

Student Focuses on Accelerator Science With Help of Research Assistantship



Thoth Gunter, a Hampton University physics major, was the recipient of the 2011-2012 Jefferson Science Associates Minority Undergraduate Research Assistantship.

Thoth Gunter, a rising senior physics major at Hampton University, has participated in a range of research related to Jefferson Lab, but over the last several months he got the opportunity to focus and accelerate his efforts.

The Chicago, Ill., native was the recipient of the 2011-2012 JSA Minority Undergraduate Research Assistantship.

He used the assistantship to carry out research that is being used to help establish a low-energy linear accelerator at Hampton University.

The university plans to build a small electron accelerator for physics staff and students, opening new opportunities for research, and providing training to students and faculty in multi-disciplinary areas.

Gunter used simulation tools to model a thermionic (electron) gun that Jefferson Lab has given to Hampton University, helping in the development of its Low Energy Linear Accelerator (LELIA) project.

The assistantship provided Gunter with the opportunity to become more familiar with a variety of simulation software, to carry out electron gun modeling and simulations, and then compare those results with existing data. He learned about accelerator optics simulation tools, as well as diagnostics tools and got some hands-on experience with the hardware.

He used a simulation tool called the Static-field Analysis Toolkit Educational software, or SATE, to create a two-dimensional model [of the radial cross section] of the field generated by the electron gun. After gaining experience and understanding by manipulating a simple design, he studied a mesh (field pattern) whose geometry more closely resembled the thermionic electron gun that will be used for LELIA. He also studied effects on the beam resulting from a change in the voltage of the electron gun's control cathode.

Growing up, Gunter recalls always being interested in science and tech-

nology. "But," he said, "it wasn't until my freshman-sophomore year in high school that I decided physics was the field for me. I chose physics out of all the STEM fields because it held equal parts math and experimentation, which is what I wanted."

After his freshman year of college, Gunter participated in a National Science Foundation-funded Research Experiences for Undergraduates internship through HU and MIT. He started out by creating geometries using Geant4 simulations to help in designing a detector for an electron ion collider – a possible research facility being studied for Jefferson Lab's future. (Geant4 is a geometry and tracking modeling software toolkit developed at CERN that uses Monte Carlo methods to simulate the movement of particles.)

"It was just a small aspect in helping to flesh out a possible EIC design," Gunter said.

Through the same joint HU/MIT REU, he also worked on aspects of a proposed experiment dubbed DarkLight, where researchers will attempt to create and measure a dark matter force-carrying particle. Beam-target aperture interception tests for the proposed experiment were done at JLab's Free-Electron Laser.

Participating in these projects piqued Gunter's desire to learn more about accelerator physics. After discussions with Paul Gueye, one of his HU Physics professors, he became

JSA Fund Supports Minority Research Assistantship

The JSA Minority Undergraduate Research Assistantship Program at Jefferson Lab offers opportunities and support to minorities and underrepresented students pursuing degrees in engineering or science at universities that are members of the Southeastern Universities Research Association, or SURA, the science partner of JSA.

The JSA research assistantship provides outstanding opportunities for the recipients and provides Jefferson Lab a source of technical students from underrepresented groups early in their professional careers. It also has the potential to fill critical positions in the future with candidates who both know the lab environment and who have specialized in an area of particular need. At the same time, the lab provides the students with opportunities not available elsewhere. "The program offers a unique opportunity to build a pipeline of minority candidates while, at the same time, addressing critical-skill shortages," according to Elizabeth Lawson, JSA Board liaison and Initiatives Fund program manager.

Criteria for selection are based on the scientific quality of the proposed project, its relevance to the Jefferson Lab program, and the student's academic record. Additional information about the assistantship is online at: http://www.oold.jlab.org/div_dept/admin/HR/research.

JSA provides a stipend through the JSA Initiatives Fund to support the student at their university during the academic year, and travel funds to visit Jefferson Lab and/or to attend a research-related workshop. Information about the JSA Initiatives Fund program is available at: <http://www.jsallc.org/IF/IFIndex.html>.

JSA is a joint venture between SURA and the Computer Sciences Corporation-Applied Technologies Group to operate and manage Jefferson Lab for the U.S. Department of Energy.

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interested in working on the LELIA project.

"I've gained so much exposure to all that physics has to offer," Gunter said about the benefits of the internships. "And the training and skills I can use no matter what career path I take."

Gunter is especially appreciative of the JSA research assistantship because it was for a longer period than his previous internships, and allowed him to become more involved in a project and to make more of a contribution.

He likes the sense of accomplishment he gets when achieving his research goals and by contributing to a larger group effort. "I really hope

to leave my mark on the HU campus with this project," he said.

The assistantship enabled Gunter to perform preliminary studies needed for the construction of a low-energy accelerator. In collaboration with Ken Law, a JLab Accelerator Division staff scientist, they developed a more accurate model of the 100 keV LELIA electron gun and verified the device's field emissions.

While the assistantship has come to an end, Gunter plans to continue with the next step in his research and development work for the LELIA project. He plans on attending graduate school after completing his bachelor's degree in 2013, and is currently preparing for his GRE and physics tests.



Thoth Gunter, recipient of the 2011-2012 JSA Minority Undergraduate Research Assistantship, carried out modeling research for a thermionic (electron) gun that will be used to help establish a low-energy linear accelerator at Hampton University.