The J. Bennett Johnston Sr.

Center for Advanced Microstructures and Devices (CAMD)

EXCELLENCE IN SCIENCE AND ENGINEERING RESEARCH

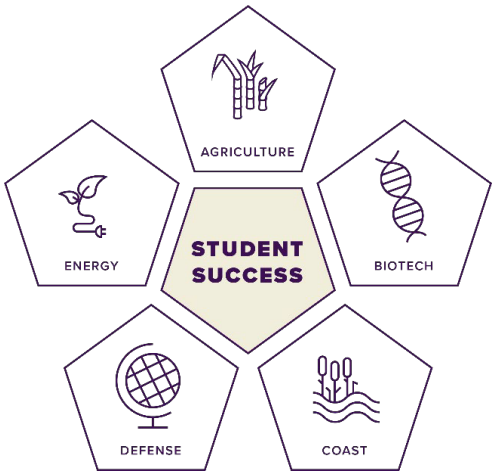
LSU

CAMD

Overview

LSU's **Center for Advanced Microstructures and Devices (CAMD)** provides researchers access to the **only synchrotron light source** in the southeastern United States. One of seven such facilities in the nation, more than 80 researchers, including LSU faculty & students, industrial users, local startup companies, and members of national research labs use CAMD. It is also a key resource in attracting major center level grants to the university as well as recruiting top quality faculty.

CAMD supports the **LSU Scholarship First Agenda** by providing the synchrotron based research resources and the technical support for conducting measurements as well as providing the training to develop the next generation of scientists.



LSU's Scholarship First Agenda and Five Pillars of Research Excellence

Agriculture
Understanding the toxic byproducts of combustion, pollution in the environment, plant take-up and developing techniques for remediation. CAMD is in the process of partnering with other synchrotrons through PALSA (PanAmerican Light Sources for Agriculture).

Biotechnology
Understanding the origin of disease and developing new drugs for more-effective radiation therapy - developing new imaging modalities with X-ray phase contrast

Coast
Evaluate toxic byproducts of oil spills and their impact on affected wildlife

Defense
Understanding crystallization and transformations in 3D printed metallic structures and characterizing advanced materials and manufacturing technologies

Energy
Developing new materials and catalysts for fuel production

CAMD's vision for research excellence is captured by the diverse ways that it can serve LSU's 5 priorities and the following summaries provide further details on prior and ongoing activities.

What is a Synchrotron?

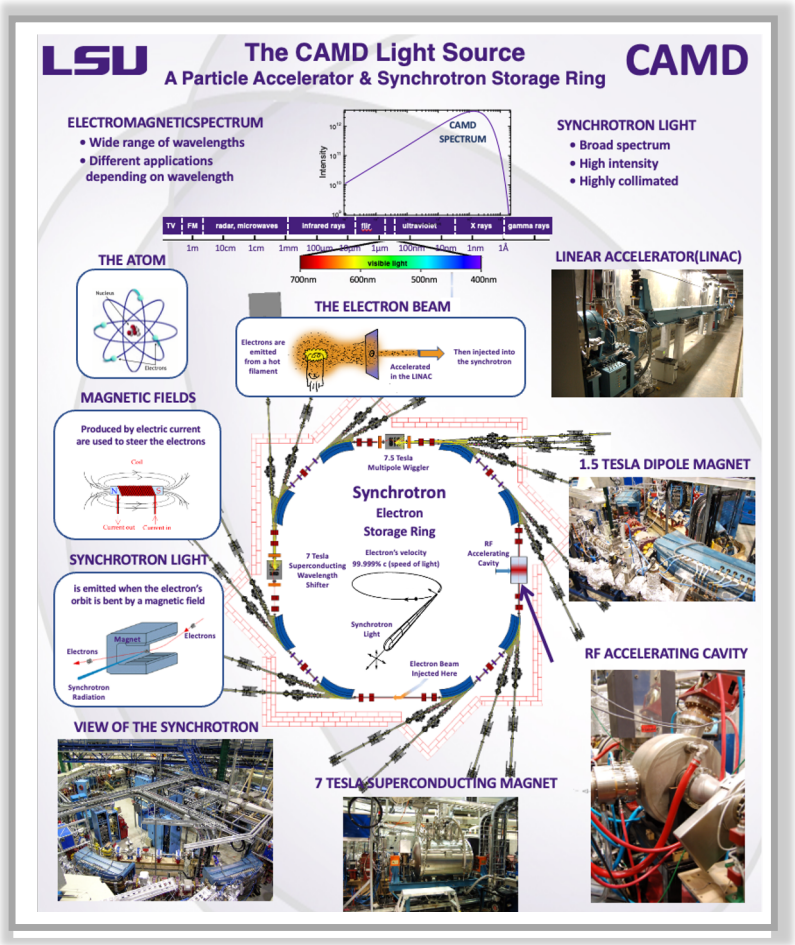
A synchrotron is a particle accelerator – in this case our particles are electrons – that sends them circulating through a vacuum at nearly the speed of light. When their direction of travel is changed by a magnet (this is an accleration) they emit light with a broad range of energies as shown in the figure on the next page. This light goes from the infrared, through visible light, to ultraviolet and at the highest energy, X-rays.

Why do we want Synchrotron Light?

We can use the light of all different energies to characterize just about anything of scientific interest, from new nanomaterials, environmental contaminants, developing energy source and storage materials to even analyzing artwork. When we shine synchrotron radiation on something we measure what light gets through and which direction it goes, what new light is emitted from our sample and even study the electrons and atoms that are emitted.

Who at LSU uses Synchrotron Light?

At one point we counted faculty and students from 19 departments that use CAMD for all different reasonsWe can use the light of all different energies to characterize just about anything of scientific interest, from new nanomaterials, environmental contaminants, developing energy source and storage materials to even analyzing artwork.



How do we get the beam of electrons into the ring?

The electrons are emitted from a hot "filament" and accelerated by a linear accelerator which is underneath the synchrotron.

How do we steer electrons?

Moving electrons travel a straight path unless they enter a magnetic field. This magnetic field can come from a permanent magnet or from an electromagnet which uses electric current to generate much larger fields such as our dipole magnets.

How do we get the beam to go around in a circle?

When our electron beam enters into a dipole magnet the field from the dipole does 2 things. It bends the path of the beam and when the electron is going at relativistic speeds (near the speed of light) it causes the electrons to emit synchrotron radiation. We have 8 dipole magnets so each magnet turns the beam by 45°.

If the electrons emit synchrotron light, why don't they slow down?

They do. In order to keep them going the storage ring has a radio frequency (RF) cavity that resupplys the energy lost in emitting synchrotron radiation.

What are the insertion devices?

We have two insertion devices called a Wavelength Shifter and the other called a Multipole Wiggler. Both of these devices have superconducting magnets that give higher energy X-rays and much more synchrotron light.

What is a beamline?

The accelerator is safely tucked behind a concrete and lead shield wall to protect the users from the X-rays. We extract the X-rays with beamlines that bring the synchrotron light to the users endstations. These beamlines include a monochromator that selects the energy of the X-ray that is then used by the scientist in their measurements. Each endstation is different allowing for a large range of different applications of the X-rays.

Major Research Projects

Fundamental Insights into the Durability and Efficiencies of CO_2 Electrolyzers

PI: John Flake
Agency: National Science Foundation NSF RII Track-2
$4 million electrolytic creation of energy sources while remediating environmental pollutants

LSU Superfund Research Program

PI: Stephania A. Cormier
Agency: National Institute of Environmental Health Sciences
$11 million research program on environmentally persistent free radicals

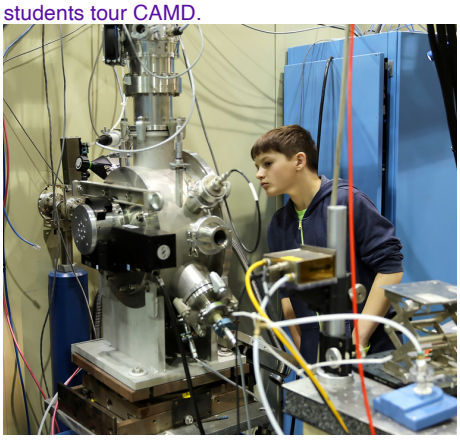
Louisiana Materials Design Alliance

PI: Shengmin Guo
Agency: National Science Foundation
$20 million research program physical and chemical properties of novel alloys

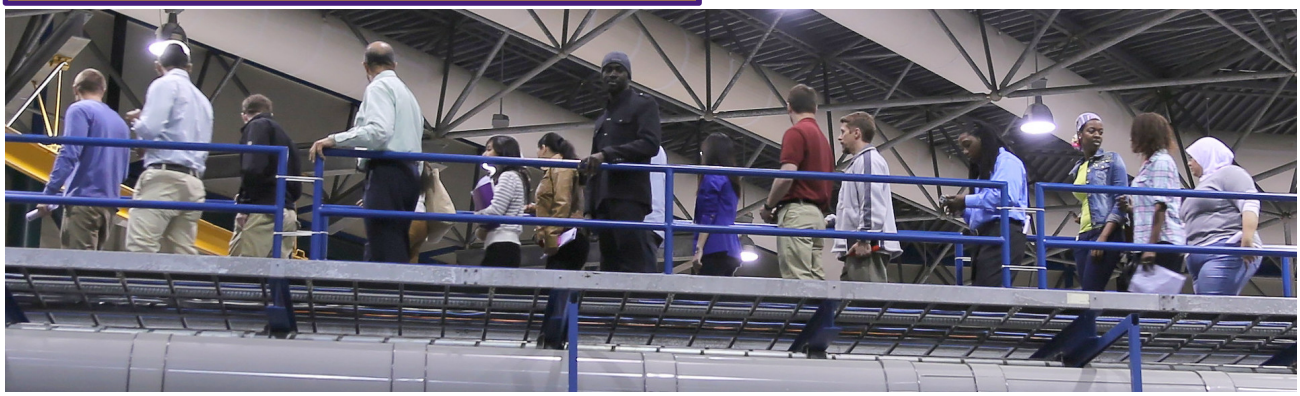
X-ray Phase Contrast Imaging

PI: Leslie Butler
Agency: $525K NSF PI: Joyoni Dey
Agency: $1.5M NSF SBIR phase 2 PI: Leslie Butler
Agency: $375K NNIH STTR PI: Cremer, Butler, Ham
grating-based X-ray and neutron imaging using phase contrast
Startup Company: Refined Imaging

Baton Rouge Community College STEM students tour CAMD.



A local student examines a beamline monochromator.



Contact Information

The J. Bennett Johnston Sr.
Center for Advanced Microstructures and Devices
6980 Jefferson Highway
Baton Rouge, LA 70806
Phone: 225-5787-8887
Fax: 225-578-6954
www.camd.lsu.edu

Richard L. Kurtz rlkurtz@lsu.edu
Director

Phillip Sprunger phils@lsu.edu
Scientific Director

Craig Stevens estev@lsu.edu
Assistant Director for Administration