## FACILITIES AND CAPABILITIES

### COMPUTATIONAL NANOSCIENCE

The CNM's 30-teraflop supercomputer accommodates highly parallel applications for modeling, simulation and visualization. Our theory and multiscale computer simulations provide the interpretive and predictive framework to understand nanoscale energy conversion and transport, and optical and quantum materials, with data science and machine learning methods.

### ELECTRON MICROSCOPY

We offer aberration-corrected chromatic (ACAT) electron microscopy, scanning transmission electron microscopy (STEM), focused-ion-beam scanning electron microscopy (FIB-SEM), in situ high-resolution transmission electron microscopy (TEM) and field-emission scanning electron microscopy (SEM).

### DEDICATED HARD X-RAY BEAMLINE

X-ray ptychography and microscopy is performed by the Hard X-ray Nanoprobe (HXN) beamline, operated by the Center for Nanoscale Materials at Sector 26 of Argonne's Advanced Photon Source. The HXN provides a platform for nanoscale materials research using highly focused coherent X-ray microscopy methods, harnessing the brilliance of the synchrotron for transformative insight into these materials with spatial resolution of 30 nanometers in the spectral range of six to 12 keV.

### MATERIALS SYNTHESIS

We provide users with the ability to synthesize various nanomaterials, including core-shell colloidal nanoparticles, peptides/DNA, polymer- and bio-templates, complex molecular-beam epitaxy structure, graphene, carbon nanotubes and nanocrystalline diamond.

### NANOFABRICATION CLEANROOM

Our cleanroom enables users to work with: controlled synthesis and directed assembly of nanomaterials; lithographically-assisted patterning of hybrid structures; chemical and biological functionalization of nanoscale materials; electron beam lithography and focused ion beam lithographic patterning; myriad deposition and etching techniques; and a full carbon deposition suite.

### PROXIMAL PROBES

The CNM has an array of scanning-probe tunneling and atomic-force microscopy capabilities for surface, interface and magnetic analysis, including ultrafast optical probes and ultrahigh-vacuum low-temperature scanning tunneling microscopy and spectroscopy.

**www.anl.gov/cnm**

### APPLY TO USE THE CNM

The CNM solicits brief proposals for user-initiated nanoscience and nanotechnology research projects three times per year.

**Applications are due:**

- March
- July
- October

Academic, industrial and international researchers can apply to use the center for both proprietary and non-proprietary research. There is no cost to use the CNM if the research is intended for the public domain.

### ACCESS MULTIPLE USER FACILITIES AT ONE LOCATION

Users at the CNM can also access Argonne's four other user facilities, including the Advanced Photon Source, Argonne Leadership Computing Facility, Argonne Tandem Linear Accelerator System and Atmospheric Radiation Measurement Facility, for multimodal and cross-functional projects.


### CNM USER OFFICE

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**www.anl.gov/cnm**



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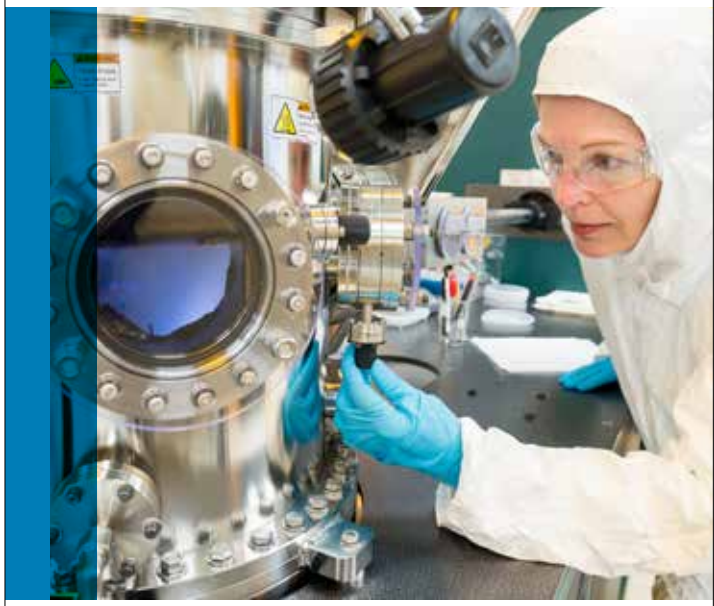
Argonne NATIONAL LABORATORY



# THE CENTER FOR NANOSCALE MATERIALS USER FACILITY

We provide free access to leading-edge expertise, instruments and infrastructure for interdisciplinary nanoscience and nanotechnology research.

The Center for Nanoscale Materials (CNM) — a U.S. Department of Energy Office of Science user facility — is located at Argonne National Laboratory, just 30 minutes from Chicago.

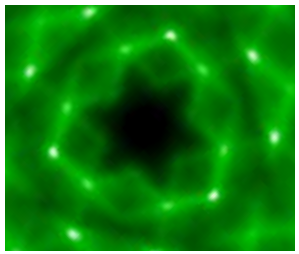
### OUR VALUE

**The CNM offers more than 150 tools and capabilities at no charge for non-proprietary studies. From X-ray microscopy to cleanroom-based nanofabrication techniques, the CNM provides researchers with a powerful combination of scientific resources found nowhere else.**

### A SHARED VISION

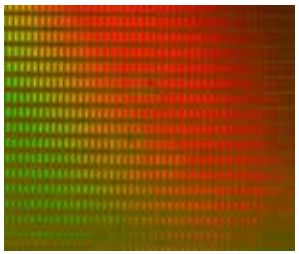
**Argonne staff and facility users conduct research consistent with the CNM's primary, cross-cutting themes of quantum materials and phenomena, manipulating nanoscale interactions, and synthesis of nano-architectures for energy, information and functionality.**

## FIVE AREAS OF EXPERTISE DEFINE THE SCIENTIFIC SCOPE OF THE FACILITY



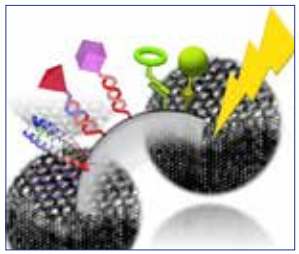
### ELECTRON AND X-RAY MICROSCOPY

We develop capabilities that go beyond off-the-shelf technology to identify, define and develop electron and X-ray microscopy needs including data science and new modalities such as ptychography.



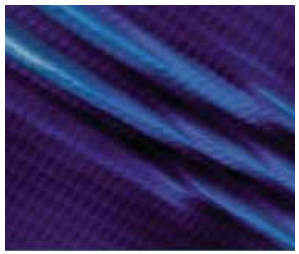
### NANOFABRICATION AND DEVICES

We fabricate, integrate and manipulate nanostructures including incorporation — under cleanroom conditions — of elements that couple mechanical, optical and electrical signals to produce working nanofabricated structures.



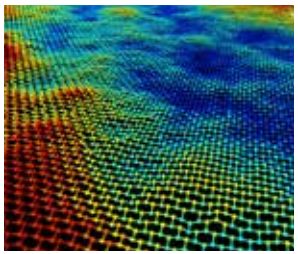
### NANOPHOTONICS AND BIOFUNCTIONAL STRUCTURES

We use ultra-fast spectroscopy and advanced microscopy to understand optical energy transduction and quantum sensing, and also create nature-inspired assemblies for energy conversion, transport and biosensing.



### QUANTUM AND ENERGY MATERIALS

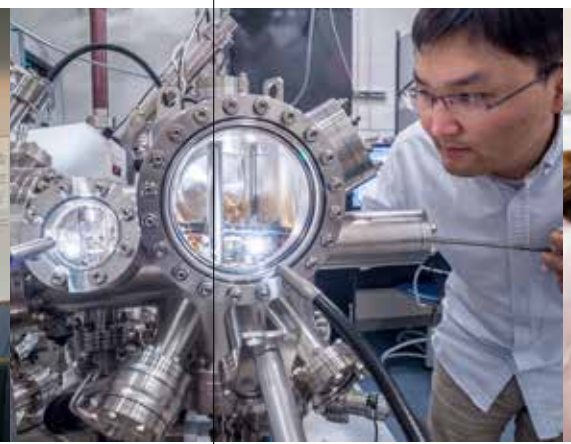
We design and study atomic-scale to meso-scale materials with implications for energy, the environment and coherent information transfer and sensing.



### THEORY AND MODELING

We use molecular dynamics, electronic structure theory, quantum and electrodynamics, multi-scale modeling, machine-learning and data science to understand and predict nanoscale tribology, thermal and charge transport and quantum entanglement in hybrid plasmonic systems.

**Scientists in the Theory and Modeling group develop and apply machine learning and data science approaches for large-scale atomistic simulations and imaging and characterization of nanoscale systems.**



**The CNM provides an unparalleled suite of near-field, low-temperature, ultrahigh vacuum scanning tunneling microscopy probes.**

**Our peptide synthesizer enables creation of biomolecules for nanobio hybrids, useful for energy and biomedical applications.**

**The hard X-ray nanoprobe, an X-ray synchrotron beamline shared by CNM and Argonne's Advanced Photon Source, can probe crystal ordering, defects and phase transitions in nanomaterials.**