



**FLORIDA ENERGY SYSTEMS CONSORTIUM—FESC**  
**U. FLORIDA NOVEMBER 26, 2013**



# **ENERGY-RELATED RESEARCH AT FLORIDA A&M UNIVERSITY (FAMU)**

**DR. K. KEN REDDA, INTERIM V.P. FOR RESEARCH  
AND DR. CHARLES A. WEATHERFORD, INTERIM  
ASSOCIATE V.P. FOR RESEARCH**



# FAMU ENERGY-RELATED RESEARCH



FAMU College of Agriculture and Food Sciences

- **Bio-Fuels**, Dr. Oghenekome Onokpise, USDA

FAMU College of Science and Technology

- **Dynamics of X-Pinches**, Dr. Richard Apartaim (Physics), DOE
- **Preparation for Future Nuclear Scientists and Engineers**,  
Dr. Andrew Jones (Mathematics), US Nuclear Regulatory Commission
- **Turbulent Transport Diagnostics for Plasmas**,  
Dr. Ephrem Mezonlin (Physics), DOE
- **Experimental and Computational Studies of Matter Under Extreme Conditions**, Dr. Charles Weatherford (Physics), National Nuclear Security Agency (NNSA)
- **Advanced Accelerators: Particle, Photo, and Plasma-Wave Interactions**,  
Dr. Ronald Williams (Physics), DOE
- **Integrating Nuclear Cyber-Security Into STEM Education**, Dr. Hongmei Chi  
Computer Science, US Nuclear Regulatory Commission
- **Megahertz Diagnostics for Turbulent Transport Parameters in Fusion Plasmas**, Dr. Charles Weatherford (Physics), DOE



# FAMU ENERGY-RELATED RESEARCH



## FAMU College of Science and Technology

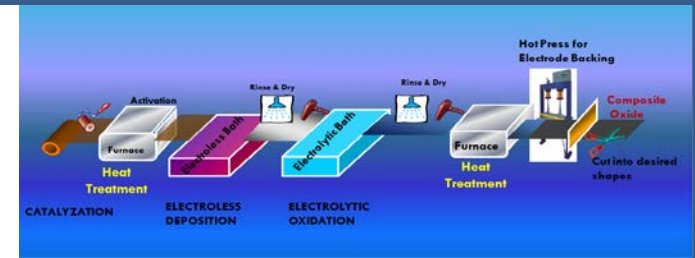
- **Laser-Assisted Muon Catalyzed Fusion**, Dr. Charles Weatherford (Physics), DOE

## FAMU/FSU College of Engineering

- **Massie Chair Energy Research and Education**, Dr. Okoli Okenwa (Industrial and Manufacturing Engineering), NNSA
- **Renewable and Advanced Power Production**, Drs. John Collier, Joel Fried, Daniel Hallinan, Eric Kalu, Bruce Locke, Biwu Ma, Subramanian Ramakrishnan, John Telotte, and Yaw Yeboah (Chemical and Biomedical Engineering), DOE, EPA, DOD, NSF
- **Electrocatalytic Materials for Batteries, Fuel Cells, and Hydrogen Generation**, Dr. Eric Kalu, (Chemical and Biomedical Engineering), DOE, DOD
- **Integrated Natural Gas Energy Networks**, Drs. Eric Kalu and Yaw Yeboah (Chemical and Biomedical Engineering), NSF

### ➤ Research

- High Performance Electrodes for Electrochemical and Solar Power Sources
  - Binder-free Electrodes – Li-air, Li-ion, ultracapacitors, redox-flow batteries
  - Nanostructured Composite Oxides
  - thin film electrodes for MEMS



- Electrocatalysis and Transport Issues in
  - Electrochemical Hydrogen Generation
  - Carbon dioxide recycling
  - Electro-reduction of Oxygen (Fuel cells)

- Tailored Catalysts
  - Hydrogenolysis of glycerols
  - Hydrogen generation from liquid fuels – Chemical Hydrides
  - Polymer-stabilized nanoparticles
  - Methane Emission Control

### ➤ Capability

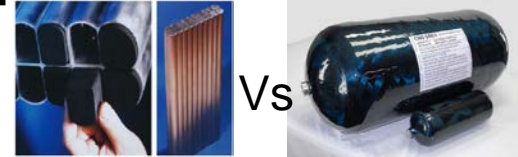
- Low-Temperature synthesis of nanostructured binder-free oxide electrodes
- Polymer-stabilized nanoparticle synthesis
- Electrosynthesis and electrochemical characterizations
- Chemical Characterization: XPS, GC
- Structural Characterization: Electron Microscopy, LIBS







## Natural Gas Research

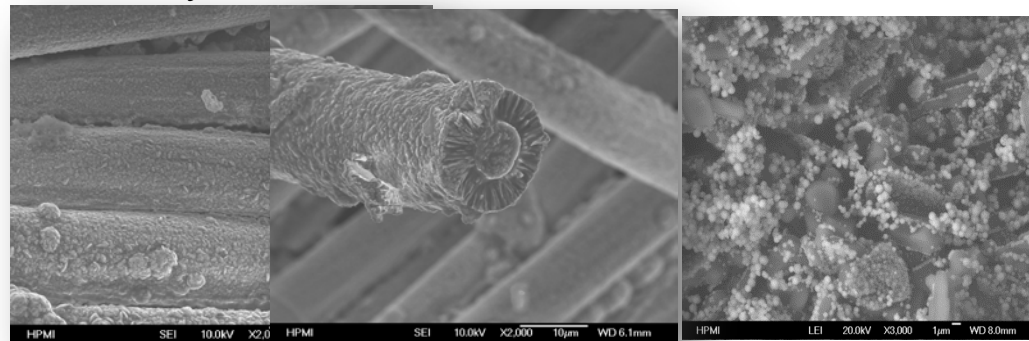


### \*\* Adsorbents for Natural Gas Tank Storage

- Develop low-pressure adsorbent material for high NG adsorption – metal-doped porous adsorbents including MOFs, COFs
- Explore and introduce new organic linkers, pillars and alloyed metal components that modify pore structure of MOFs
- Aid new tank design to minimize space usage at optimal adsorbent loading

### \*\* Low Temperature Catalysis for Emission Control

- Develop cost effective & low temperature catalyst for methane exhaust emission
- Catalyst durability and stability



Electroless: Co on Carbon and Pd/Cu/Al<sub>2</sub>O<sub>3</sub>



# EXPERIMENTAL AND COMPUTATIONAL STUDIES OF MATTER IN EXTREME CONDITIONS



**Florida A&M Center for Plasma Science and Technology**  
**Charles Weatherford, Bidhan Saha, Lewis Johnson, Carol Scarlett**



*Fig. 1: The FAMU STPX (Spheromak). Left—Baysha Bernales (physics junior); Right—Brandon Alexander (lead technician)*

Figure 1 shows a gun sitting atop the vacuum chamber. This machine was constructed by Dr. Kyron Williams, Mr. Brandon Alexander, Ms. Baysha Bernales, and Mr. Jerry Clark. Ms. Bernales (shown in picture) is a rising physics junior and is at Lawrence Berkeley Laboratory during the summer of 2013. Mr. Clark is at the University of Wisconsin "Reversed Field-Pinch" fusion reactor serving as a summer intern. Both were employed at FAMU on the Tuskegee/NNSA contract during 2012-2013.

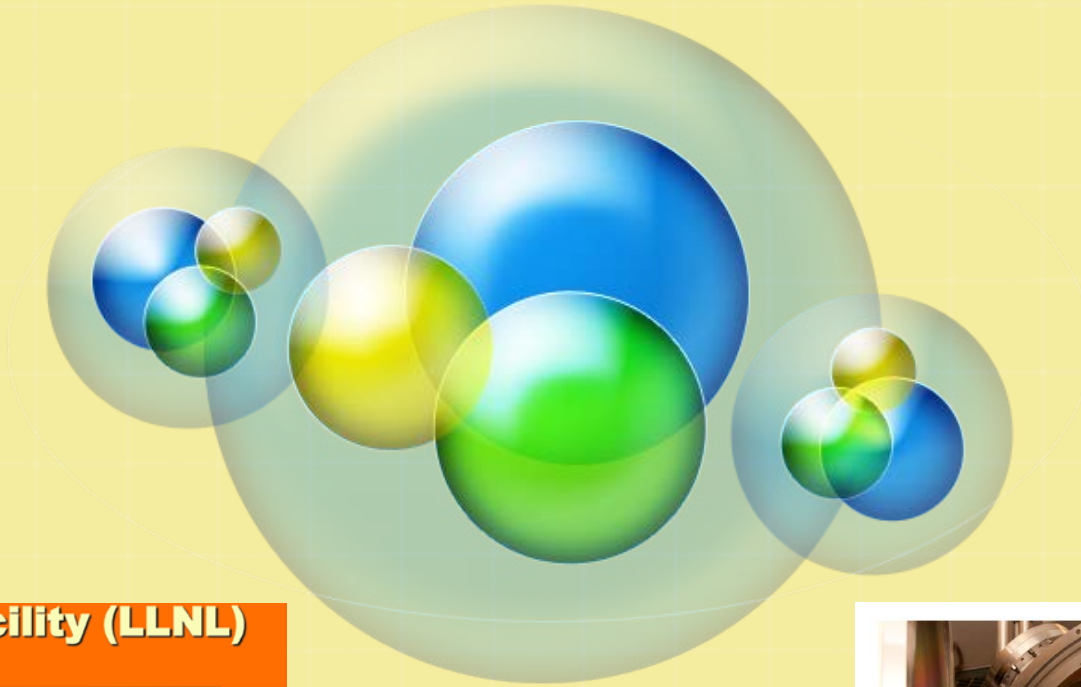


**High-Performance  
Simulation of the Quantum  
Control of Laser-Plasma  
Coupling**

**Scattering Processes in Fission  
and Fusion Plasmas**

**Spheromak Turbulence Physics  
Experiment (STPX)**

**Particle Physics in High-  
Temperature Plasmas**



## Jupiter Laser Facility (LLNL)

EPPS stands for Electron-positron-proton spectrometer

Long-pulse

Parabolic mirror & support structure

IPS

EPPS

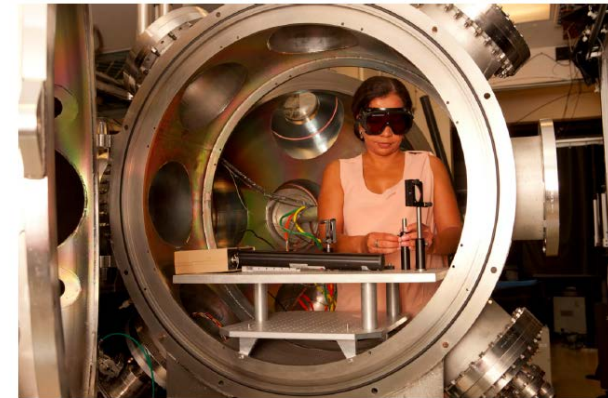
Happy

IPS

GCS

Wedge filter

- Dr. Chen of LLNL has demonstrated production of  $e^+$  using the JLF
- Studies of the background spectrum (e.g. protons) have begun
- Development of a suitable target for:  $n + e^+ \rightarrow p + \nu$  underway
- Design of steering and focusing elements for  $e^+$  beam is current objective



FAMU Professor Carol Scarlett at the LLNL Jupiter Laser Facility

# Laser Produced Antimatter

Applications to Nuclear & Plasma Physics

Carol Scarlett (FAMU) and Hui Chen (LLNL)