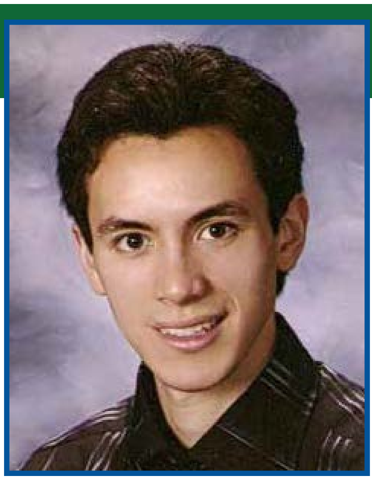

Christopher Yerino

Graduate Institution: Yale University

Graduate Discipline: Electrical Engineering

Hometown: Kansas City, MO

Relevant SC Research: Basic Energy Sciences

Research Interest:

My research interests lie in the science of novel materials growth for electronic applications. I utilize both molecular beam epitaxy and metalorganic vapor phase epitaxy to study and develop the growth of III-V semiconductors based on the arsenides, phosphides, and nitrides. I am particularly interested in the growth of materials and devices on alternative crystallographic orientations, enabling both polar and non-polar devices for both zincblende and wurtzite type semiconductors to tune their electronic properties. My current work is focused on the growth of GaAs quantum dots (QDs) that are formed by tensile strain on (110) and (111) substrates, a challenging materials system. In previous work, I have mapped out the kinetic-Wulff plot to understand and control the growth kinetics in nonpolar and semipolar GaN. Finally, I seek to use these materials to enhance the performance of optoelectronic devices such as light emitting diodes, laser diodes, photodetectors, and solar cells.

About Me:

I am currently working with Prof. Minjoo Lee at Yale on novel quantum dot (QD) materials.

We seek to demonstrate the growth of QDs using tensile strain and (110) or (111) substrates. Doing so would expand the range of materials and properties accessible to QD devices, and would enable tensile-based band engineering. We have developed a model based on dislocation mechanics to determine the conditions favorable to QD self-assembly. To validate this model, I have successfully grown tensile strained GaAs QDs on an InP(110) substrate by molecular beam epitaxy. These quantum dots are defect free by transmission electron microscopy and exhibit QD luminescence characteristics. I am continuing to study the application of this model to other material systems.

In prior work, I studied the kinetic Wulff plots of GaN, graphical representations of the growth rates of various crystal facets, as a function of growth condition. These plots are a tool for controlling the 3D growth mode of GaN on a foreign substrate. Through such plots I was able to understand and control both the morphological evolution and the propagation of defects in nonpolar and semipolar GaN, yielding substantial defect reduction. The impact of this work was underscored by my selection as a plenary speaker at the International Workshop on Nitride Semiconductors in Tampa, FL in 2010.

I have also studied the use of nanoporous GaN as a template for III-nitride growth. The nanoporous medium improves optoelectronic devices in terms of light extraction, dislocation filtering, and strain relief. I studied the morphological restructuring of nanoporous GaN under thermal annealing to manipulate the pore shape and material properties. Through this study I developed a new technique for micromachining buried cavities and nanomembranes into a GaN template, advancing the processing capabilities of this otherwise inert material.

Post-graduation, I plan to continue research in either an academic or industrial setting. I seek a career in the development of novel materials for electronics, and I wish to continue work in high performance LED's or solar cells to support our energy economy.

Personally, I am an active member of a church, and I have an interest in benefiting the lives of low income children by supporting tutoring, mentoring, and after-school programs. I also enjoy amateur astronomy, hiking, running, and weightlifting.