Professor: Joshua A. Robinson
School: Pennsylvania State University
Email: jrobinson@psu.edu
Interests: Growing Novel 2D Materials
Lab Description: The synthesis of transition-metal dichalcogenides (TMDs) began with the synthesis of MoS_2 from molybdenum trisulfide (MoS_3) by reduction with hydrogen in the 1950s and 1960s. More recently, the majority of monolayer films are grown via vaporization of metal-oxide powders (MoO_3, WO_3,etc.) and chalcogen powders (S, Se). However, despite the excitement for 2D materials as "the next big thing", and the success of their synthesis, there is essentially no understanding of how these materials nucleate and grow, or the impact of substrate choice on their properties. If we are to engineer 2D material properties, and stack them into van der Waals heterostructures, then we must first understand the impact of substrate surface properties and functionalization on their formation and properties. The visiting student for the Bose Program will help establish the impact of substrate properties (crystallographic orientation and surface chemistry) on nucleation and growth of various 2D materials as a means to establish routes to tailoring substrate properties for single crystal 2D materials. Initial research will focus on using semi-insulating, polycrystalline silicon carbide substrates, which will provide a wide range of orientations within a single sample, thereby leading to rapid discovery of crystalline orientation impact.

Professor:Rakesh K. Kapania
School: Virginia Polytechnic Institute and State University
Email: kapania@vt.edu
Interests: Topological Optimization of Ribs Under Various Load Cases
Lab Description: The intern would investigate the role of topological optimization in the design of ribs used to stiffen various frame and wing structures. The intern will develop a background in the use of geometric modeling, finite element meshing, and structural analysis in general. Unlike simple structures, used in many academic exercises, the structure would have to sustain a large number of load sets with each load set requiring different designs. The key thing would be to design a structure that is safe for all load cases. The duration of the project could be anywhere from three to 12 months.

Professor: Joseph Ready
School: UT Southwestern Medical Center
Email: Joseph.Ready@UTSouthwestern.edu
Interests: Biochemistry
Lab Description: DNA polymerase represents an attractive drug target for the development of cancer therapies. Based on a newly discovered inhibitor of one isoform of DNA polymerase and a recently determined crystal structure, we are designing and synthesizing optimized small molecule inhibitors. An efficient chemical synthesis will provide access to multiple derivatives of a lead compound. These compounds will be tested in enzyme inhibition assays, cell-based

toxicity assays, and, when appropriate, in mouse models of cancer. Overall, our objective is to identify a potent inhibitor with suitable physicochemical properties for in vivo testing.
Professor: Feyza Engin
School: UW Madison
Email: qnaveeda@winstepforward.org
Interests: T-Genetics, Diabetes, Immunology, Biochemistry, Disease, Metabolism
Lab Description: The main goal of the laboratory is to understand the role of organelle stress in the pathogenesis of diabetes. We are particularly interested in examining the β-cell Endoplasmic Reticulum (ER) Stress and Unfolded Protein Response (UPR) in the context of autoimmune diabetes. We use numerous interdisciplinary approaches, including biochemistry, molecular biology, genetics, cell biology, molecular biology and immunology in our in vitro and in vivo studies.
By using novel mouse models and cutting edge experimental systems such as Seahorse metabolic flux analysis, electron microscopy, FACS analysis and imaging techniques, we aim to identify the molecular mechanisms of stress induced diabetes with the ultimate goal of development of better and more effective therapeutic approaches for this disease.
For more information please visit our lab webpage: http://enginlab.org

Professor: Jim Freericks
School: Georgetown
Email: James.Freericks@georgetown.edu
Interests: Physics
Lab Description: Prof. Freericks has worked extensively with undergraduate students on research projects during the summer. A 2014 Bose scholar completed a project on effective spin couplings in a quantum computer made from trapped ions in a Penning trap. This work was published in Physical Review A in 2015. I continue to have projects related to quantum simulators and quantum computing available for students with appropriate interests and backgrounds. Please contact me to discuss further if you have any questions regarding the projects themselves or the required preparation needed to be able to be successful.

Professor: Peter Bermel
School: Purdue
Email: pbermel@purdue.edu
Interests: Electric and Computer Engineering
Lab Description: Project Description: More energy reaches the earth every hour from the sun than human civilization uses in a year. Although tremendous progress has been made in improving the affordability of solar photovoltaic (PV) modules, challenges in terms of storage remain, given that batteries can be expensive and short-lived. An alternative is to capture sunlight as heat, using a selective solar absorber. There are several approaches to then convert this heat into electricity. One strategy uses thermal radiation, typically from a blackbody emitter, to illuminate a PV diode, thus generating electricity. Typically, there are many losses limiting the efficiency of this approach. For example, the temperature difference between emitter and

receiver requires us to separate the two, which creates a gap in which photons can be lost. This project will consider strategies to achieve selective solar absorption and conversion in an experimentally realistic fashion. You will utilize and modify a GUI-based simulation tool to precisely calculate the details of how special absorber designs can improve the capture and storage of solar energy. Time permitting, we will also consider the role of optical, electronic, and thermal transport in efficiently converting this solar energy into electricity on demand, using a PV module.
Desired Qualifications: Familiarity with introductory mechanics and electromagnetism is required. A working ability to read and modify scientific code (e.g., in MATLAB) is also needed. Finally, the ability to quickly learn a new scientific topic is desired. Knowledge of the drift-diffusion and heat diffusion equations for current and heat transport is a plus. An understanding of basic (first-quantized) quantum mechanics, including Schrodinger's equation and time-independent plus time-dependent first-order perturbation theory is a plus. Prior experience with Linux and shell scripts is a plus.
Related website: http://web.ics.purdue.edu/~pbermel/photovoltaics.html