very high probability of publication in a leading scientific journal and/or very high probability of technological/societal impact*. **(1)** ◦ **Significant**: The outcome of the proposed research will advance knowledge in a specific scientific/technology field. High probability of publication in a leading scientific journal and/or high probability of technological/societal impact*. **(2)** ◦ **Important**: Experiment results likely to produce incremental scientific/technological advances. Likely probability of publication in a non-leading scientific journal and/or some technological/societal impact*. **(3)** ◦ **Minimal**: The experiment results will not significantly impact a specific scientific/technology field. Publication may or may not result from this research and/or minimal technological/societal impact*. **(4)** ◦ **Insignificant**: Results not likely to make contributions to understanding of fundamental or applied fields. Publication not likely and/or no technological/societal impact*. **(5)**
Quality of Research Plan	◦ **Very High Quality**: Planned experiment demonstrates clear viability*, optimal understanding of facility resources and experimental team and their resources are above average. Data analysis strategy is very well thought out. **(1)** ◦ **High Quality**: Planned experiment is well thought out, viable*, and experimental team and their resources are adequate. Data analysis strategy is sound. **(2)** ◦ **Moderate:** Planned experiment is viable* but team would benefit from collaboration with facility staff. **(3)** ◦ **Below Average**: Research planning, resources, and/or data analysis strategy is lacking some important details. **(4)** ◦ **Poor**: Research plan is not well thought out. **(5)**
Justification of Need for Facility Resource	◦ **Essential**: The unique characteristics of the facility resources are shown to be essential for the success of the proposed work. **(1)** ◦ **Important**: The unique characteristics of the facility resources are important for the success of the proposed work **(2)** ◦ **Beneficial**: The proposed work will likely benefit from the use of the unique facility resources. **(3)** ◦ **Not required**: The proposed work does not take advantage of unique facility resources. **(4)**

APS proposals are rated on a scale from 1 to 5
Average score was ~1.6, but seems to slowly decrease
Cut off score for receiving beam time varies by beamline (1.3 - 2.2)

Proposal "**ageing**" (score improves by 0.2 each cycle it does not receive time, up to 0.4). This is needed for getting time at some oversubscribed beamlines, so long-term planning is needed. **But you have to remember to request beamtime again for every cycle.**

ALS provides cutoff scores – Helps you know what to expect

https://als.lbl.gov/general-user-proposal-score-statistics/



SNS/HFIR does not tell you a score or panel members.

You can try asking user office or beamline.

Beamline cutoff scores

Beamline	% Beam Time Allocated / Requested		Cutoff Score
1.4 (IR)	50		1.96
2.4 (SINS)	33		1.80
4.0.2 (Magnetic Spectroscopy/Scattering)	17		1.65
5.3.2.2 (Polymer STXM)	31		1.50
5.4 (IR)	49		1.97
6.1.2 (Soft X-Ray Microscopy)	21	easier	2.13
6.3.1.1 (Magnetic Spectroscopy)	31		1.83
6.3.2 (Calibration, Optics Testing, Spectroscopy)	40		1.87
7.0.1 (COSMIC)	20		1.44
7.0.2 (Surface & Materials Science (MAESTRO))	12		1.48
7.3.1 (ISAAC)	10		1.67
7.3.3 (SAXS)	15	harder	1.40
8.0.1 (SXF)	7		1.56
8.3.2 (Tomography)	24		1.50
9.0 (Chemical Dynamics, Coherent Imaging)	48		2.00
9.3.1 (Tender APXPS)	7	harder	1.28
9.3.2 (APXPS)	20		1.34
10.0.1 (HERS/AMO)	12		1.66
11.0.1 (PEEM3, Soft X-Ray Scattering)	23		1.40
11.0.2 (APXPS, STXM)	16		
12.2.1 (Small Molecule Crystallography)	42		1.70
12.2.2 (High Pressure)	27		1.49
12.3.2 (Microdiffraction)	61		1.52

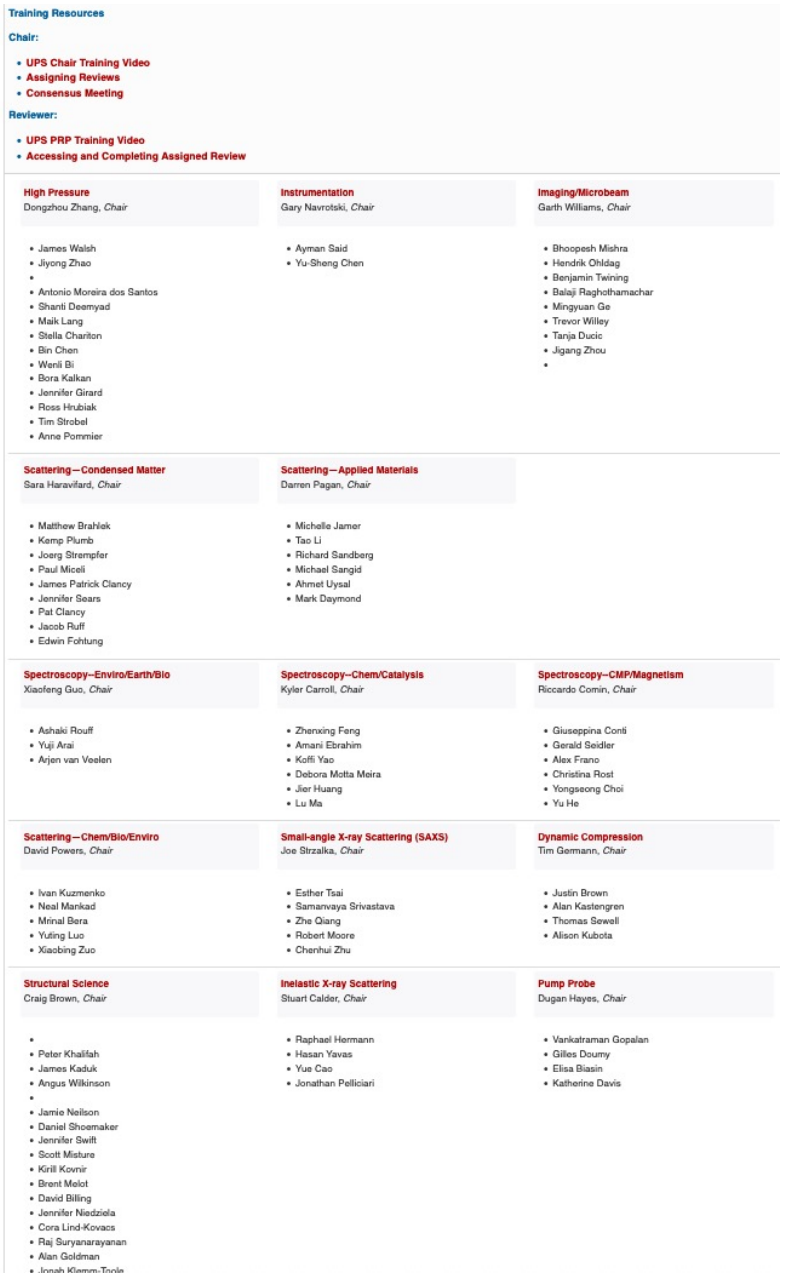
Pick appropriate panel!

13 Current Panels

High Pressure
Instrumentation
Imaging/Microbeam
Macromolecular Crystallography
Scattering - Condensed Matter
Scattering - Applied Materials
Scattering – Chem / Biol / Environment
Small Angle Scattering (SAXS)
Spectroscopy
Structural Science
Inelastic X-ray scattering
Pump Probe
Dynamic Compression

If multiple possibilities - Look at members & Ask staff

https://www.aps.anl.gov/About/Committees/Proposal-Review-Panels



Training Resources

Chair:

- UPS Chair Training Video
- Assigning Reviews
- Consensus Meeting

Reviewer:

- UPS PRP Training Video
- Accessing and Completing Assigned Review

High Pressure
Dongzhou Zhang, *Chair*

- James Walsh
- Jiyong Zhao
-
- Antonio Moreira dos Santos
- Shanti Deemyad
- Maik Lang
- Stella Chariton
- Bin Chen
- Wenli Bi
- Bora Kalkan
- Jennifer Girard
- Ross Hrubiak
- Tim Strobel
- Anne Pommier

Instrumentation
Gary Navrotski, *Chair*

- Ayman Said
- Yu-Sheng Chen

Imaging/Microbeam
Garth Williams, *Chair*

- Bhoopesh Mishra
- Hendrik Ohldag
- Benjamin Twining
- Balaji Raghothamachar
- Mingyuan Ge
- Trevor Willey
- Tanja Ducic
- Jigang Zhou
-

Scattering—Condensed Matter
Sara Haravifard, *Chair*

- Matthew Brahlek
- Kemp Plumb
- Joerg Strempfer
- Paul Miceli
- James Patrick Clancy
- Jennifer Sears
- Pat Clancy
- Jacob Ruff
- Edwin Fohtung

Scattering—Applied Materials
Darren Pagan, *Chair*

- Michelle Jamer
- Tao Li
- Richard Sandberg
- Michael Sangid
- Ahmet Uysal
- Mark Daymond

Spectroscopy--Enviro/Earth/Bio
Xiaofeng Guo, *Chair*

- Ashaki Rouff
- Yuji Arai
- Arjen van Veelen

Spectroscopy--Chem/Catalysis
Kyler Carroll, *Chair*

- Zhenxing Feng
- Amani Ebrahim
- Koffi Yao
- Debora Motta Meira
- Jier Huang
- Lu Ma

Spectroscopy--CMP/Magnetism
Riccardo Comin, *Chair*

- Giuseppina Conti
- Gerald Seidler
- Alex Frano
- Christina Rost
- Yongseong Choi
- Yu He

Scattering—Chem/Bio/Enviro
David Powers, *Chair*

- Ivan Kuzmenko
- Neal Mankad
- Mrinal Bera
- Yuting Luo
- Xiaobing Zuo

Small-angle X-ray Scattering (SAXS)
Joe Strzalka, *Chair*

- Esther Tsai
- Samanvaya Srivastava
- Zhe Qiang
- Robert Moore
- Chenhui Zhu

Dynamic Compression
Tim Germann, *Chair*

- Justin Brown
- Alan Kastengren
- Thomas Sewell
- Alison Kubota

Structural Science
Craig Brown, *Chair*

-
- Peter Khalifah
- James Kaduk
- Angus Wilkinson
-
- Jamie Neilson
- Daniel Shoemaker
- Jennifer Swift
- Scott Misture
- Kirill Kovnir
- Brent Melot
- David Billing
- Jennifer Niedziela
- Cora Lind-Kovacs
- Raj Suryanarayanan
- Alan Goldman

Inelastic X-ray Scattering
Stuart Calder, *Chair*

- Raphael Hermann
- Hasan Yavas
- Yue Cao
- Jonathan Pelliciari

Pump Probe
Dugan Hayes, *Chair*

- Vankatraman Gopalan
- Gilles Doumy
- Elisa Biasin
- Katherine Davis

Several common pitfalls

- Proposer assumes committee is familiar with their research and jargon.
- Proposal does not address ”Why should I care?”
- Proposer writes vague proposal asking for multiple weeks of time. Better to write a proposal with a well-defined objective and realistic time request.
- Proposer submits 2 (or more) similar proposals for related materials thinking that multiple proposals increases chances. Reviewers may not appreciate.

Common Reviewer comments:

- “Proposers could improve their score by including more experimental details, attaching previous results and expanding on the purpose and importance of the research.”
- “Hasn't the proposed research been published previously?”
- “We do not feel that granting 20 shifts/cycle for 2 years is consistent with the history of publication of this work.”
- “Proposer should perform initial characterization with lab sources or TEM.”
- “Will the signal be strong enough compared to background?”

After submission

- Allow time for review and revisions
- Expect feedback several weeks from the call close
- Be ready to schedule experiment if approved
  - Identify participating team members
  - Respond to facility access approval information
  - Facilitate execution of user agreements
  - Complete required training. Confirm sample availability and description and laboratory needs
- Consider reviewer comments if not approved and plan to resubmit this proposal or a new proposal in the next call. Opportunities continue to grow.

Scientific and Funding Opportunities

As a student

- Attend neutron & x-ray schools, workshops & user meetings. Knowledge and connections have long-term impact. Collaborations are essential.
- Join SNS HFIR User Group (SHUG) and other facility user organizations
  Advocacy group, learn about and influence new developments
- Explore DOE and NSF internships, fellowships, and research programs
  SCGSR; ORISE/ORAU (HERE, GO!). Local contacts help (a lot).
  https://science.energy.gov/wdts/scgsr/how-to-apply/priority-sc-research-areas/
- Invite scientists from national labs to your campus, e.g. for seminar

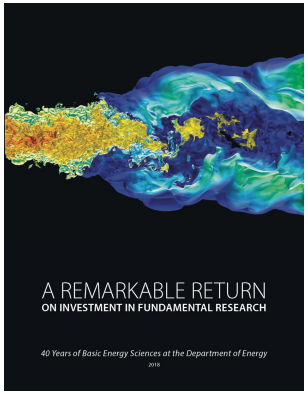
As a young professional

- Continue to use “free” user facilities
  New faculty and industrial users can be favored in reviews
- Volunteer to be a reviewer on proposal panels
- Consider EPSCoR programs if located in a participating state
- Apply for Early Career award – great for tenure application

Proposal Resource: "Basic Research Needs Workshop on..."

~50 reports in past ~20 yrs; Participants from academia, industry, and DOE labs

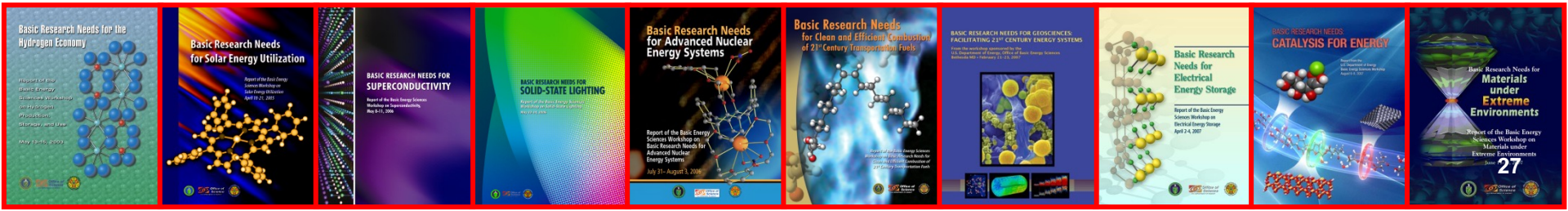
2002-2018



- **BES at 40: Remarkable Return on Investment in Fundamental Research**
- **Basic Research at the Frontiers of XFEL Ultrafast Science (2017)**
- **Quantum Computing in Chemical and Materials Sciences (2017)**
- **BRN on Energy and Water (2017)**
- **BRN for Future Nuclear Energy (2017)**
- **BRN on Next Generation Electrical Energy Storage (2017)**
- **BRN on Catalysis Science (2017)**
- **BRN Synthesis Science for Energy Relevant Technology (2016)**
- **BRN on Future Electron Sources (2016)**
- **BES Computing - Exascale Requirements Review (2015)**
- **BRN Quantum Materials for Energy Relevant Technology (2015)**
- **BRN for Environmental Management (2015)**
- **Challenges at the Frontiers of Matter and Energy (2015)**
- **Controlling Subsurface Fractures and Fluid Flow (2015)**

http://science.energy.gov/bes/community-resources/reports/

Focused on current & future, not a scientific review – good source of science motivation



QUESTIONS?

NXS Lecture - Mike Manley:
"Proposal Writing"