U.S. Department of Energy

Energy Frontier Research Centers

One Page Overviews

Office of Science
August 2016; Revised 01/03/2018

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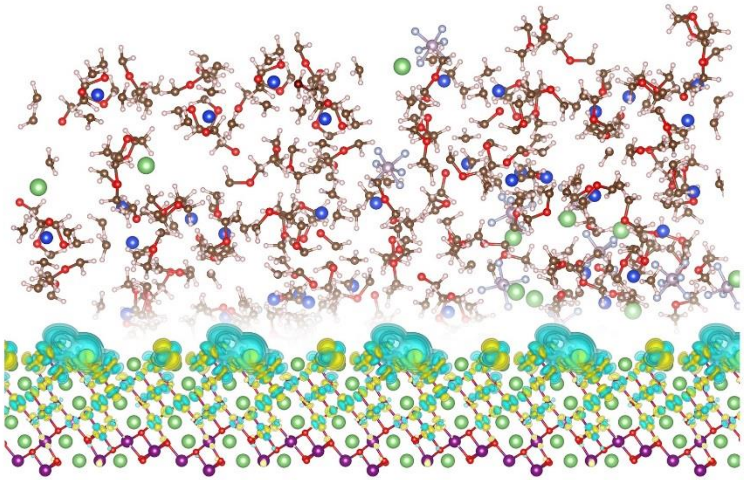
Ordered by Institution and then by Director

Center for Electrochemical Energy Science (CEES)
Paul Fenter (Argonne National Laboratory)

The Center's mission is to develop a fundamental understanding and robust control of the reactivity of electrified oxide interfaces, films and materials relevant to lithium-ion battery chemistries.

http://www.cees.anl.gov

CENTER FOR ELECTROCHEMICAL ENERGY SCIENCE AN ENERGY FRONTIER RESEARCH CENTER



ARGONNE NATIONAL LABORATORY • NORTHWESTERN UNIVERSITY
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN • PURDUE UNIVERSITY

RESEARCH PLAN

CEES probes the molecular-scale structure and reactivity at electrified oxide-electrolyte interfaces, leverages advanced materials synthesis to create materials with well-defined properties (composition, structure, etc.), and develops novel approaches and chemistries to direct electrochemical reactivity.

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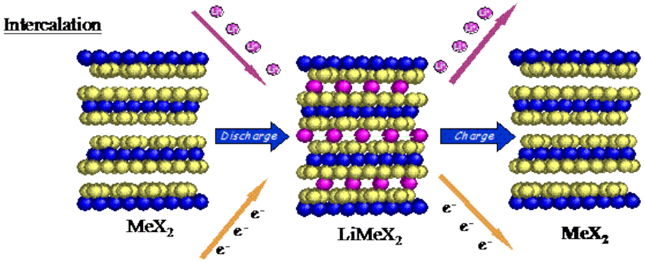
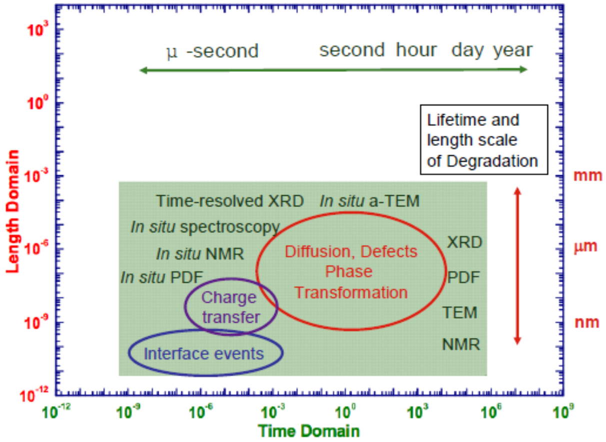
Northeast Center for Chemical Energy Storage (NECCES)
M. Stanley Whittingham (Binghamton University)

MISSION: Develop an understanding of how key electrode reactions occur in cathode materials for Li based batteries, and how they can be controlled to improve electrochemical performance, from the atomistic level to the macroscopic level throughout the life-time of the operating battery.

http://necces.binghamton.edu



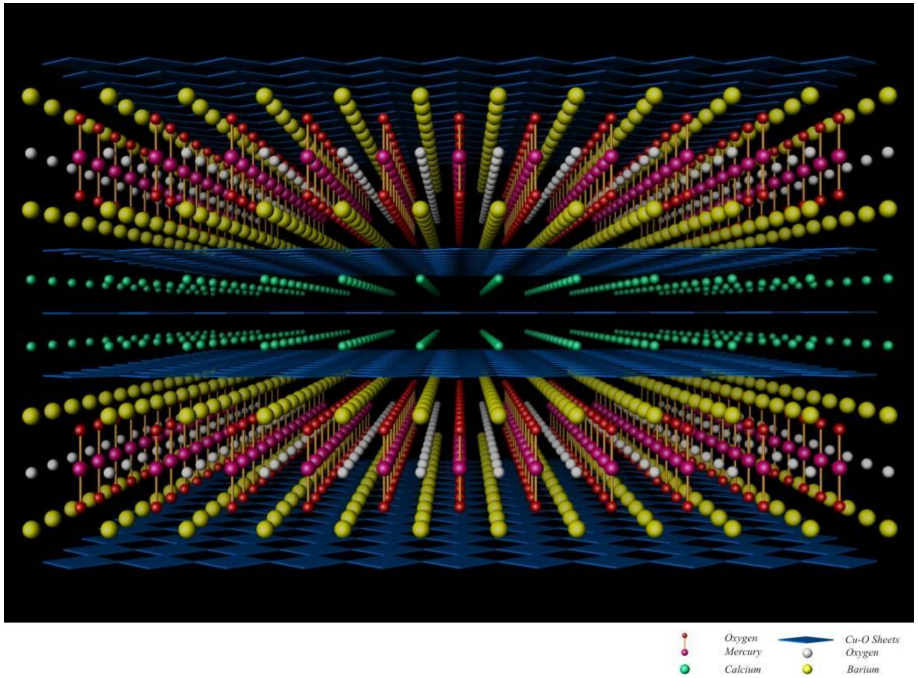


RESEARCH PLAN

The processes that occur in batteries are complex, spanning a wide range of time and length scales. The team of experimentalists and theorists will make use of, and develop new methodologies to determine how model compound electrodes function in real time, as batteries are cycled.

Center for Emergent Superconductivity (CES)
Peter D. Johnson (Brookhaven National Laboratory)

The central mission of CES is the development of an understanding of High Tc Superconductivity that will enable the prediction and perfection of new High Tc materials for use in a range of energy technologies including applications in generation, storage and transmission.



http://www.bnl.gov/energy/ces/

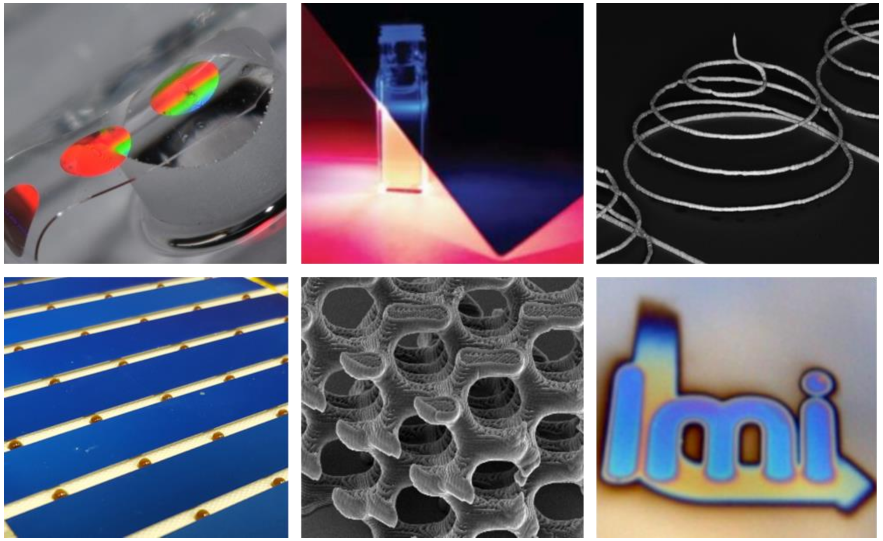
RESEARCH PLAN

Research to design superconductors with enhanced performance will be directed towards three key areas: (1) develop techniques to create new classes of superconducting materials by design, (2) understand the mechanism of high-temperature superconductivity, and (3) understand the current carrying limiting properties of existing high-temperature superconductors.

Light-Material Interactions in Energy Conversion (LMI)
Ralph Nuzzo (Caltech)

LMI-EFRC: a national resource for fundamental optical principles and design for solar energy conversion.
Goal: to tailor the morphology, complex dielectric structure, and electronic properties of matter so as to sculpt the flow of sunlight and heat, enabling light conversion to electrical energy with unprecedented efficiency.

http://lmi.caltech.edu



RESEARCH PLAN

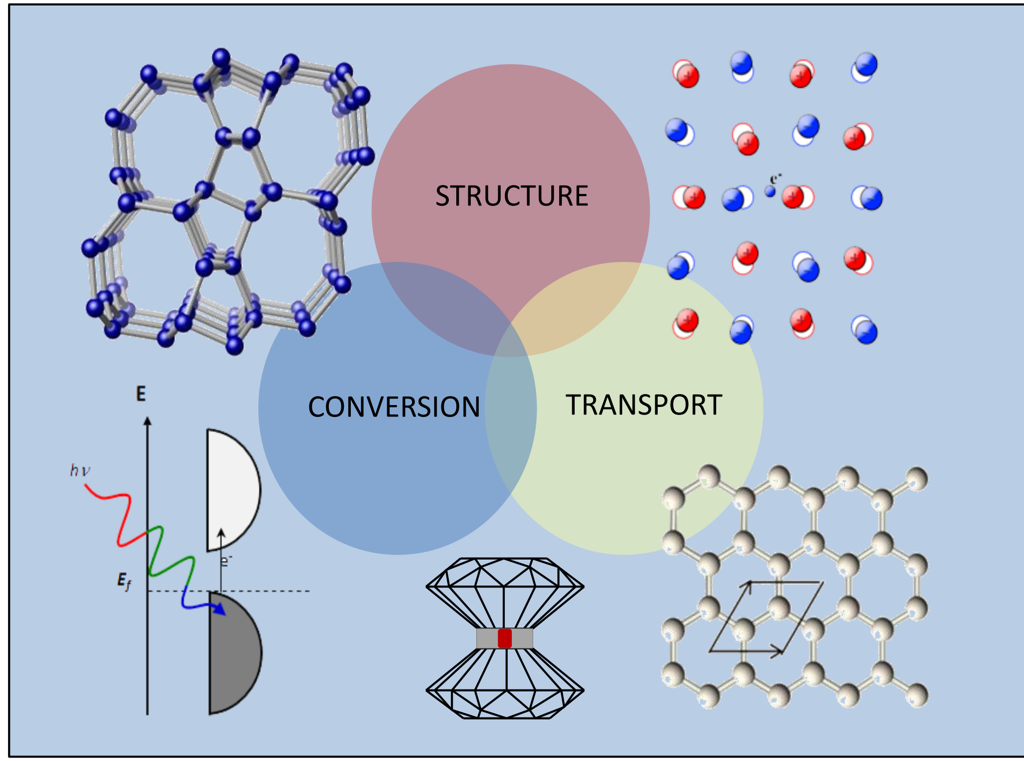
Challenge: Solar energy conversion that effectively utilizes the entire solar spectrum. ***Approach:*** Photonic design combining fundamental limits to solar conversion efficiency, spectrum splitting and control, broad angle light capture and concentration, and thermal photonics. ***Outcome:*** **Photonic principles that enable record photovoltaic conversion efficiency and utilization of the entire visible and infrared solar resource.**

Energy Frontier Research in Extreme Environments (EFree)
Russell J. Hemley (Carnegie Institution of Washington)

***EFRC Mission Statement*:**

To accelerate the discovery and synthesis of energy materials using extreme conditions.

https://efree.carnegiescience.edu/



RESEARCH PLAN

By use of advanced extreme conditions techniques, EFree discovers, characterizes, and creates transformative energy materials, including novel structural, energy conversion, and energy transport materials.

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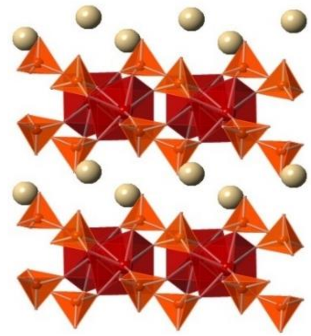
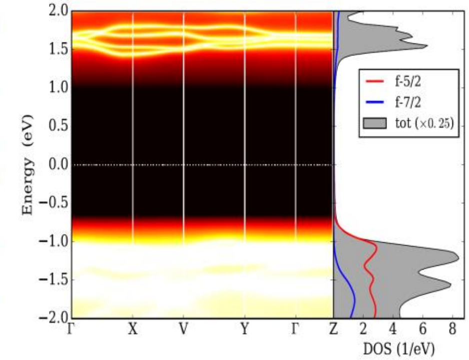
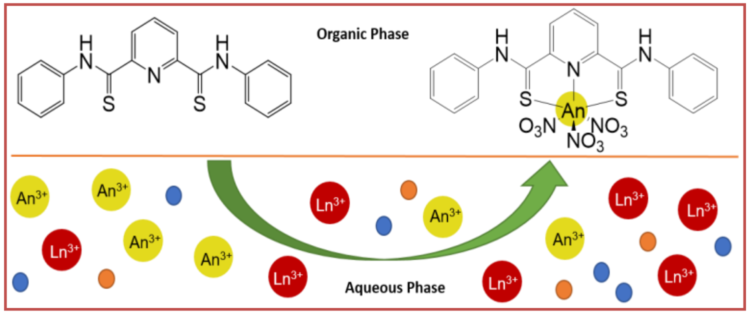
Center for Actinide Science & Technology (CAST)
Thomas Albrecht-Schmitt (Florida State University)

The mission of CAST is to advance our understanding of how electronic structure and bonding control the properties of heavy element materials. This knowledge will aid in the development of nuclear technologies that enhance energy security, address nuclear legacy issues and environmental concerns, and foster the next generation of nuclear scientists.

https://cast.magnet.fsu.edu/







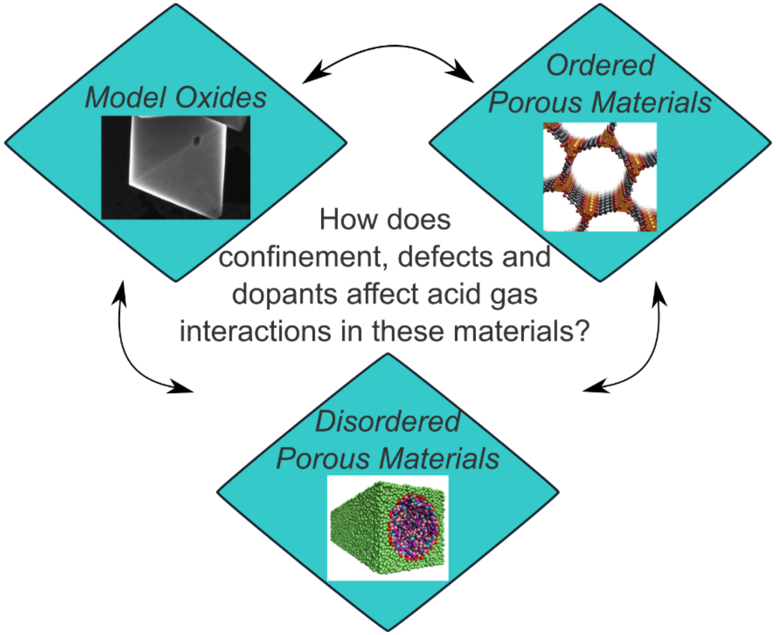
RESEARCH PLAN

CAST develops new materials that capture radionuclides found within legacy waste from the Cold War. Optimization of these materials requires advances in synthesis, characterization, and theoretical methods that provide a deep understanding of the origin of the unusual properties of these nuclear materials.

Revised 11/14/2017

Center for Understanding and Control of Acid Gas-Induced Evolution of Materials for Energy (UNCAGE-ME)
Krista Walton (Georgia Tech)

UNCAGE-ME focuses on developing a deep knowledge base in the characterization, prediction, and control of acid-gas interactions with a broad class of materials to accelerate materials development for large-scale energy applications.



http://efrc.gatech.edu

RESEARCH PLAN

Degradation effects are often decisive factors in the practical use of materials such as sorbents for carbon capture, acid gas conversion, and natural gas purification. Our core research model is to use a variety of in-situ experimental tools coupled with complimentary modeling techniques to improve the performance of materials in these environments and advance materials discovery.

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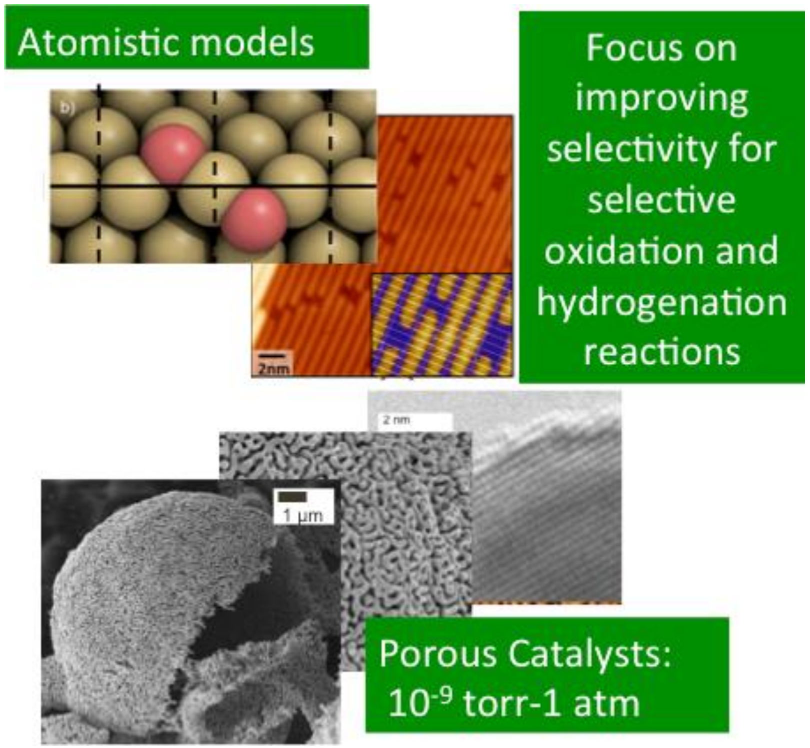
Georgia Institute of Technology · Oak Ridge National Laboratory · Lehigh University · Wisconsin · Penn State · The University of Alabama · Washington University in St. Louis · UF University of Florida · UNCAGE-ME

Integrated Mesoscale Architectures for Sustainable Catalysis (IMASC)
Cynthia Friend (Harvard University)

MISSION STATEMENT:

The mission of IMASC is to drive and conduct transformative research in mesoscale science for sustainable catalysis, with full integration of multi-scale experimental, theoretical and computational approaches.

http://www.efrc.harvard.edu



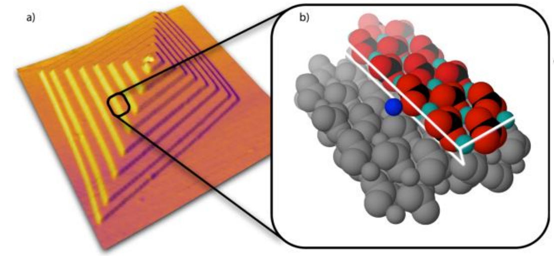
RESEARCH PLAN

The plan is to develop principles for designing catalytic processes, based on porous catalyst architectures (non-zeolite), that will reduce energy consumption in producing platform chemicals by carrying out investigations under a wide range of conditions using advanced experiment and theory.

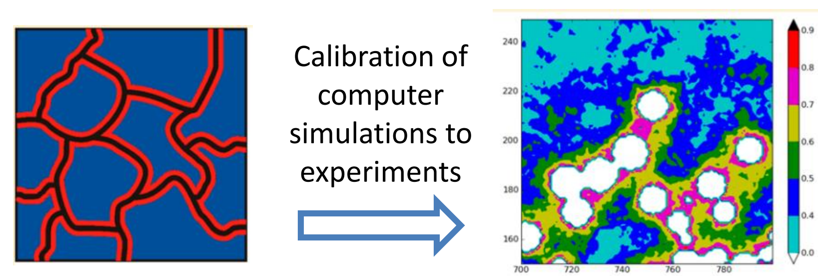
Center for Nanoscale Controls on Geologic CO_2 (NCGC)
Donald J. DePaolo (LBNL)

NCGC Mission Statement
Enhance the performance and predictability of subsurface storage systems by understanding the molecular and nanoscale origins of CO_2 trapping processes, and developing computational tools to translate to larger-scale systems

esd1.lbl.gov/research/facilities/ncgc/



Molecular-to-nanoscale characterization and models



RESEARCH PLAN

Experimental investigations will probe nanoscale fluid-fluid and fluid-mineral interactions and their effects on subsurface CO_2 trapping. Characterization and experiments will be integrated with mesoscale chemical-mechanical-hydrologic modeling and simulation to achieve a transformational predictive capability for stratigraphic- and reservoir CO_2 trapping efficiency and long-term reliability.

Center for Advanced Solar Photophysics (CASP)
Victor I. Klimov (Los Alamos National Laboratory)

The purpose of this center is to explore, design and apply the unique interactions of *nanomaterials* with light to enable *disruptive advances* in the efficiency of solar energy capture and conversion.

http://casp.lanl.gov
http://www.centerforadvancedsolarphotophysics.org

RESEARCH PLAN

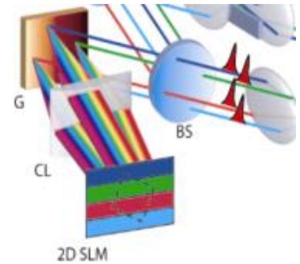
Our focus is on fundamental physics and chemistry of solution-processible semiconductor nanocrystals specifically designed to exhibit novel phenomena that will enhance the conversion of sunlight into electricity. The desired outcomes of this work are effective, low-cost schemes for light harvesting and conversion using approaches such as up- and down-conversion, carrier multiplication, and controlled coupling in mesoscopic nanocrystal assemblies.

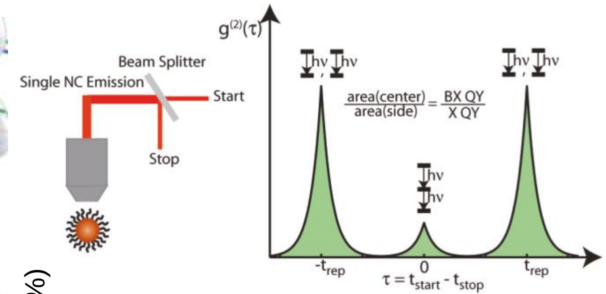
Center for Excitonics (CE)
Marc Baldo (MIT)

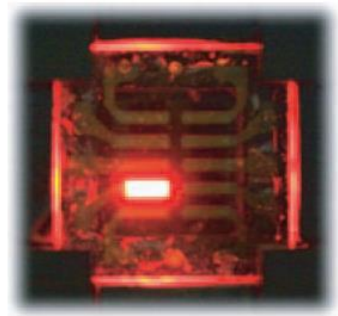
Electronics vs Excitonics

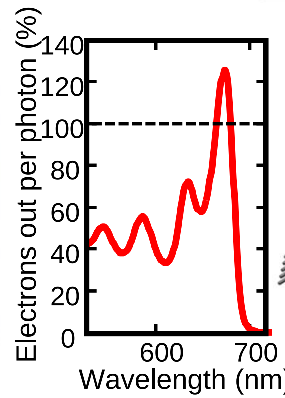
Excitons are nanoscale packets of energy that are characteristic of low-cost materials for solar cells and solid state lighting. The CE EFRC seeks to supersede traditional electronics with devices that use excitons to mediate the flow of energy.

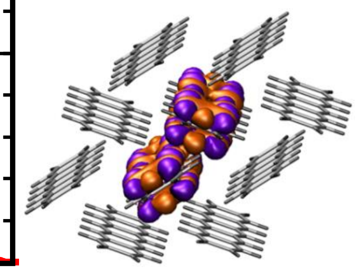
http://www.rle.mit.edu/excitonics/











RESEARCH PLAN

The CE EFRC addresses the two grand challenges in excitonics:

(1) Understand, control and exploit exciton transport

(2) Understand and exploit energy conversion between excitons, electrons, and photons.

CE's advances will be applied to low-cost solar cells and solid state lighting.

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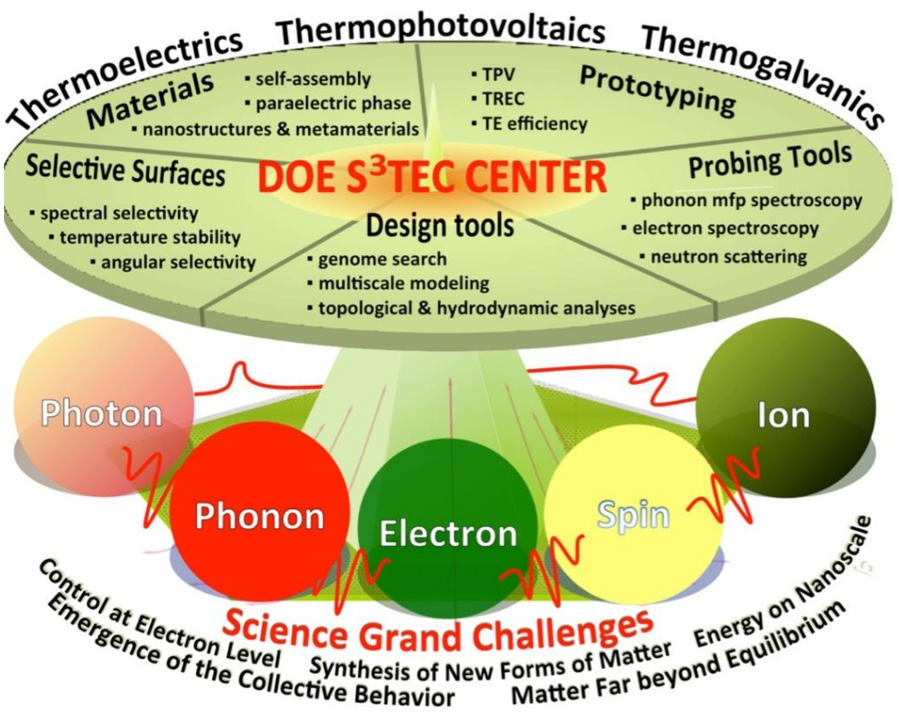
BROOKHAVEN NATIONAL LABORATORY

center for excitonics

Solid-State Solar-Thermal Energy Conversion Center (S^3TEC)
Gang Chen (Massachusetts Institute of Technology)

EFRC Mission: To advance fundamental science and materials for harnessing heat from the Sun and terrestrial sources and for converting this heat into electricity via thermoelectric, thermo-photovoltaic, and thermogalvanic technologies.

http://s3tec.mit.edu/

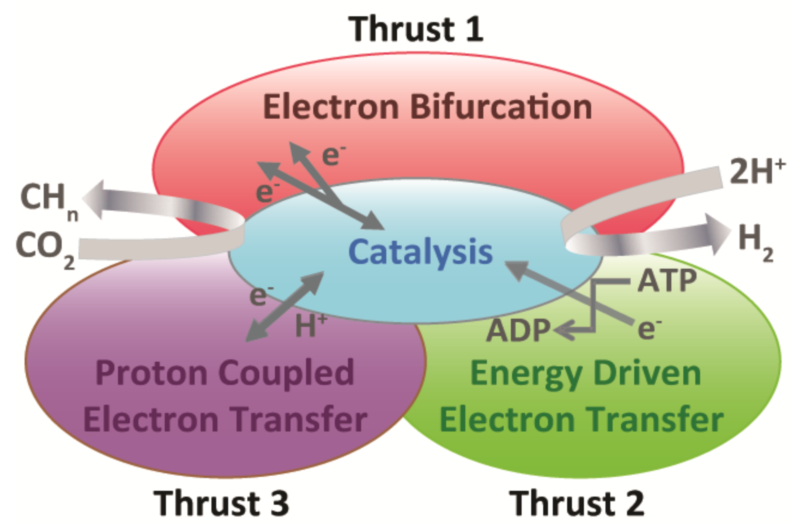


RESEARCH PLAN

The Center combines experiments, modeling, and simulation to study and optimize the properties of elementary energy carriers involved in heat-to-electricity energy conversion, which will guide design and synthesis of new materials and demonstration of proof-of-principles prototypes.

Biological Electron Transfer and Catalysis (BETCy)
John Peters (Montana State University)

EFRC mission: The focus of the Biological Electron Transfer and Catalysis (*BETCy*) EFRC research is elucidating mechanisms of conversion of electrochemical potential into chemical bond energy through investigating the basis for controlling electron bifurcation, electron-ion coupling, and redox catalysis in model enzymes.



http://eu.montana.edu/betcy-efrc/

RESEARCH PLAN

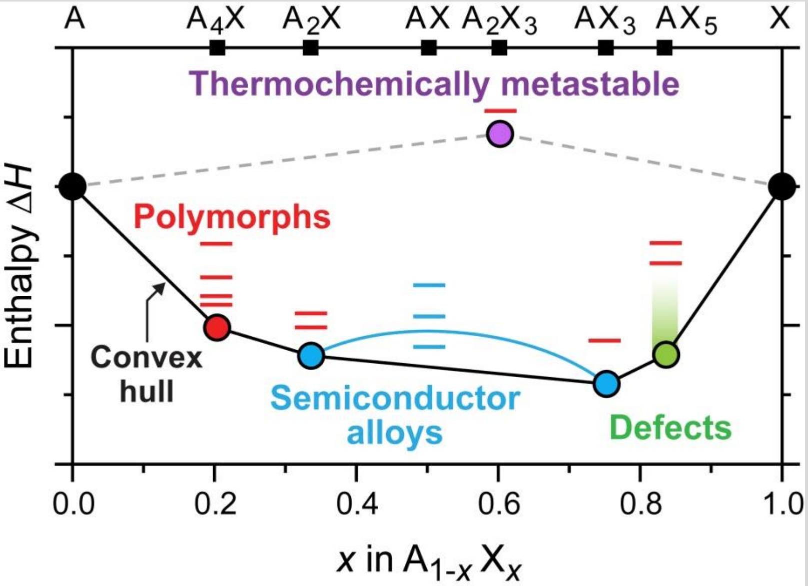
The research plan of the *BETCy* EFRC has been designed to provide the basis to exploit the unique features of biochemical mechanisms that have yet to be explored substantively in the context of energy production but have the potential for innovative solutions and game-changing advancement.

Revised 11/14/2017

Center for Next Generation of Materials Design (CNGMD)
William Tumas (National Renewable Energy Laboratory)

The mission of CNGMD is to dramatically transform the discovery of functional energy materials **using high-throughput multiple-property search, incorporation of metastable materials into predictive design, and the development of theory to guide materials synthesis.**

www.cngmd-efrc.org



Four classes of metastable materials (shown in color) targeted for theory-driven synthesis in the CNGMD EFRC.

RESEARCH PLAN

- **Integrate high-throughput theory, synthesis, characterization, and data mining to rapidly *discover new functional semiconductor materials for energy applications.***
- **Develop new theory and experimental *tools* to accelerate materials discovery.**
- **Discover and study *metastable materials* including polymorphs, alloys, defects.**
- **Identify *synthesis pathways* by coupling theory and *in-situ* characterization.**

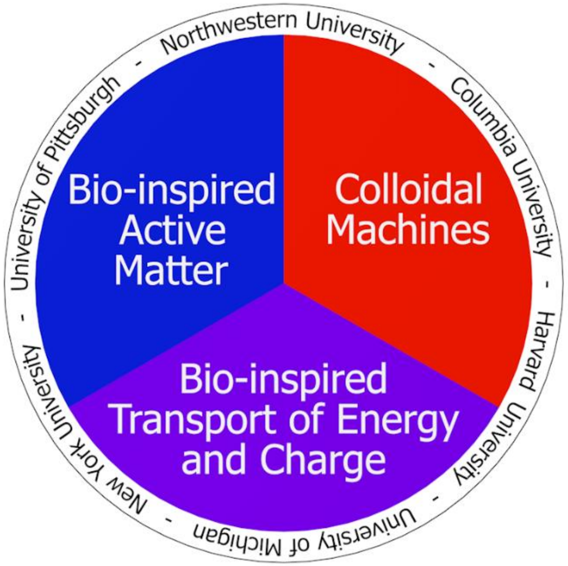
Revised 1/3/2018

Center for Bio-inspired Energy Science (CBES)
Samuel Stupp (Northwestern University)

CBES mission statement:

To discover and develop bio-inspired systems that reveal new connections between energy and matter.

http://cbes.northwestern.edu/



RESEARCH PLAN

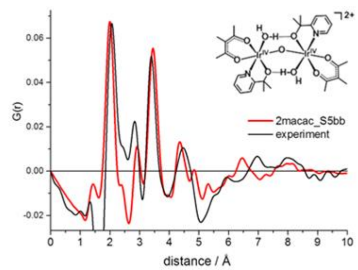
Combining theory and experiments, the Center will develop artificial materials and systems that take inspiration from biology. These systems will include materials with bio-inspired functions (artificial muscles, organelles, and adaptive materials), colloidal machines (motors, ensembles of motors, and artificial cells), and energy and charge transport (quantum ratchets and ion pumps).

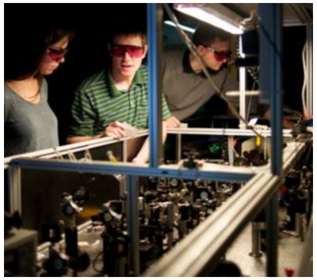
Argonne-Northwestern Solar Energy Research (ANSER) Center
Michael R. Wasielewski (Northwestern University)

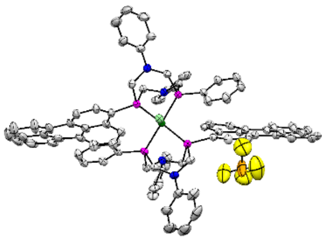
The mission of the ANSER Center is to revolutionize our understanding of molecules, materials, and methods necessary to create dramatically more efficient technologies for solar fuels and electricity production.

http://www.AnserCenter.org

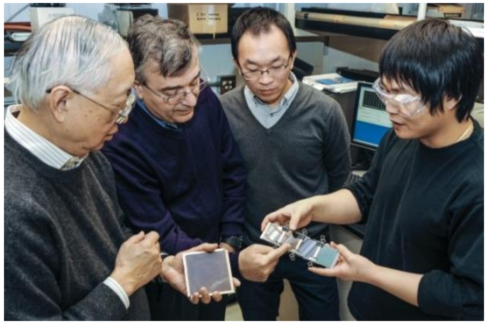
Solar Fuels

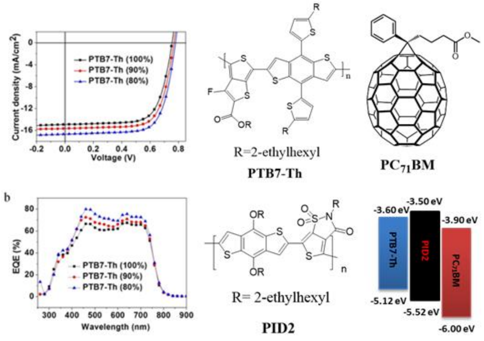






Solar Electricity





RESEARCH PLAN

Develop a fundamental understanding of how to:

- **Design, fabricate, and characterize new catalysts to split water to hydrogen and oxygen and to convert carbon dioxide into liquid fuels using sunlight.**
- **Design, fabricate, and characterize new materials for low-cost, earth-abundant, next generation solar cells and powering solar fuels catalysts.**

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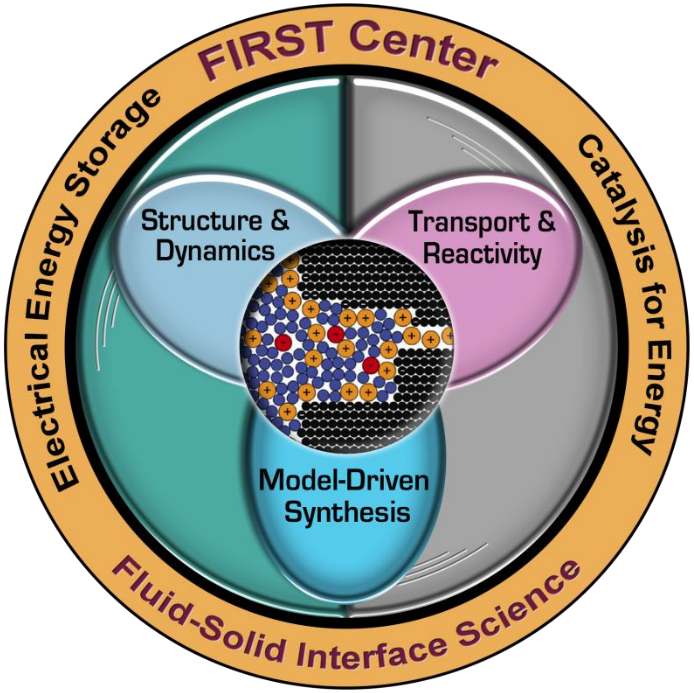
Fluid Interface Reactions, Structures and Transport (FIRST)
Sheng Dai (Oak Ridge National Laboratory)

FIRST Center Mission Statement:

To develop fundamental understanding and validated, predictive models of the unique nanoscale environment at fluid-solid interfaces that will enable transformative advances in electrical energy storage and electrocatalysis

http://web.ornl.gov/sci/first/



RESEARCH PLAN

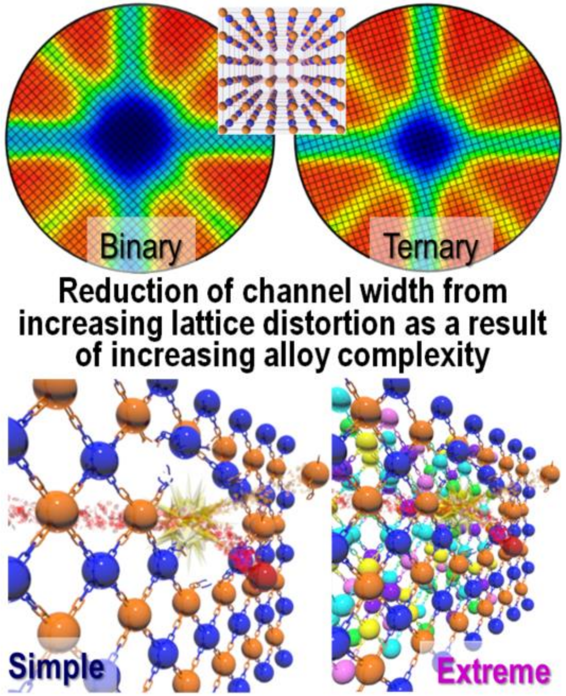
FIRST integrates novel experimental and analytical approaches, advanced materials synthesis and characterization, and multiscale computational modeling to achieve a level of understanding of the structures, dynamics, transport properties and reactivity of fluid-solid interfaces sufficient to design and test novel interfacial systems with transformative properties.

U.S. DEPARTMENT OF ENERGY | Office of Science | Oak Ridge National Laboratory | Argonne National Laboratory | Drexel University | PennState | UC Riverside | UC Davis | University of Delaware | Minnesota | Vanderbilt University | Georgia State University

Energy Dissipation to Defect Evolution (EDDE)
Yanwen Zhang (Oak Ridge National Laboratory)

EFRC Mission: To develop a foundation of energy dissipation mechanisms in tunable concentrated solid-solution alloys, to control the early stage processes of radiation damage formation and defect evolution, and to yield new design principles and accelerate science-based material discovery of radiation–tolerant structural alloys for energy applications.

http://edde.ornl.gov/



RESEARCH PLAN

Challenge: To improve structural alloy performance in a radiation environment for safe and economical operation.

Approach: To understand energy dissipation through electron and phonon interactions, and how they are influenced by alloy complexity.

Outcome: New design principles for radiation-tolerant structural alloys.

U.S. DEPARTMENT OF ENERGY | Office of Science | Oak Ridge National Laboratory | University of Michigan | Virginia Tech | The University of Tennessee Knoxville | Wisconsin University of Wisconsin–Madison | University of Wyoming

Center for Performance and Design of Nuclear Waste Forms and Containers (WastePD)

Gerald Frankel (Ohio State University)

The mission of WastePD is to understand the fundamental mechanisms of waste form performance, and apply that understanding to develop tools for design of waste forms with improved performance.

https://efrc.osu.edu

RESEARCH PLAN

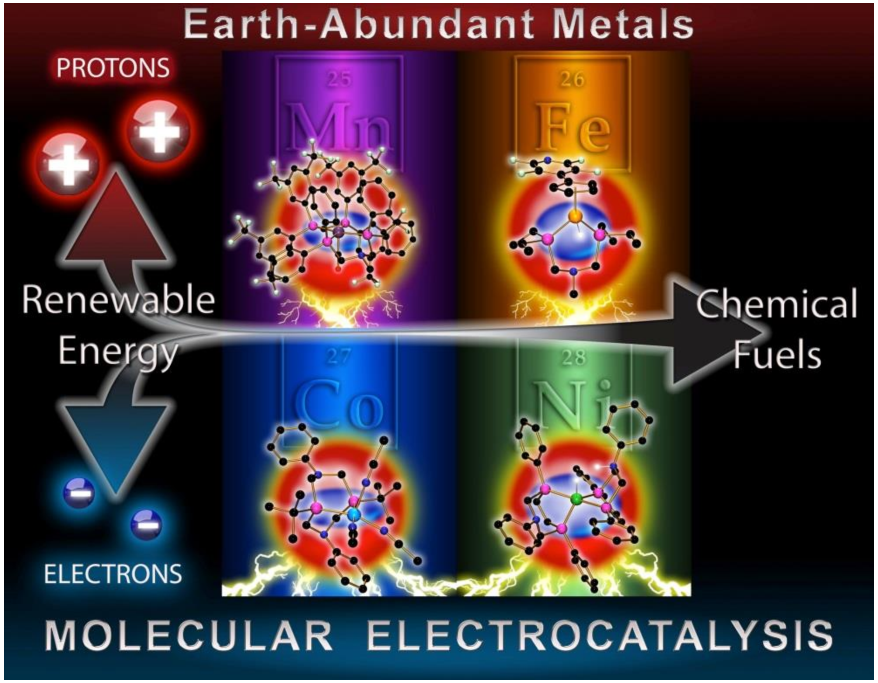
- Science of Environmental Degradation of Waste Form Materials
- Roles of Surface Films and Material Reactivity
- Impact of Environment on Degradation of Waste Form Materials

Revised 11/14/2017

The Center for Molecular Electrocatalysis (CME)
R. Morris Bullock (Pacific Northwest National Laboratory)

CME's vision is to develop a comprehensive understanding of proton transfer reactions that will lead to transformational changes in the ability to design molecular electrocatalysts that rapidly and efficiently convert between electrical energy and chemical energy (bonds) in fuels.

http://efrc.pnnl.gov



RESEARCH PLAN

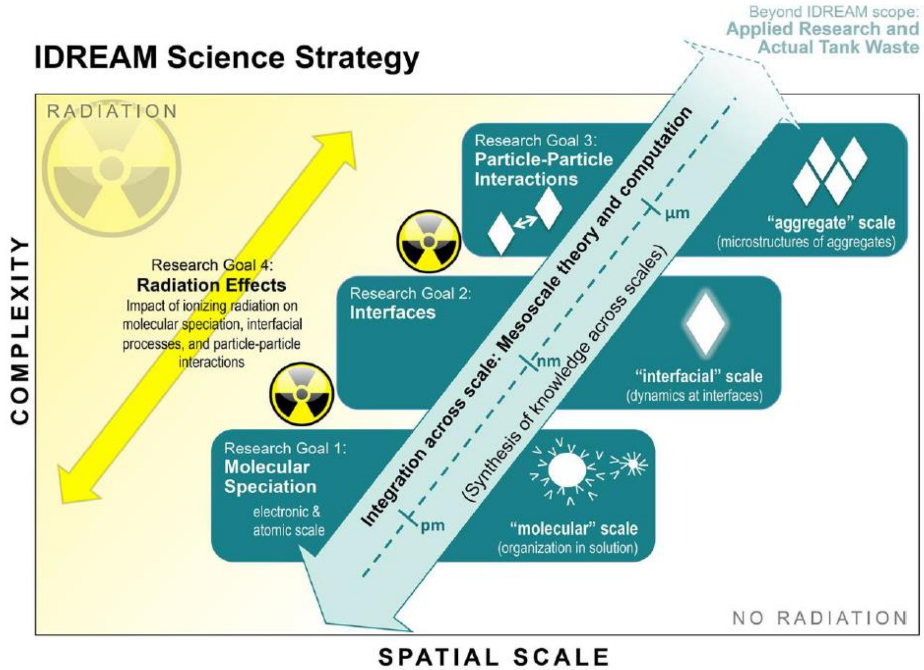
Catalysts facilitate the conversion of electricity obtained from carbon-neutral, sustainable energy sources (such as solar and wind) into chemical bonds in fuels. CME's research addresses the precise control of movement of protons and electrons to enhance the rate and efficiency of electrocatalysts.

Revised 11/14/2017

Interfacial Dynamics in Radioactive Environments and Materials (IDREAM)

Sue Clark (Pacific Northwest National Laboratory)

Mission: Master molecular–to–mesoscale chemical and physical phenomena at interfaces in complex environments characterized by extremes in alkalinity and low-water activity, and driven far from equilibrium by ionizing (γ,β) radiation.



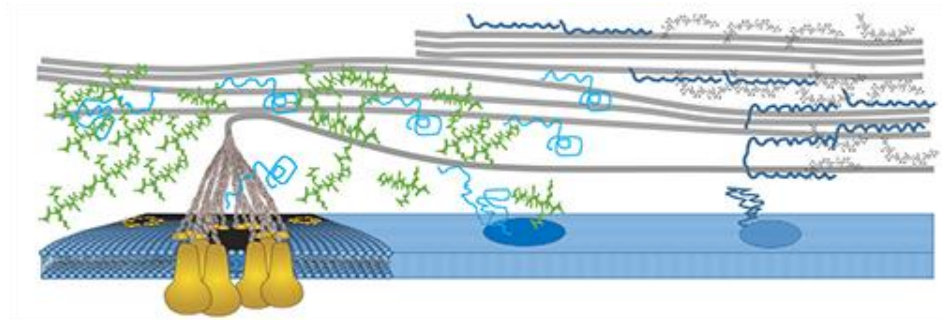
RESEARCH PLAN

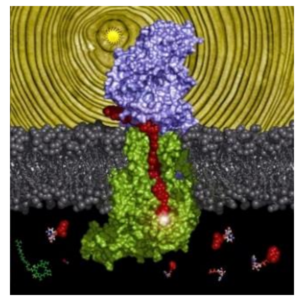
IDREAM is conducting fundamental studies to support innovations in processing high-level radioactive wastes (HLW). This work facilitates the transformation of HLW processing by elucidating the basic chemistry and physics required to control and manipulate interfacial phenomena in extreme HLW environments.

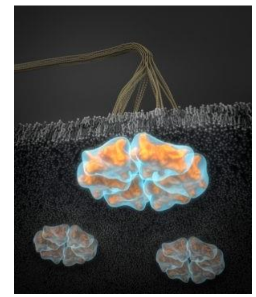
Center for Lignocellulose Structure and Formation (CLSF)
Daniel J. Cosgrove (Penn State University)

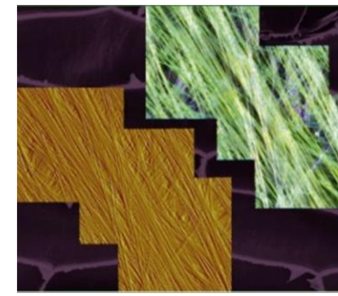
Mission: to develop a nano- to meso-scale understanding of plant cell walls, the main structural material in plants, and the mechanisms of their assembly, forming the foundation for significant advances in sustainable energy and novel biomaterials.

www.lignocellulose.org









RESEARCH PLAN

With a unique mix of molecular biologists, chemists, physicists, engineers and computational modelers, CLSF is developing a molecular understanding of the nano-machinery that transforms simple sugars into cellulose microfibrils and the 'rules of assembly' that enable scaffolds of cellulose microfibrils to interact with water, matrix polysaccharides, and lignin to produce hierarchically-ordered cell walls with diverse physical and material properties.

Revised 11/14/2017

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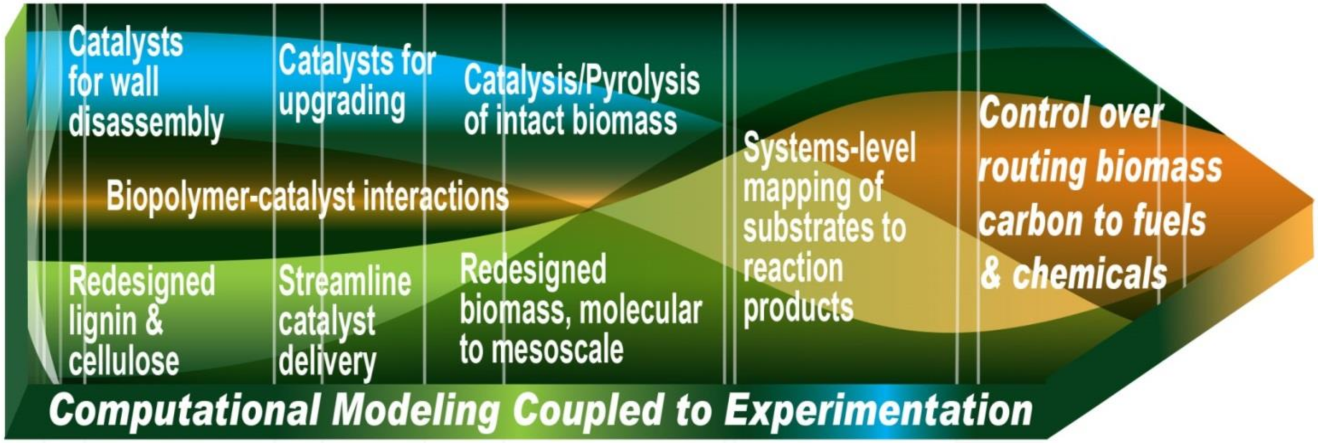
Center for Direct Catalytic Conversion of Biomass to Biofuels (C3Bio)
Maureen McCann (Purdue University)

The C3Bio mission is to master the ability to reconfigure all partially reduced carbon from plant cell walls into desired molecules.



http://www.purdue.edu/discoverypark/c3bio/

RESEARCH PLAN

C3Bio develops fundamental understanding of how biomass structural complexity impacts the yields and selectivities of liquid hydrocarbon fuels and high-value chemicals during catalytic or pyrolytic transformations of plant cell walls. We modify cell wall composition and catalytically transform intact biomass to specify both the structures within, and the reaction products from, lignocellulosic biomass.

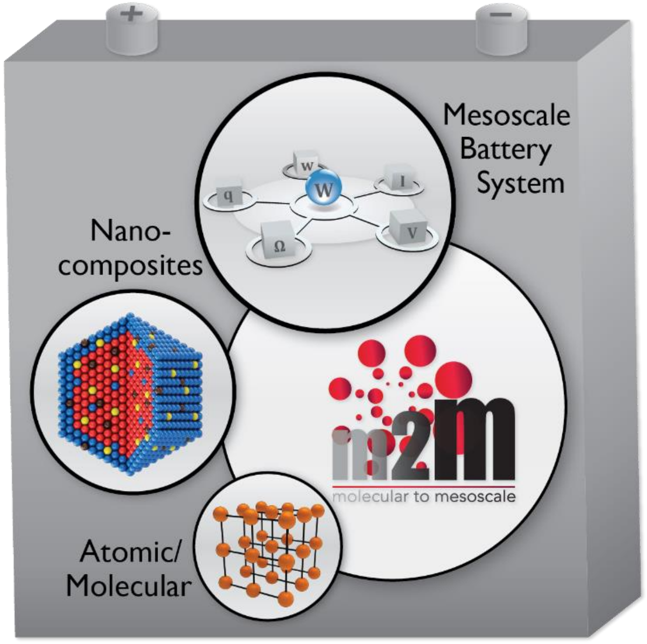
U.S. DEPARTMENT OF ENERGY | Office of Science | C3Bio | PURDUE UNIVERSITY Discovery Park | THE UNIVERSITY of TENNESSEE KNOXVILLE | NREL RENEWABLE ENERGY LABORATORY | Northeastern University

Center for Mesoscale Transport Properties (*m2m*)
Esther S. Takeuchi (Stony Brook University)

m2m **EFRC mission statement:**

to understand and to provide control of transport properties in complex battery systems with respect to multiple length scales, from molecular to mesoscale (m2m);
to minimize heat and maximize work of electrical energy storage devices.

http://www.stonybrook.edu/m2m/



RESEARCH PLAN

Construct and probe battery-relevant systems over a range of dimensional scales, from the molecular to mesoscale (*m2m*); to provide an iterative theory and application based process to expedite understanding and optimization of functional energy delivery; to minimize heat and maximize work of energy storage devices under genuine use conditions.

U.S. DEPARTMENT OF ENERGY | Office of Science | m2m molecular to mesoscale | Stony Brook University | TEXAS The University of Texas at Austin | BROOKHAVEN NATIONAL LABORATORY | COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK | Rensselaer | Berkeley UNIVERSITY OF CALIFORNIA | Georgia Institute of Technology | OAK RIDGE National Laboratory

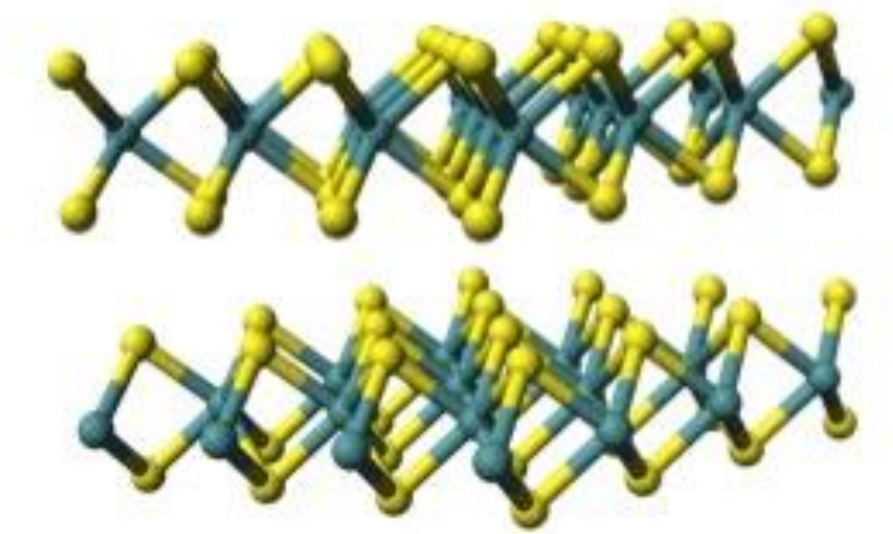
Center for the Computational Design of Functional Layered Materials (CCDM)

John P. Perdew (Temple University)

EFRC mission statement

To develop, apply, and validate methods to calculate the electronic structure of materials. While these methods can be useful for the design of many new materials, we focus on the layered and two-dimensional materials that have potential for clean-energy technologies.

http://efrc.cst.temple.edu

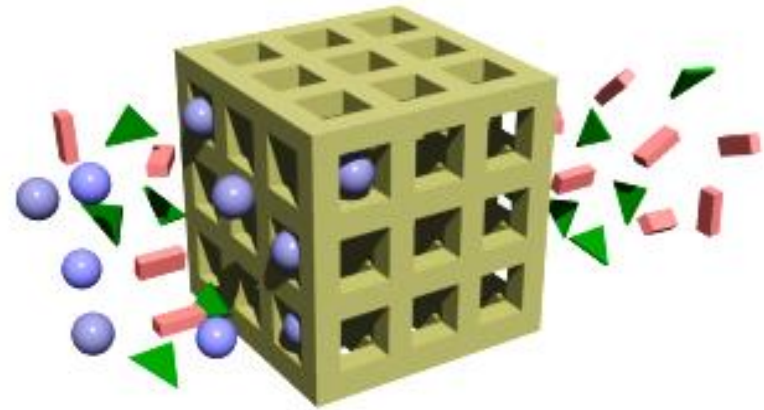


RESEARCH PLAN

We are developing efficient and accurate density functionals including intermediate or full-range van der Waals interaction, and higher-level methods. These methods are being applied to understand how properties of layered materials are affected by composition, structure, defects, interfaces, and strain, and to the catalysis of hydrogen evolution.

Center for Gas Separations Relevant to Clean Energy Technologies (CGS)
Jeffrey R. Long (University of California, Berkeley)

The aim of the CGS is to develop new materials and membranes that enable energy-efficient separation of gas mixtures, as required in the clean use of fossil fuels and in reducing emissions from industry. Particular emphasis is placed on (i) separations that reduce CO_2 emissions from power plants and (ii) energy-intensive gas separations in industry and agriculture.



http://www.cchem.berkeley.edu/co2efrc/

RESEARCH PLAN

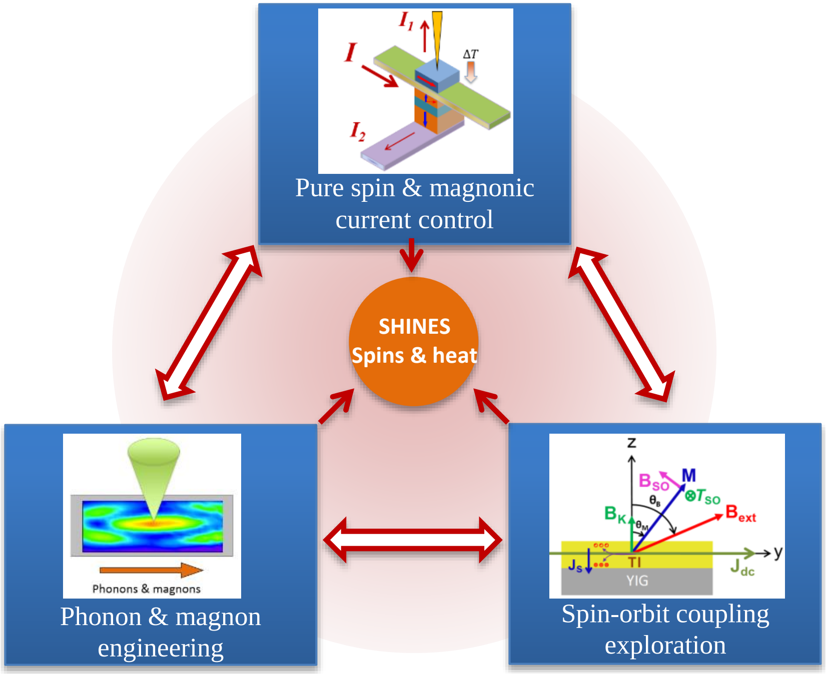
To reduce the industrial separation energy costs by employing more effective materials, new materials for the efficient separation of industrially-relevant gases will be developed. In particular, CGS is targeting novel adsorbents for CO_2 capture, the separation of O_2 from air and N_2 from methane, and for the shape-selective separation of hydrocarbons. New characterization methods and computational tools will be developed to guide and support these quests.

Spins and Heat in Nanoscale Electronic Systems (SHINES)
Jing Shi (University of California, Riverside)

EFRC mission:

To explore the interplay of spin, charge, and heat and to control the transport of spin and energy for achieving significantly higher energy efficiencies in nanoscale electronic devices

http://efrcshines.ucr.edu/

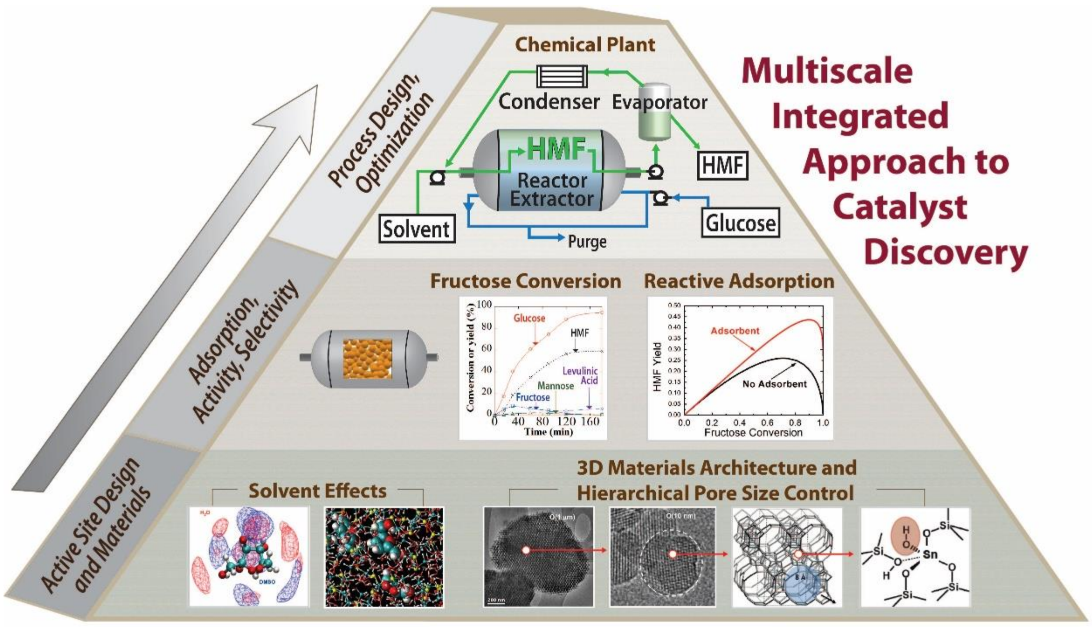


RESEARCH PLAN

Developing better understanding of and significantly improving pure spin current effects in nanoscale electronic devices; engineering acoustic phonon and magnon transport in nano-structured materials via controlling their dispersions and interactions; and exploring spin-orbit coupling for low energy effects and spin superfluidity for dissipationless spin and energy transport.

Catalysis Center for Energy Innovation (CCEI)
Dionisios G. Vlachos (University of Delaware)

CCEI focuses on developing innovative, transformational heterogeneous catalytic technologies to economically convert lignocellulosic (non-food-based) biomass into chemicals and fuels.



www.efrc.udel.edu

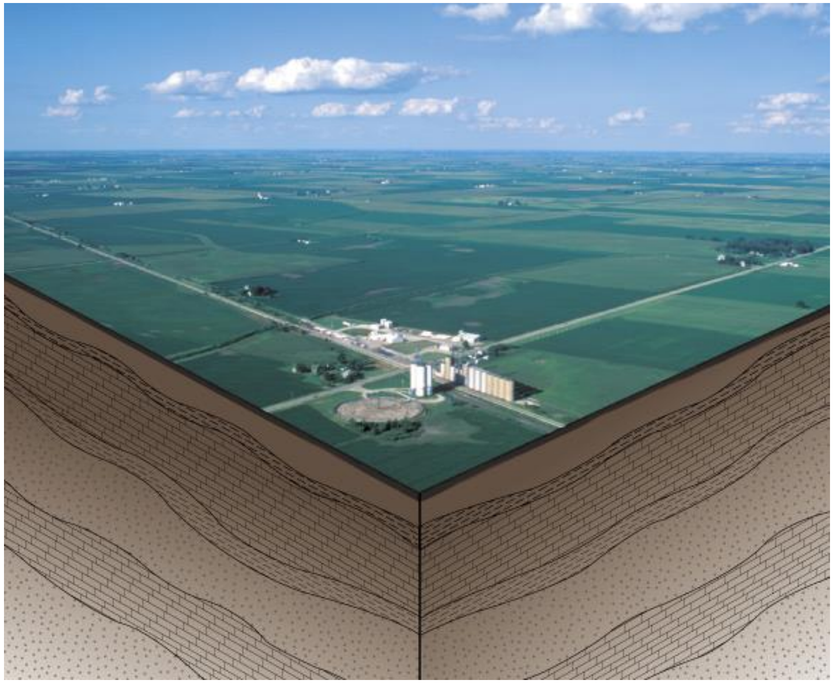
RESEARCH PLAN

CCEI develops novel catalytic materials and processes for the operation of modern biorefineries for carbon neutral production of chemicals and fuels. It advances fundamental knowledge by developing methods that can tackle the complexity of biomass feedstock and the multiscale nature of chemical reactions.

Center for Geologic Storage of CO_2 (GSCO2)
Scott M. Frailey (University of Illinois at Urbana-Champaign)

The goal of the GSCO2 is to generate new conceptual, mathematical, and numerical models applicable to geologic storage systems in specific and strategically identified research areas, based on uncertainty and limitations observed in field pilots and CO_2 injection demonstration projects, laboratory experiments, and the experience of researchers.

http://www.gsco2.org/



RESEARCH PLAN

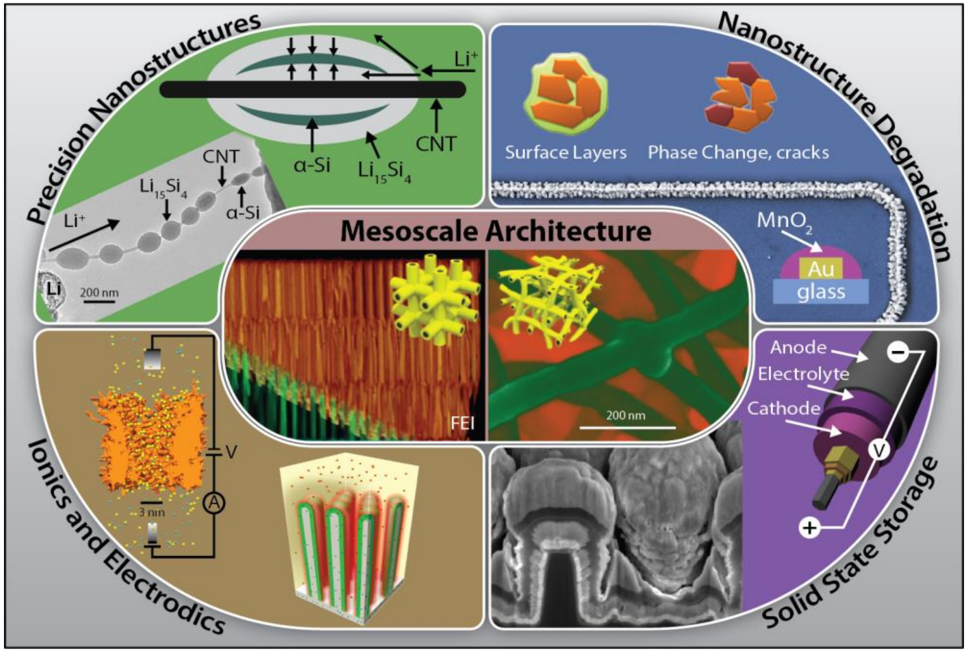
The GSCO2 will use fundamental and basic scientific principles as the basis for investigating recognized CO_2 storage challenges. Our focus is on the mechanism of injection-induced microseismicity and controlling and predicting its occurrence.

Revised 11/14/2017

Nanostructures for Electrical Energy Storage (NEES)
Gary W. Rubloff (University of Maryland)

***NEES mission:* To reveal scientific insights and design principles that enable a next-generation electrical energy storage technology based on *dense mesoscale architectures of multifunctional nanostructures*.**

www.efrc.umd.edu



RESEARCH PLAN

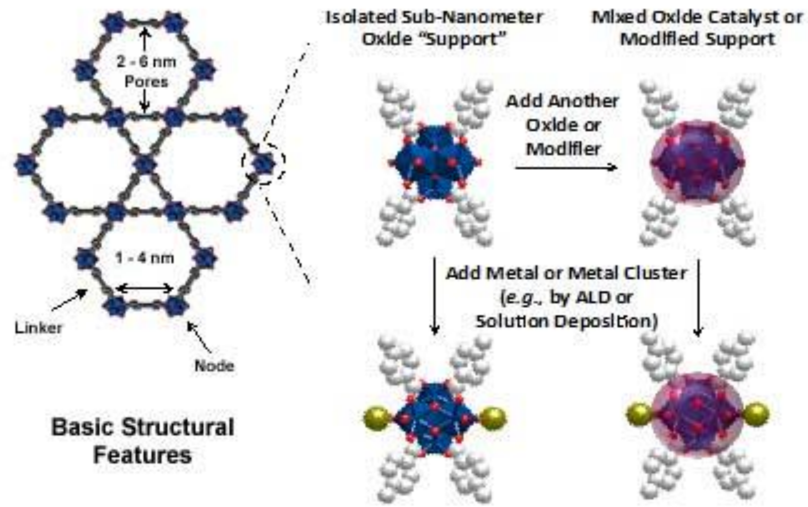
- arrange ***precision nanostructures*** into ***mesoscale architectures*** in regular & random configurations,
- investigate ***mesoscale ionics & electrodics consequences***,
- pursue a ***science of dynamic nanostructure degradation*** addressing both short & long term time scales,
- enable ***solid-state nanostructured batteries*** for safety, high power & energy.

U.S. DEPARTMENT OF ENERGY | Office of Science | NEES NANOSTRUCTURES for ELECTRICAL ENERGY STORAGE | University of Maryland | Sandia National Laboratories | UCI | Yale | UF University of Florida | The University of Utah | Michigan State University | UCLA

Inorganometallic Catalyst Design Center (ICDC)
Laura Gagliardi (University of Minnesota)

ICDC is devoted to guiding the discovery of superior catalysts by integrating computational modeling with experiments in well-defined systems that are amenable to high-throughput search and discovery methods.

http://www.chem.umn.edu/icdc/



RESEARCH PLAN

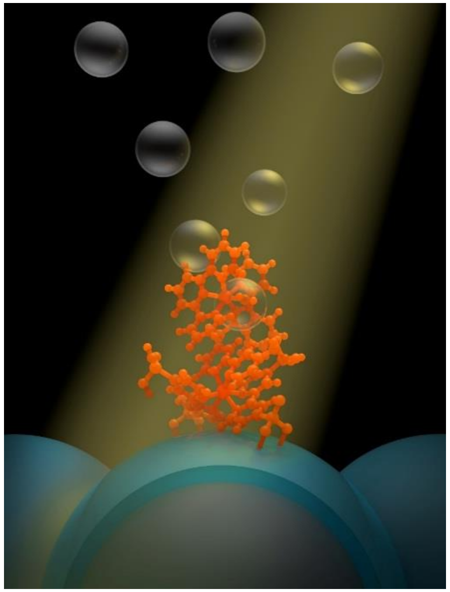
ICDC designs a new class of catalysts consisting of inorganometallic clusters supported by metal-organic frameworks. ICDC computationally predicts such cluster catalysts for conversions of natural gas into methanol and oligomers, with new quantum and classical simulation techniques. The coupling between the experimental and the theoretical efforts ensures that the discovery of these novel materials and the understanding of their properties occurs through a truly iterative theoretical/experimental loop.

Center for Solar Fuels (UNC EFRC)
Thomas J. Meyer (University of North Carolina at Chapel Hill)

UNC EFRC MISSION:

The Center for Solar Fuels conducts research on the dye sensitized photoelectrosynthesis cell (DSPEC) for water splitting and tandem cells for the reduction of carbon dioxide to carbon-based solar fuels.

www.efrc.unc.edu



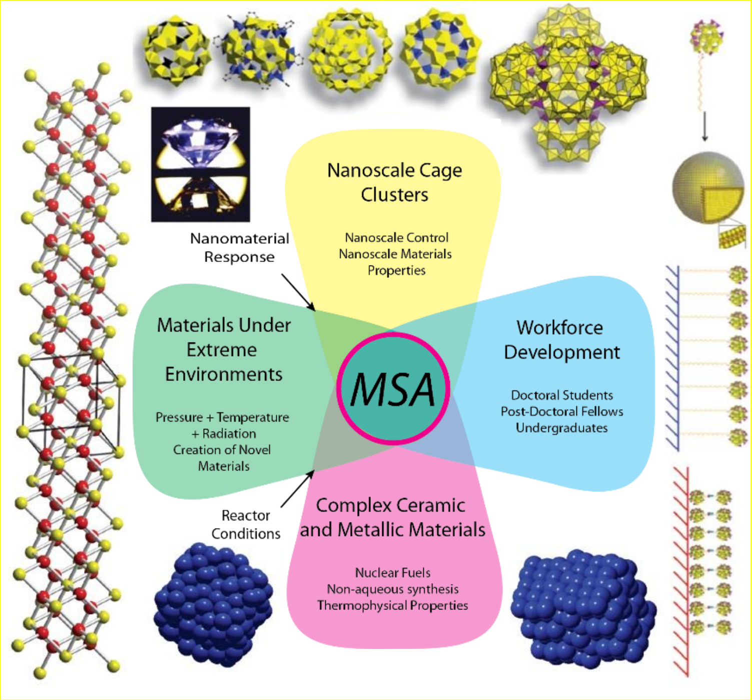
RESEARCH PLAN

A modular approach is applied to design, test, and evaluate high efficiency DSPEC device prototypes for solar water oxidation and CO_2 reduction to formate or syngas H_2:CO mixtures. Results are being integrated from research on water oxidation, CO_2 reduction, light-harvesting chromophores and chromophore arrays, chromophore-catalyst assemblies, mesoporous nanoparticle semiconductor oxide and transparent conducting oxide films, and core/shell structures to create efficient DSPEC device prototypes.

Materials Science of Actinides (MSA)
Peter C. Burns (University of Notre Dame)

The MSA EFRC seeks to conduct transformative research in the actinide sciences with full integration of experimental and computational approaches, and an emphasis on research questions that are important to the energy future of the nation. Workforce development is a motivating goal.

http://msa-efrc.com



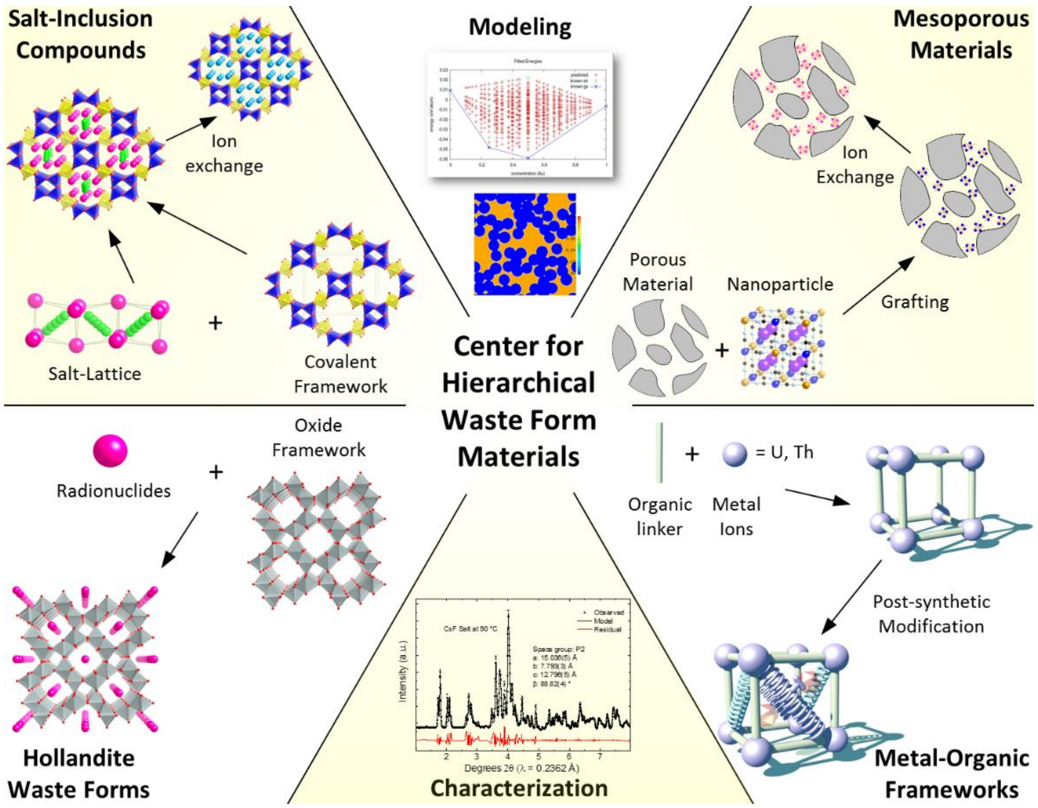
RESEARCH PLAN

This EFRC blends experimental and computational approaches to study highly complex actinide materials (such as materials for fuels, waste forms, or separations), with an emphasis on the nanoscale. The behaviors and properties of such materials in extreme environments of radiation and pressure is a major focus of this research.

Center for Hierarchical Waste Form Materials (CHWM)
Hans-Conrad zur Loye (University of South Carolina)

CHWM Mission: To combine experiment and modeling to develop the chemistry and structure motifs needed to create hierarchical materials that effectively immobilize nuclear waste in persistent architectures.

http://CHWM.sc.edu



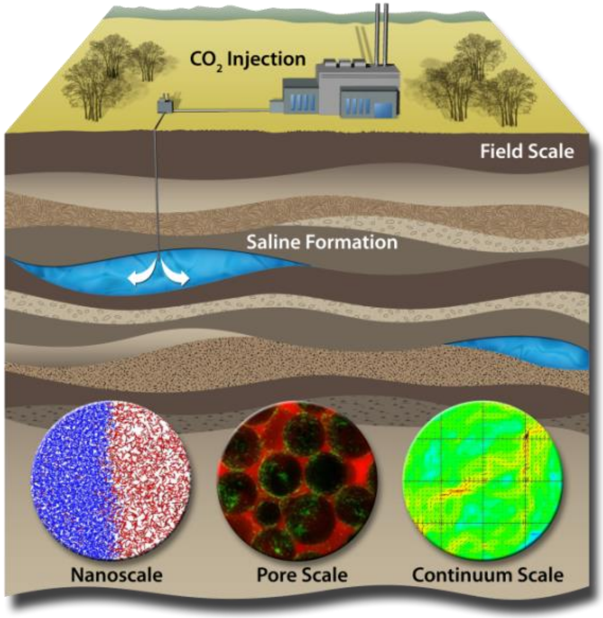
RESEARCH PLAN: Fundamental knowledge necessary to create new materials to safely sequester nuclear waste will be developed through the computationally-informed design of novel hierarchical materials, generating innovative chemical approaches and structure motifs through the use of advanced synthesis and characterization methods.

Revised 11/14/2017

Center for Frontiers of Subsurface Energy Security (CFSES)
Larry W. Lake (University of Texas at Austin)

CFSES Mission: to understand and control emergent behavior arising from coupled physics and chemistry in heterogeneous geomaterials, particularly during the years to decades time scale over which injection for geologic CO_2 storage will drive natural systems far-from-equilibrium.

http://www.utefrc.org/

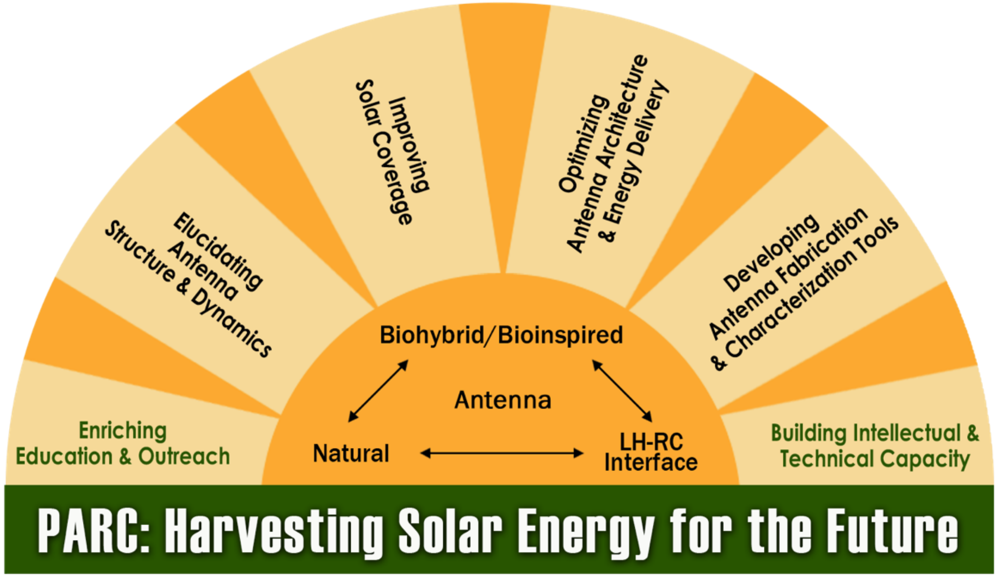


RESEARCH PLAN

CFSES will pursue scientific advances with the goal to (i) establish scientific understanding of far-from-equilibrium processes in heterogeneous geologic media, and (ii) develop novel materials and methods for controlling those processes.

Photosynthetic Antenna Research Center (PARC)
Robert Blankenship (Washington Univ. in St. Louis)

The objective of PARC is to understand the basic scientific principles that underpin the efficient functioning of natural photosynthetic antenna systems as a basis for design of biohybrid and bioinspired architectures for next-generation systems for solar-energy conversion.



http://parc.wustl.edu/

RESEARCH PLAN

PARC will investigate:

- **Natural Antennas: Structure and Efficiency**
- **Biohybrid and Bioinspired Antennas: Design and Characterization**
- **Antenna-Reaction Center Interface: Organization and Delivery**

Revised 11/14/2017

U.S. DEPARTMENT OF ENERGY | Office of Science | PARC | Northern Arizona University | Sandia National Laboratories | Oak Ridge National Laboratory

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