Title: **Materials and Interfaces Center for High Energy Storage and Sensing (MICHESS)**
Institution: **Xavier University of Louisiana**
City/State: **New Orleans, LA**
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Summary: Materials and Interfaces Center for High Energy Storage and Sensing (MICHESS) The Materials and Interfaces Center for High Energy Storage and Sensing (MICHESS) will bring together established researchers and promising junior faculty from Xavier

University of Louisiana (Xavier), and collaborators from the Georgia Institute of Technology (GA Tech), Tulane University, Stony Brook University, and federal partners from NASA, the US Army, and the Department of Energy (DOE). These institutions formed an interdisciplinary program to unravel properties and structure relationships through chemical interactions that will lead to innovation in materials with applications in energy storage and sensors, which are of critical importance to NASA deep-space explorations. The MICHESS represents a growing interdisciplinary materials program at Xavier, which focuses on the sustainability of materials research. Combining the synergy between energy storage and the sensors group with these key collaborators embodies the interest of Xavier in sustainability. The MICHESS will continue to support the outstanding recruitment, mentoring, and retention of minority students in Science, Technology, Engineering, and Mathematics (STEM) by providing unique research experiences for undergraduates. Xavier will partner with Delgado Community College (DCC) to provide opportunities for students in the Louisiana Space Grant program and the NASA MUREP-MISTC. These students will have access to state-of-the-art research facilities and perform cutting-edge research. The research program at the MICHESS will focus on two interdisciplinary research groups (IRG1 and IRG2). Both groups integrate synthesis, computation, advanced and in-situ characterizations. IRG1. Energy Storage: Advancing research in high gravimetric energy density (500+ Wh/kg), rechargeable lithium metal batteries with dramatically enhanced reliability and safety is critically needed for designing new energy storage systems for future mid- and far-term NASA missions to power astronaut equipment and extravehicular activities applications, such as life support, lighting, communications, heaters, and tools for space suits, human and robotic landers and rovers, habitats and crew exploration and rescue vehicles. Two to three times increase in the attainable specific energy of battery building blocks will be enabled by moving from conventional intercalation-type Li-ion to conversion-type Li metal cells. Such revolutionary performance enhancements, however, require the development and successful integration of two key technologies: (i) high-conductivity, high-durability solid-state electrolytes (SSE) stable in contact with Li metal anodes during their cycling, and (ii) conversion-type cathodes compatible with the SSEs. IRG2: Ionic Gel/solid Interface: A general feature of ionic liquids (ILs) is high viscosity relative to the conventional solvents. As a result, the diffusion coefficients of dissolved species are often two or more orders of magnitude smaller in ILs than in conventional solvents. Using ultra microelectrodes to probe electrochemical systems, including the use of scanning electrochemical microscopy, is critical to understand interfacial interactions.

IRG2 will use plasmonic nanoarrays detection, which enables collecting signals from the thin layers of ca.10 nm at the interface. Water and gas adsorption and transport in room temperature ionic liquids (RTILs) and RTIL-polymer hybrids will be investigated in molecular dynamics simulations using a polarizable force field. The MICHESS will continue the partnership between the SHELiB

Center and Xavier Admissions office to recruit qualified undergraduate students. The strategic alliance with DCC is part of the University's strategic goals in reaching out to two-year community college students. Our partnerships with key Universities and National Laboratories will create additional opportunities for our students and the sustainability of our program.