

Possible Research Areas for ACTS Teachers - 2009

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For more information click the [Research Divisions](#) page

BIO Biosciences, Bio-fuels Research

The project involves converting algae bio-oils to hydrocarbon fuels using enzyme and/or photo reactions.

CNM The Center for Nanoscale Materials

1. Nanofabrication Group. Involves nanoscale device fabrication in a cleanroom environment. Projects include electrical devices, interactions of nanoparticles with nanoscale boundaries and interactions with light, and synthesis of nanoparticles using x-rays and research in microfluidic devices. The group strives to push the limits of nanofabrication by combination of top-down and bottom-up approaches. Work will also include interactions with other groups in the CNM and the APS.
2. Electronic and Magnetic Materials and Devices Group. The characterization of DNA encapsulated carbon nanotubes with atomic force microscopy and scanning tunneling microscopy. It combines biology, chemistry, materials science, and physics.

MSD Materials Science, Image Computer Processing

Assist researchers in the granular physics laboratory to study self-assembly processes in biological and colloidal systems, such as suspensions of magnetic micro-particles and bacterial suspensions. The main research task will be image processing of the result of video-microscopy. They will use Matlab and ImageJ image-processing software to enhance and analyze raw experimental images, and to track individual objects between the images.

HEP High Energy Physics

1. The Dark Energy Survey (DES) is a new DOE project (www.darkenergysurvey.org) to study the nature of dark matter and dark energy. Dark matter and energy are believed to be 95% of the energy density of the universe, and their origin and composition are completely unknown. The DES will build a new 520 mega-pixel CCD camera for an existing 4-meter telescope in Chile, in exchange for a 5-year program of observations. These new observations of the southern-hemisphere sky will include 300 million galaxies, 120 thousand galaxy clusters, and more than 3000 supernova explosions. First light for DES is in 2011; work is now underway to build the camera and perform science simulations to prepare for early studies of cosmology. The DES group at Argonne is involved in both camera development and testing and science simulations.
2. Neutrino Group. Argonne is involved in a series of experiments to study neutrino properties. There are three particles known as neutrinos and a series of experiments in the last few years has greatly improved our knowledge of neutrino mass and measured two of the three parameters known as mixing angles. An intense worldwide effort is proceeding to measure the third mixing angle.

- DIS** Decision & Informational Sciences. Renewable Energy (solar, wind); energy efficiency and energy conservation in schools.
- XSD** Advanced Photon Source, Insect Research Program
To expand understanding of the biomechanics and physiology of insect respiration and flight using a new method of internal visualization of small animals via phase-enhanced synchrotron x-ray imaging. Increased knowledge of recently discovered novel breathing mechanics in insects, coupled with new research directions in x-ray imaging of flight systems will greatly advance our knowledge of insect function and biophysics.
- PHY** Physics. Low and Medium Energy Nuclear Physics; Accelerator (ATLAS) Physics. Can accommodate several teachers.
- NE** Nuclear Engineering, Vulnerability Assessment Team
1. Product Tampering and Counterfeiting: Work with the Vulnerability Assessment Team (<http://www.ne.anl.gov/capabilities/vat>) at Argonne National Laboratory to study vulnerabilities and test potential solutions to product tampering and counterfeiting, including of food and drugs. Co-author a paper. Learning objectives: Learn about homeland security, product piracy, tamper detection, preparing a technical paper, and food/drug safety. Desired background and interests: Chemistry, physics, engineering, home economics, video production, electronics, or medicine.
 2. New Approaches to Cargo Security: Help the Vulnerability Assessment Team (<http://www.ne.anl.gov/capabilities/vat>) at Argonne National Laboratory to develop and test new security devices for cargo security and nuclear safeguards. Co-author a paper. Learning objectives: Learn about homeland security, cargo security, nuclear safeguards, tamper detection, microprocessors, and electronics. Desired background and interests: Chemistry, physics, engineering, electronics, computers (especially Macs), or microprocessors.
 3. Security Culture: Help the Vulnerability Assessment Team (<http://www.ne.anl.gov/capabilities/vat>) at Argonne National Laboratory study human factors associated with physical security, cyber security, and nuclear safeguards. Explore important but under-studied aspects of what makes security work on a human and organizational level. Study human interaction with security technology. Co-author a paper. Desired background and interests: Social sciences (including psychology, journalism, or survey taking) and an interest in society & technology. Interest in video production is useful.
 4. The Journal of Physical Security: Help with the editing, promotion, growth, and organization of the Journal of Physical Security (<http://jps.anl.gov>). JPS is the first multidisciplinary, peer-reviewed journal devoted to physical security. It involves both the social and technical sciences. Learning objectives: Learn how to operate a technical journal. Desired background and interests: Journalism, writing, editing, business administration, engineering, security, and/or science & society. Interest in video production is useful.

EVS Environmental Science

The National Science Foundation deep underground science & engineering laboratory (DUSEL) project (8N697) is a multi-year project that is just starting. The proposed NSF facility will enable deep underground science in physics, astrophysics, high energy physics, biology, biogeoscience, and geoengineering. The EVS role is to assess environmental impacts associated with constructing, operating (with the range of research experiments), and decommissioning the facility (decades in the future), including surface features and the deep underground. Related project participants include UC Berkeley-LBNL and the South Dakota School of Mines & Technology (SDSM&T) – these are the co-PI awardees of a multi-year NSF grant to develop the science for this deep underground science & engineering laboratory. Our role is to support NSF, working with these awardees to understand the conceptual research experiments & facility design, to assess potential impacts associated with the facility in accordance with the National Environmental Policy Act and other relevant requirements.

BIO Biosciences, Soil Carbon Sequestration

1. The application of organic geochemistry to ecological and soil related climate change questions. It requires background in using spectroscopy equipment such as FTIR to help develop methods for quantifying the changing chemistry of carbon residues in soil organic matter during carbon sequestration.
2. A project that extracts, derives, and analyzes (using gas or high pressure liquid chromatography) specific carbohydrate and amino sugar biomarkers of plant and microbial residues.