Midscale Research Infrastructure (MSRI)

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Please mute your microphone!

Submit questions through the Zoom Q&A feature.
National Science Foundation’s 10 Big Ideas

Understanding the Rules of Life

Harnessing the Data Revolution

Growing Convergence Research

Quantum Leap

Mid-scale Research Infrastructure

NSF Includes

- Future of Work
- Navigating the New Arctic
- Windows on the Universe
- NSF 2026

Where Chemistry Fits

Industries of the Future

“The Industries of the Future are cross-cutting, convergent, and independent fields of research that collectively offer enormous economic potential and are critical to the Nation’s long-term economic and national security.”

(Former) NSF Director France Córdova
Mid-scale Research Infrastructure-1 | NSF - National Science ...
https://www.nsf.gov/funding/pgm_summ
NSF's mission is to advance the progress of science, a mission accomplished by funding proposals for research and education made by scientists, engineers, ...

Mid-scale Research Infrastructure-2 | NSF - National Science ...
https://www.nsf.gov/funding/pgm_summ
The NSF Mid-scale Research Infrastructure-2 Program (Mid-scale RI-2) supports implementation of projects that comprise any combination of equipment, ...

Mathematical Sciences Research Institutes | NSF - National ...
https://www.nsf.gov/funding/pgm_summ
NSF's mission is to advance the progress of science, a mission accomplished by funding proposals for research and education made by scientists, engineers, ...

Dear Colleague Letter: Mid-scale Research Infrastructure ...
https://www.nsf.gov/pubs/nsf20066
Mar 25, 2020 - 7 of the NSF PAPPG. The title of a conference proposal should begin with M&RI-EW. Workshop proposals should be submitted by May 22, 2020, ...

People also ask
- What is the NSF program?
- How much is an NSF grant?
- How long are NSF grants?
- What is NSF Rui?
FY 21 version coming soon!
Mid-scale Research INFRASTRUCTURE (MSRI)

• Scope:
  • NSF-Wide. Submitted to the Office of Integrative Activities, reviewed in Divisions/Directorates.
  • Equipment (stand-alone construction or acquisition), infrastructure, computational hardware and software, and necessary commissioning. May include upgrades of existing infrastructure. Operational by the end of the award (≤ 5 years).

• Scale:
  • MSRI-1: Design ($600K-$20M); Implementation ($6M-$20M).
  • MSRI-2: Implementation only ($20M-$70M).

• Mechanism (FY 21 details to be determined):
  • Mandatory preliminary proposal.
  • Full proposal by invitation only (“Strong scientific merit and response to an identified need of the research community”).

“Fine Print”
• Project Execution Plan, including plans (but not MSRI funds) for Operation & Maintenance, including well-developed plans for student training and the involvement of a diverse workforce in all aspects of mid-scale activities.
• Consult the NSF Large Facilities Manual.
Important Merit Review Criteria

- Potential to significantly advance the Nation’s research capabilities;
- Relevance to any research community-established priorities, e.g., through strategic goals and/or roadmaps;
- Potential to train the next generation of leaders in technological innovation; and
- Demonstration of appropriately robust project management and cost estimation plans.
Mid-scale RI-1 (M1:IP): The Next Generation Wyoming King Air Atmospheric Research Aircraft
Award Number: 1935930; Principal Investigator: Bart Geerts; Co-Principal Investigator: Jeffrey French, Zhien Wang, Shane Murphy, Dana Caulton; Organization: University of Wyoming; NSF Organization: AGS Start Date: 10/01/2019; Award Amount: $10,557,329.00; Relevance: 48.54;

Mid-scale RI-1 (M1:IP): NSF National EXtreme Ultrafast Science (NEXUS) Facility
Award Number: 1935885; Principal Investigator: Lawrence Baker; Co-Principal Investigator: Claudia Turro, Roland Kawakami, Louis DiMauro, Jay Gupta; Organization: Ohio State University; NSF Organization: CHE Start Date: 10/01/2019; Award Amount: $8,500,000.00; Relevance: 48.42;

Mid-scale RI-1 (M1:DP): Consortium Proposal for CMB-S4 Design Development
Award Number: 1935982; Principal Investigator: John Carlstrom; Co-Principal Investigator: Julian Borrelli, James Yek; Organization: University of Chicago; NSF Organization: OPP Start Date: 10/01/2019; Award Amount: $3,984,189.00; Relevance: 47.66;

Mid-scale RI-1 (M1:DP): Compact X-ray Free-Electron Laser Project (CXFEL)
Award Number: 1935994; Principal Investigator: William Graves; Co-Principal Investigator: Onur Erten, Arvinder Sandhu, Petra Fromme, Sefaattin Tongay; Organization: Arizona State University; NSF Organization: DBI Start Date: 10/01/2019; Award Amount: $3,114,964.00; Relevance: 47.66;

Mid-scale RI-1 (M1:IP): FABRIC: Adaptive Programmable Research Infrastructure for Computer Science and Science Applications
Award Number: 1935966; Principal Investigator: Ilya Baldin; Co-Principal Investigator: James Griffin, Kuang-Ching Wang, Indermohan Monka, Anita Nikolich; Organization: University of North Carolina at Chapel Hill; NSF Organization: CNS Start Date: 10/01/2019; Award Amount: $13,059,716.00; Relevance: 47.53;

Mid-scale RI-1 (M1:IP): Zettawatt-Equivalent Ultrashort Pulse Laser System (ZEUS)
Award Number: 1935950; Principal Investigator: Karl Krushelnick; Co-Principal Investigator: Igor Jovanovic, Alexander Thomas, Carolyn Kuranz, Louise Willingale; Organization: Regents of the University of Michigan - Ann Arbor; NSF Organization: PHY Start Date: 10/01/2019; Award Amount: $15,500,000.00; Relevance: 47.23;

Mid-scale RI-1 (M1:DP): Next Generation Event Horizon Telescope Design
Award Number: 1935980; Principal Investigator: Shepard Doeleman; Co-Principal Investigator: Jonathan Weintroub, Michael Johnson, Lindy Blackburn; Organization: Smithsonian Institution Astrophysical Observatory; NSF Organization: AST Start Date: 10/01/2019; Award Amount: $8,816,427.00; Relevance: 46.93;

Mid-scale RI-1 (M1:IP): 1.2 GHz NMR Spectrometer for National Gateway Ultrahigh Field NMR Center
Award Number: 1935913; Principal Investigator: Rafael Bruschweiler; Co-Principal Investigator: Philip Grandinetti, Mark Foster, Christopher Jaroniec, Blanton Tolbert; Organization: Ohio State University; NSF Organization: DBI Start Date: 10/01/2019; Award Amount: $8,577,202.00; Relevance: 46.93;

Mid-scale RI-1 (M1:IP): A world-class Neutron Spin Echo Spectrometer for the Nation: UD-NIST-UMD Consortium
Award Number: 1935956; Principal Investigator: Norman Wagner; Co-Principal Investigator: Organization: University of Delaware; NSF Organization: DMR Start Date: 10/01/2019; Award Amount: $7,714,581.00; Relevance: 46.42;

Mid-Scale RI-1: SAGE: A Software-Defined Sensor Network
Award Number: 1935984; Principal Investigator: Peter Beckman; Co-Principal Investigator: Eugene Kelly, Charles Catlett, Ilkay Altintas, Scott Collins; Organization: Northwestern University; NSF Organization: OAC Start Date: 10/01/2019; Award Amount: $9,026,927.00; Relevance: 45.44;
The NeXUS Team

TR-XAS/XRS
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Co-Director

Lou DiMauro
Co-Director

Roland Kawakami

Jay Gupta

CLAUDIA TURRO

Tom Allison

ATTO / LIED

TR-XAS/XRS

TR-ARPES

TR-STM

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TR-ARPES

Tim Scarborough
Facility Manager

TJ Ronningen
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Jessi Middleton
Administrative

Kelsey Cook
NSF Program Officer

NSF Office Hours

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September 4, 2020
Mid-scale Program Directly Addresses NAS Recommendations for US Laser Infrastructure

“The United States was the leading innovator and dominant user of high-intensity laser technology when it was developed in the 1990s, but Europe and Asia have now grown to dominate this sector through coordinated national and regional research and infrastructure programs. In Europe, this has stimulated the emergence of the Extreme Light Infrastructure (ELI) program.”

Opportunities in Intense Ultrafast Lasers: Reaching for the Brightest Light, NAS, 2018
NSF NeXUS Bridging Light Sources

- **X-Ray Free Electron Lasers**
- **Synchrotrons**
- **Existing High Harmonic Generation**

**Plot Details:**
- **Y-axis:** Photons/sec / 0.1% Bandwidth (log scale)
  - Range: $10^5$ to $10^{17}$
- **X-axis:** Time Resolution (log scale)
  - Range: 10 as to 1 ns

**Legend:**
- NSF NeXUS

**Notes:**
- NSF Office Hours 4
- September 4, 2020
NSF NeXUS Bridging Light Sources

X-Ray Free Electron Lasers
(LCLS, SLAC Linear Accelerator Lab)

Tabletop High Harmonic Generation
(Ohio State University)
The NeXUS Facility

• kW-class Ultrafast Laser:
  8 mJ at 100 kHz or 0.8 mJ at 1 MHz, pulse duration down to 8 fs
• Drive attosecond and femtosecond XUV and soft X-ray generation
• Supply XUV light to the following experimental end-stations
  • X-ray absorption / X-ray reflection spectroscopy (TR-XAS/XRS)
  • Angle-resolved photoelectron spectroscopy (TR-ARPES)
  • Element-specific scanning tunneling microscopy (TR-STM)
  • Attosecond science / Laser induced electron diffraction (ATTO / LIED)
Chemical, Physical, and Biological Science Enabled by NeXUS

• **Element Specificity:**
  - Bright XUV and soft x-ray pulses (e.g. Fe M-edge, Co M-edge, C K-edge)

• **Ultrafast time resolution:**
  - Resolve electronic (atto) and nuclear (femto) coherences

• **High repetition rate:**
  - Faster acquisition rates needed for dilute, solution phase samples

• **Supply XUV light to following experimental end stations:**
  - X-ray absorption spectroscopy
  - Angle-resolved photoemission spectroscopy
  - Scanning tunneling microscopy
  - Laser-induced electron diffraction / Attosecond science
NeXUS Will Be an Open Access NSF User Facility

- Completely user accessible
- Transparent, external peer review process
- Institutional support for external users
  - Logistical support with travel and accommodations
  - Access to wet laboratory / sample preparation facilities
  - User office space
  - Control room for real time data monitoring outside of laboratory
- Our goal is that user access to facility will be free of charge
- Modeled after other US national light source facilities
- NeXUS will be the first user-accessible attosecond beamline in the US
NeXUS Project Timeline

- **NeXUS** is a 5-year implementation project (2019–2024)
- **Years 1-3:**
  - Lab renovation and site preparation
  - Acquisition of laser and other major equipment
  - Beamline and end-station design and construction
- **Years 4-5:**
  - System integration
  - Science validation – First users
  - Transition to operations
- **Year 5 and beyond:**
  - Operation and maintenance

5-year project timeline:
- FY20
- FY21
- FY22
- FY23
- FY24

- First Users
- Open Access

reno, design, construction, commissioning
integration & science validation
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Upcoming CHE Office Hours/Webinars

NSF’s ChemMatCARS: Opportunities for Advanced X-Ray Diffraction and Scattering

September 18, 2020, 4:00 PM EDT
Carlos Murillo, Host
https://chemmatcars.uchicago.edu/

Submit general office hour questions/suggestions to: chemhighlights@nsf.gov

Send requests to be included in our Chemistry Communications to: chem-comm@listserv.nsf.gov

CHE Virtual Office Hour slides: