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PEOPLE - Written by [OLCF Staff Writer](#) on October 14, 2014

# Interns Gain Skills, Experience from Summer at ORNL

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*OLCF opportunities offer diverse, hands-on exposure*

Every summer, hundreds of college students join the ranks at the Department of Energy's Oak Ridge National Laboratory (ORNL), serving as interns assigned to a variety of tasks.

Students in assorted disciplines come from across the nation to do everything from helping develop nuclear nonproliferation policy to performing hands-on climate research in the lab. Although their individual projects differ, all speak about the challenges they faced at the lab that ultimately yielded valuable career experience.



Summer intern, Abigail Brudvig, discusses the work she focused on during her experience at the OLCF. She was mentored by OLCF SciComp team member Markus Eisenbach. A senior at Sewanee: The University of the South, Brudvig is majoring in Mathematics and Physics. Her internship involved Wang-Landau simulations.

Here's a look into the experiences of a few of this year's OLCF summer students.

## Sean McDaniel

Sean McDaniel spent his summer creating smaller, faster-running kernels that mimic real-world applications that can be used to test supercomputers and ensure the hardware and software are always robust. McDaniel worked specifically on the Hardware/Hybrid Accelerated Cosmology Code (HACC) framework.

"HACC is this big scientific application that has to do with simulating the birth of the universe, but it's huge," McDaniel explained. "So we're trying to extract the key parts and shorten the testing time while still capturing how the application interacts with the system."

During his internship McDaniel noted the vast difference between his experience doing undergraduate research and his work at the lab.

"Back at home my advisor is pretty hands on," he said. "But here they let you go and do your own thing. You formulate your own methodology. That was a really big struggle for me—trying to think about how to set things up. When you run into a hurdle, sometimes you get disheartened. Just getting through those obstacles was really tough for me because I'm used to always having somebody say, 'Okay, so this didn't work. Why don't you try this?' But here it's me doing the research, me looking up the papers, and me facilitating meetings with others."

Other experiences were equally eye opening. For instance, the breadth of research being done on Titan continually astounded McDaniel.

"You hear about high-performance computing, and a lot of people don't understand the scope, like [they think] you're just running on these really big computers. But what's really cool about high-performance computing is the fact that there are so many different types of scientists who actually use these machines. So I'm surrounded by physicists, but you also have climate scientists. You also have people who study cars and wind resistance. You have all these different types of scientists, and you can talk to a lot of great people."

One such opportunity arose when McDaniel participated in the student poster session, an annual event at

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which interns can present their work to staff and other students. He listed the poster session as both one of his favorite experiences of the summer and one of the hardest.

"Criticism is a big part of research, and what's great is that I got the chance to get ideas about how to deal with criticism in the workplace. It's all part of it. So the poster session was a highlight but also something I didn't like. You're kind of putting your baby, something you've worked on for 10 weeks, out there, and people are saying, 'Why did you do it this way?' or 'You should have thought about doing it this way.'"

As the first person in his family to go to college and therefore have the chance to be an intern, McDaniel says the internship has absolutely impacted his career.

"It really brought things into perspective. This whole journey did a lot because many of my peers never got these kinds of opportunities; just coming here is groundbreaking for me. So I can take this back home and use this to be a mentor to other people and recommend 'Hey, you should try Oak Ridge. It's a pretty good place for an internship.'"

McDaniel worked under the direction of mentors Sarp Oral and Hai Ah Nam from the OLCF and will be pursuing a PhD in computer science at the [University of Delaware](#) this spring, where he plans to specialize in high-performance computing.

### Matthew Donovan

Matthew Donovan is a senior in Computer/Electrical Engineering at [Tennessee Tech University](#). A three-time veteran of the ORNL internship, this summer he worked under the guidance of Adam Simpson to design and build a supplementary physics experiment for [Tiny Titan](#).

"Tiny Titan is educational in the fact that it teaches parallel processing, but something that teaches parallel processing alone is hard to get into schools. We wanted some way to bring in multiple different subjects such as physics, math, and even construction so that we can reach a wider audience."

Once students have been introduced to basic parallel computing through traditional exercises, Donovan's gravity experiment allows them to better understand its role and importance by putting it in the context of a physics lab.

The experiment uses a 6-foot metal contraption that records a ball dropping and sends the information to Tiny Titan. Students then plug the coordinates into an algorithm to show the gravity constant. While Donovan wrote the program from end to end, he also made it fully customizable in case students want to delve deeper into programming instead of using his code.

Donovan talks excitedly about this prospect in terms of education.

"I mean, it's a fantastic way for students to actually see what's going on. If somebody tells me the gravity constant, I'm like 'Okay.' I mean, how exciting. When I actually get to see it being calculated and actually interact on how it works and everything, it's much more interesting than just being told something."

Donovan spent the first half of the summer designing and the second half in development. Although he did run into a learning curve regarding servos (small devices that allow for precise control of angular position), his primary frustration was a result of financial limitations.

"I learned a lot about how expensive this kind of stuff is." As Donovan's project was going to be rebuilt by individual schools, it was important that the materials be as inexpensive as possible. "I actually went through four or five designs before we settled on this one because everything was way too pricey."

The rising college senior said that his internship confirmed that this was really what he wanted to do.

"The first year I did some business stuff. The second year I did all computer science work. Being my third year, I'm actually doing the stuff I *really* enjoy. It's developing very simple GUIs. I mean, I used Python. I got to use my building skills. It's definitely made me realize that I enjoy the mixture between the hardware and the software."

### Daniel Wherry

Daniel Wherry, a sophomore in Computer Science at [Austin Peay State University](#), spent his summer developing a tool to improve users' everyday research experiences. His project, "Estimating Lustre Striping

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Impact on Scientific Application Checkpointing," gives users a better understanding of how their data gets saved as well as insight into different strategies they can use to improve their speed.

"Basically the tool will mimic the part of the programs they make that actually write to the Luster File system and apply different striping configurations to those writes. Striping is just one way of improving the speed of writing to a file. The end goal is that the user will be able to boost parts of their program that need to be as quick as possible so they can get back to doing the real science."

Although Wherry is happy with his end product, at first he struggled to transition to programming on a supercomputer like Titan.

"All the programming I've done in the past has been serialized. I haven't had to worry about what the processor does behind the scenes and how it interacts with a file. I haven't had to figure that out before."

Wherry says that working at the lab has forced him to become comfortable with supercomputing concepts and given him valuable skills, but above all else, it's benefited him by providing him with valuable work experience. Wherry mentioned a conversation he had with someone over the summer about how that person would choose between two promising job candidates.

"One has a perfect 4.0 straight out of undergrad. He has never worked any sort of job and has only done school, but he's great at it. The other is someone who got A's and B's, maybe some C's, but he has done an internship or something every summer. He's built up some actual experience and had good recommendations. This person said he would choose the candidate with experience nine times out of ten over the one with the good education who has never proven himself in the real world."

Wherry worked under the supervision of Robert French in the User Assistance Group of the OLCF.

### **Chris Martin**

Chris Martin was able to combine his graphic design experience with his interest in computer science during his internship. Martin's work dealt more with presenting the data than collecting or analyzing it and was quite different from what many other interns have worked on over the summer.

"I've been working on a project that is basically a web front end for power and water usage effectiveness coupled with humidity and temperature. It's a radial graph that shows how those values fluctuate within 24 hours. How they fluctuate over 7 days, 30 days, 90 days, a year. It's interesting data because it jumps around a lot."

Martin jokes that the task came around because his mentor, Jim Rogers, "likes pretty things. He likes things that you can look at and get a quick picture of what's going on."

Despite coming in with experience in design, Martin was challenged by a steep learning curve and a series of technical hurdles to access the data he needed.

"I expected it to take about 3 weeks, but doing this project has been like learning another language. You have documentation on how to do it but then to actually make it work you have to learn so many nuances of it, and that's not written in the documentation because the people who have written the textbook are already fluent in the language. For somebody as early in their career as I am, it took a lot of time to dissect what was going on."

Martin managed to overcome this challenge and now recites a laundry list of benefits he's gained from the experience. From broad communication skills to low-level UNIX system knowledge, Martin is sure that this internship will be a huge boon to him in the future.

"I'd say one of my favorite moments was being able to take out a paper and draw a bunch of boxes, a bunch of arrows, and show where all the data was coming from and from what process it was moving to the next. I just liked having that laid out." He remembers thinking, "This is set in stone—this is actually what is going on. I can second-guess myself all I want, but this is what I've figured out. That's... gratifying."

Martin is currently a sophomore in Economics at the [University of Tennessee](http://www.utk.edu); however, this semester, he will be changing his major to Computer Science.

### **21 Students**

A total of 21 students completed summer internships at the OLCF. Those students were: Elijah Aybar, Abigail

Brudvig, Mark Carringer, Zachery Gable, Todd Groff, Kevin Hannon, John Hardy, Angel Jordan, Jamie Kelley, Rachel Kwon, Ryan Levy, Wan Lipeng, Pranshu, Pablo Reboredo, Xia Ruofan, Karen Sapra, and Sam Shadwell as well as Donovan, Martin, McDaniel and Wherry.

Another component of summer activities on site was the presentations of postdoc fellows at the ORNL poster session. Those who presented were Mingyang Chen, Supada Laosooksathit, and Dmitry Liakh.

—Christie Thiessen

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