National Synchrotron Light Source II

Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

Welcome!

Erik D. Johnson

NSLS-II Interim Director and Deputy Director for Construction

XAS 2024, March 19th , 2024

Brookhaven Lab Today

Relativistic Heavy Ion Collider, future Electron-Ion Collider

Physics

Instrumentation

Computational Science

Northeast Solar Energy Research Center

Chemistry

Biology, More

Interdisciplinary Science Bldg. for Energy

Center for Functional Nanomaterials

Lab for BioMolecular Structure (Cryo-EM)

National Synchrotron Light Source II

Environment, Nonproliferation, and More

Plus Much, *Much* More!

Long Island Solar Farm

Brookhaven Lab Yesterday

BNL *circa* 1962

AGS brand new

BGRR operating

HFBR construction

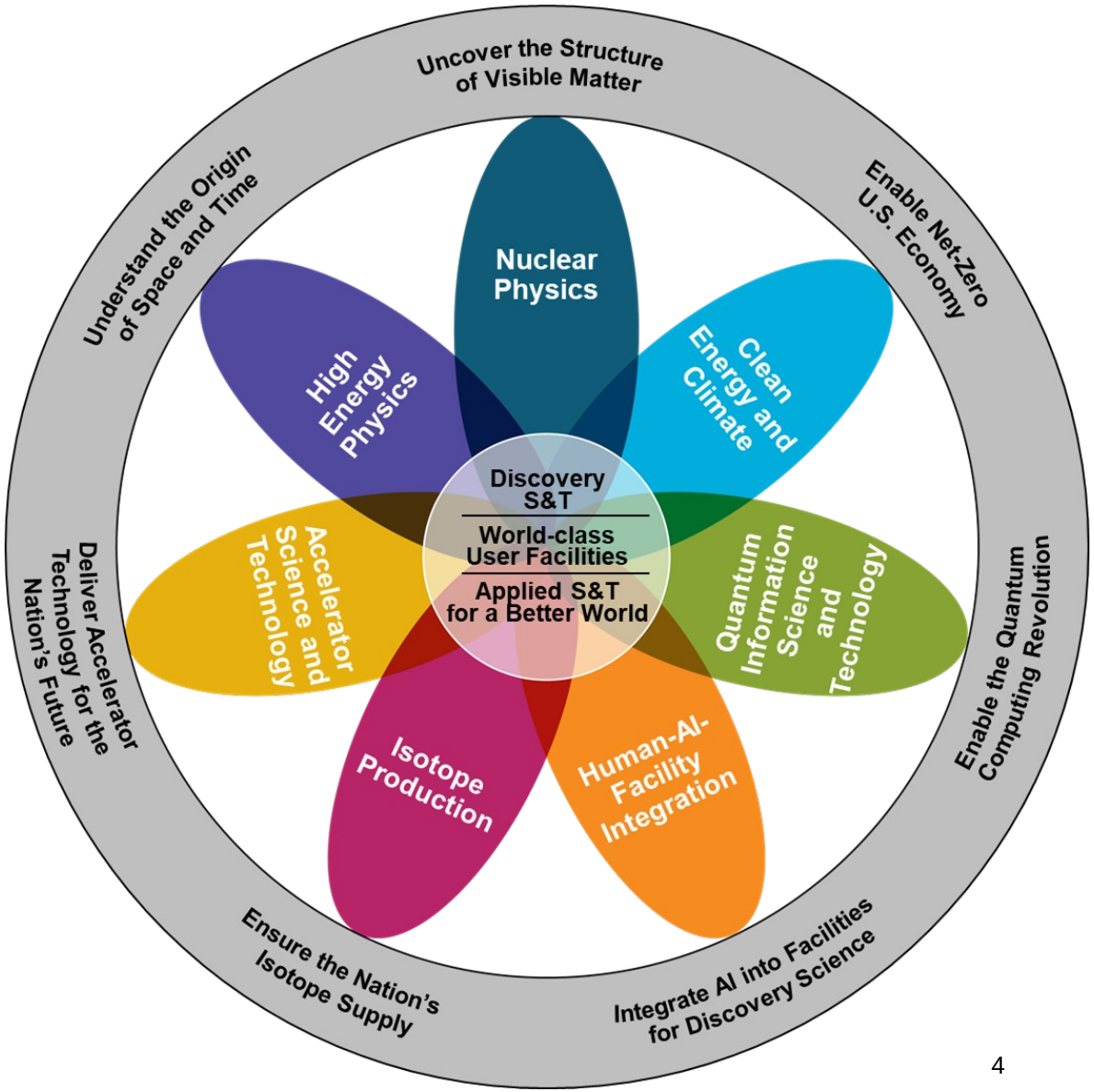
Enduring Priorities and Science Initiatives

Brookhaven's enduring priorities:

- Discovery science and technology
- Transformational user facilities, including accelerator science and technology
- Applications of the Lab's core capabilities to new opportunities

Enhanced by DOE, national lab, NYS, university, industrial, and international partners

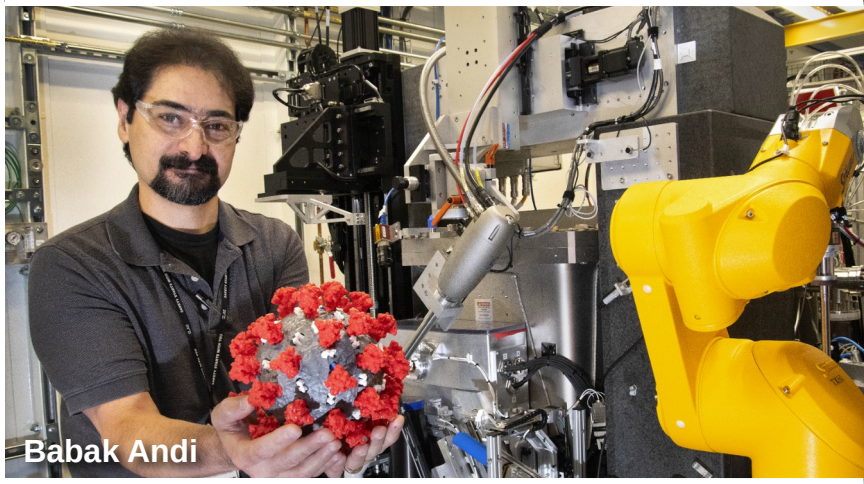
Science Initiatives



Brookhaven National Laboratory
A Multipurpose DOE Office of Science Lab

- Managed for the U.S Department of Energy (DOE) by Brookhaven Science Associates. BSA is a partnership between Stony Brook University and Battelle.
- Operating principle: Simultaneous excellence in S&T, operations, and community engagement
- People
  - 2,900 staff
  - 140 joint faculty
  - 500 students
  - 4,400 facility users and guests
  - Pre-COVID: 30,000+ students and educators (K–12) annually
- Mission: Discovery S&T that addresses national issues
  - Pulls together large teams from labs, industry, universities
  - Builds, operates large facilities
- Budget: >$750 million
- Regional economic impact:
  - Supports over 4,700 jobs in New York State
  - Strong relationship with New York State: $400M invested by NYS since 2013
  - Long Island Railroad station near Discovery Park


Jasmine Hatcher-Lamarre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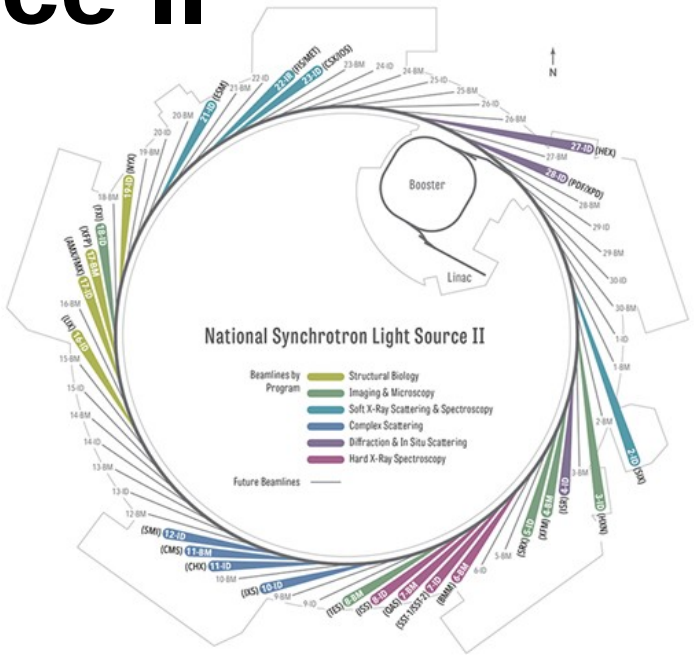
Brookhaven National Laboratory

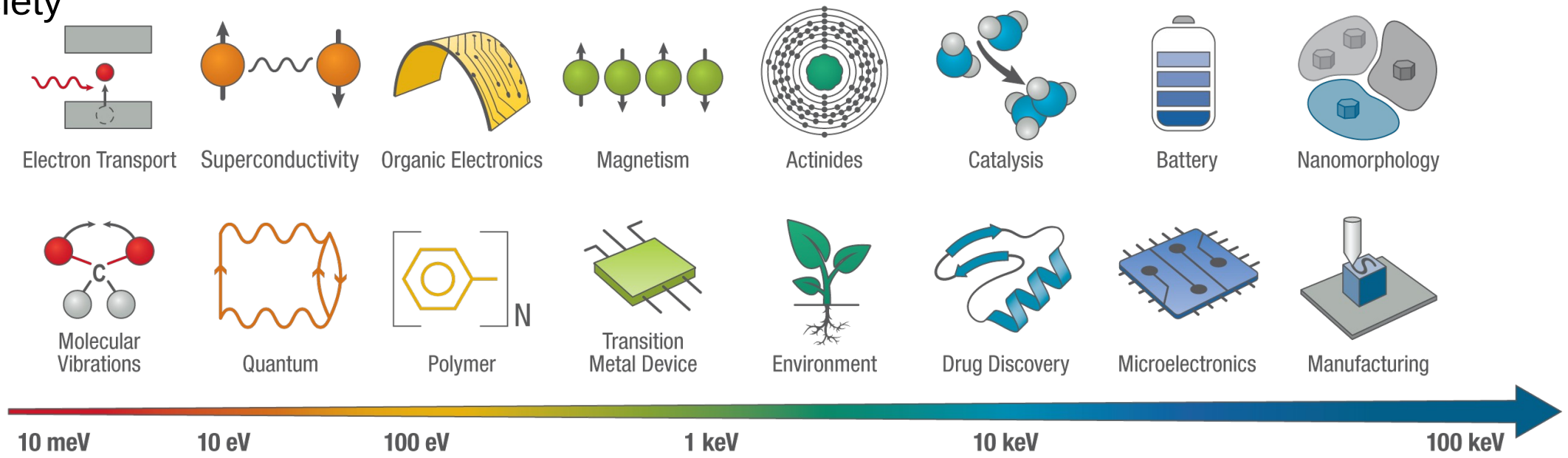
National Synchrotron Light Source II

- U.S. Department of Energy Facility
  - Hosts peer reviewed science and technology research
  - Serves scientific, industrial and education communities
- World brightest synchrotron light source
  - 3 GeV electron beam energy
  - 792m in circumference
  - Designed for current up to 0.5A
  - Can host ~ 60 instruments (Beam
- In eighth year of user ops
  - 29 beamlines from InfraRed to Hard X-rays
  - 4 beamlines in construction



NSLS-II Mission

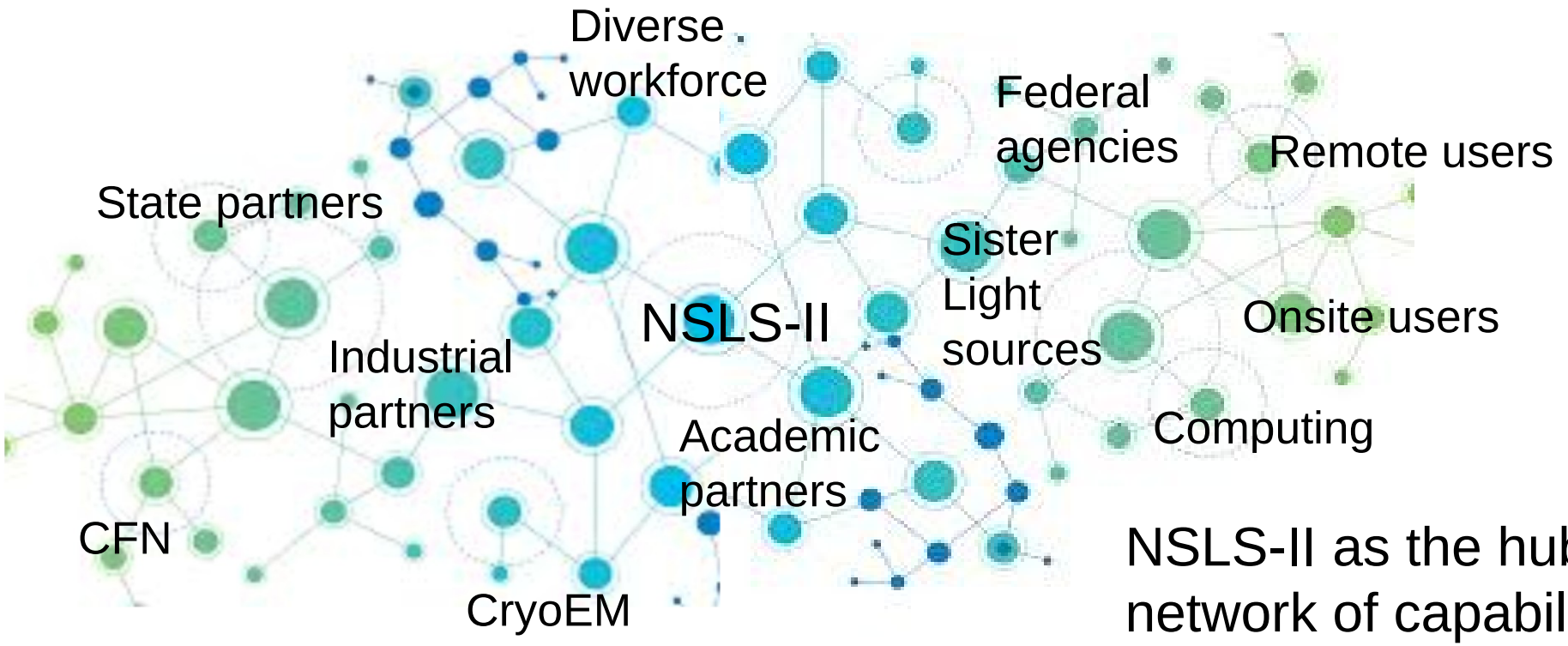
To develop and operate a premier user facility that embraces diversity to safely and efficiently deliver high-impact and cutting-edge science and technology for the benefit of society



- The challenges of today are complex and multiscale and require a multimodal approach enabled by an advanced data infrastructure
- To achieve its mission, NSLS-II must remain a competitive facility delivering cutting-edge science across a wide range of photon energies

Vision

To be an extraordinary hub for the use of synchrotron light to solve the world's most challenging scientific problems that will improve our lives for decades to come.



NSLS-II as the hub for a network of capabilities, partners and users to tackle those problems

NSLS-II User Program

For FY 2023

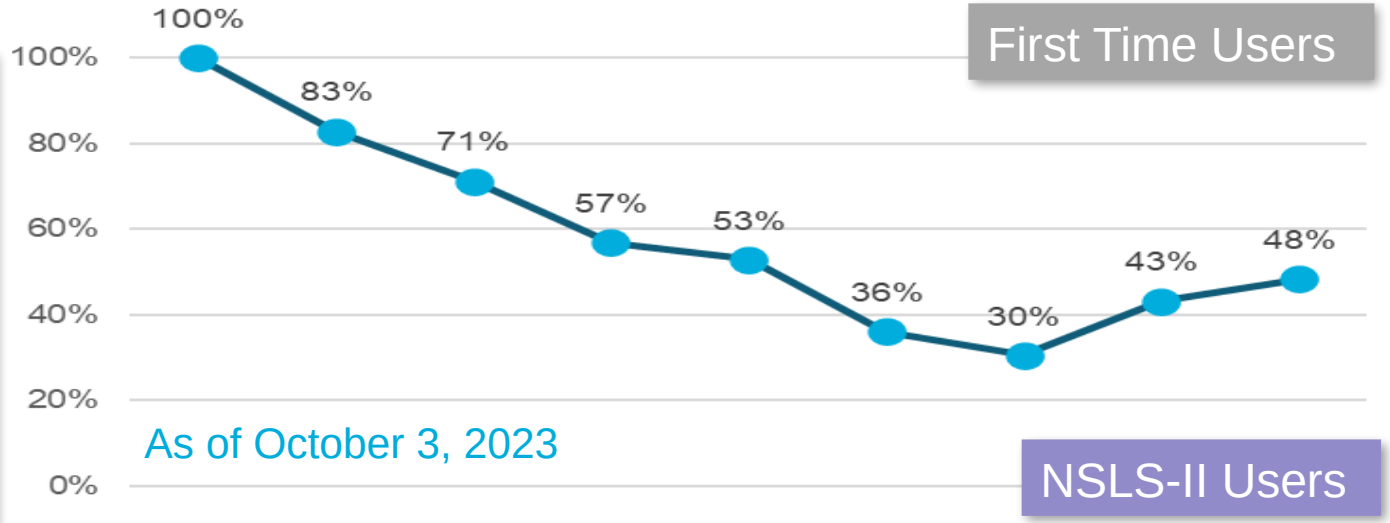
Fraction Onsite users: 77%

<u>First-time users:</u>

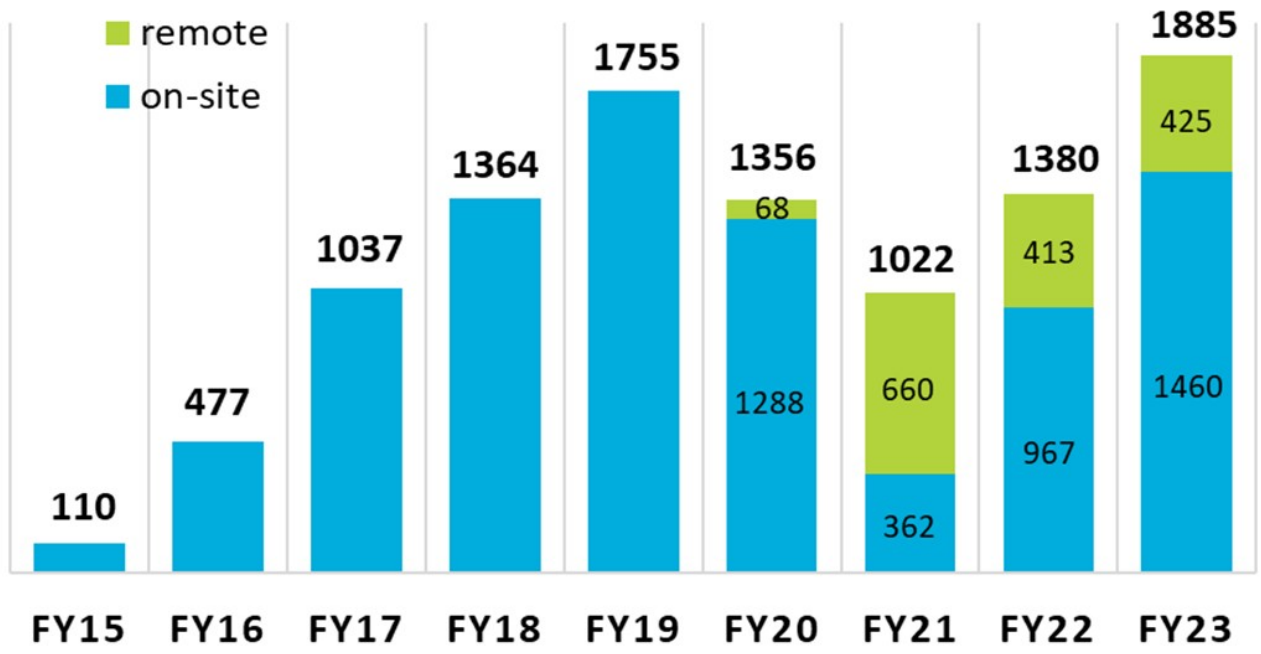
- On-site: 690
- Remote: 220
- Fraction on-site: 76%

<u>User visits (no staff):</u>

- On-site: 3522
- Remote: 1554
- Fraction on-site: 69%

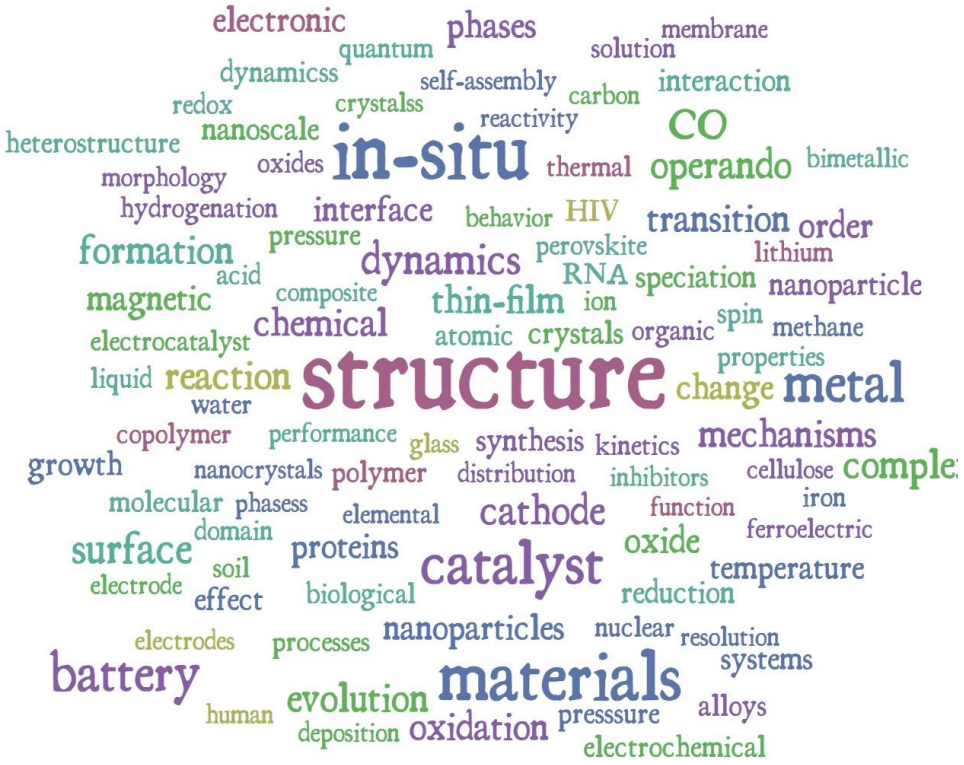


As of October 3, 2023

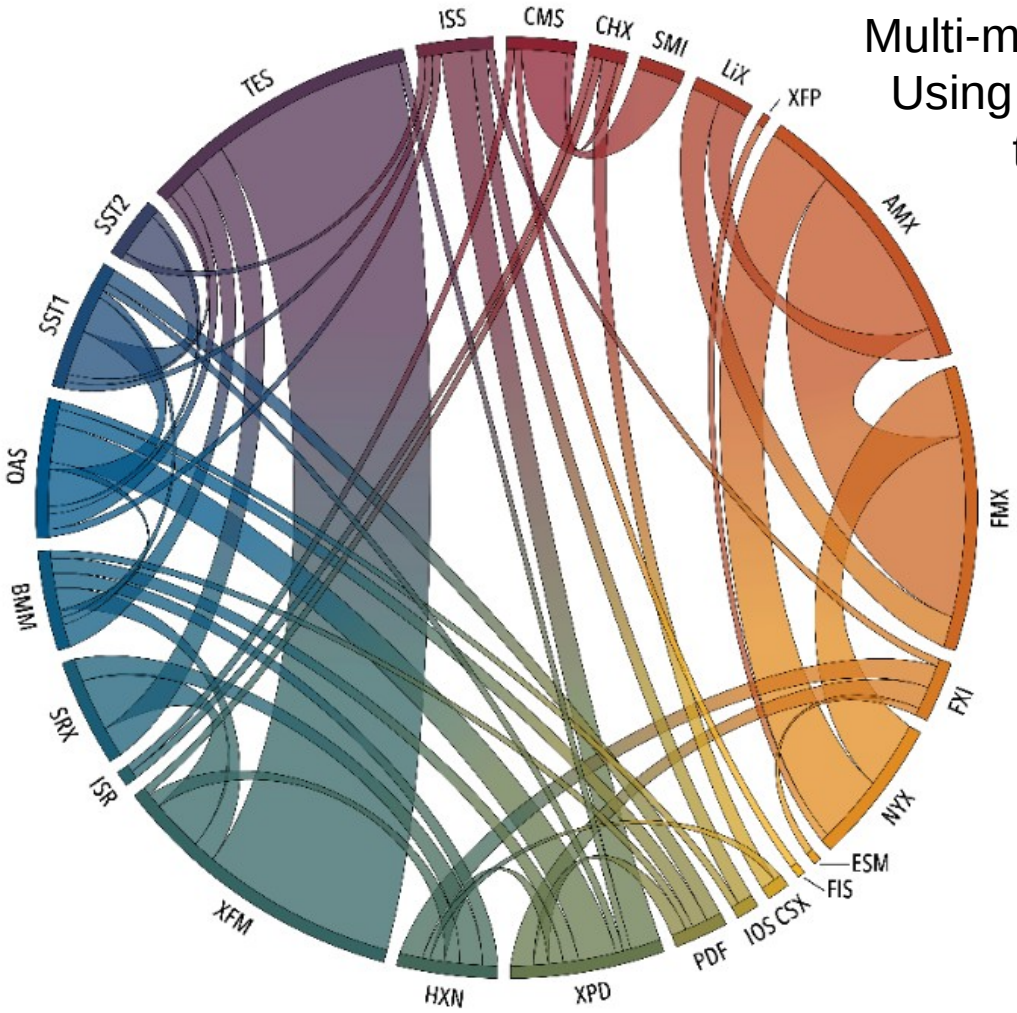


Insight to NSLS-II experiments since 2015

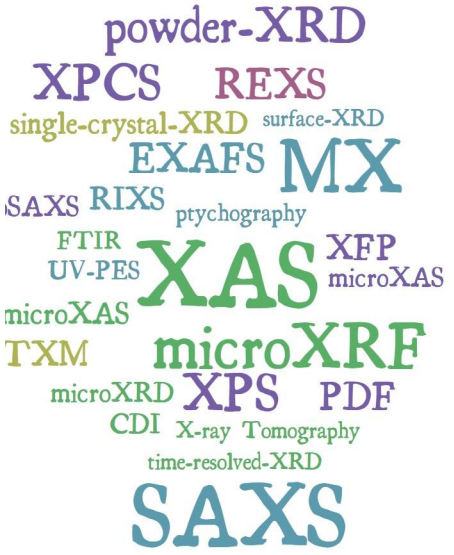
Allocated NSLS-II Proposal Titles – Subjects and Techniques



The larger the word, the more frequent. The color coding is random.



Multi-modal Research Map
Using multiple techniques to address research problems



The Power of Multimodal at NSLS-II

Reaction mechanism in aqueous batteries

operando studies on five beamlines using scattering (XPD), imaging (FXI, SRX) and spectroscopy (ISS, BMM) to reveal the structural, chemical, and morphological changes during battery cycling.

Verified for the first time a dissolution-deposition mechanism

Work could lead to faster charging times and longer lifetimes in aqueous batteries

But, we are missing additional capabilities that prevent our users doing the science that they need..

…. A story for another time

Kankanallu, et al., *Energy Environ. Sci.*, (2023)
Impact Factor=39. DOE Energy Frontier Research Center

Sense of NSLS-II

- High demand
- High productivity
- Lots of potential

- *Only about ½ built out*

NSLS-II BY THE NUMBERS

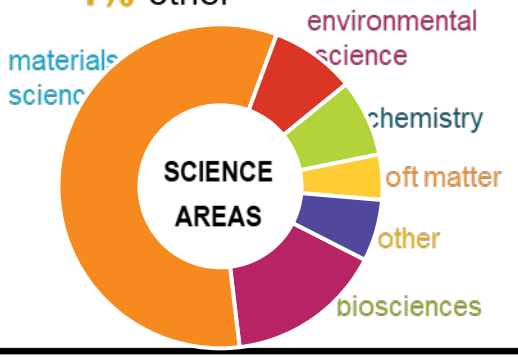
FY 2023

Together, we shine light on the world's most challenging problems

1,885 unique users:
- **321** institutions
- **211** universities
- **33** companies
- **42** states
- **30** countries

>7600 user visits

RESEARCH COVERING:
- **57%** materials science
- **17%** biosciences
- **8%** environmental science
- **9%** chemistry
- **5%** soft matter
- **4%** other



29 beamlines
- **20** partner users
- **5** partner beamlines

550 papers published
- **49%** in high-impact journals
- **>14,900** citations of NSLS-II papers

>2300 proposals submitted
>1000 proposals run

~196,000 hours of beam time requested
~83,000 hours of beam time used
2.4x beam time oversubscription rate

$143.2 M spent
- **$121.8 M** (BES-SUF)
- **$21.4 M** (other)

13 conferences, workshops, training courses hosted

Welcome to NSLS-II

Hopefully you can gain a sense of our current capabilities and potential opportunities for you and your work!