Featured Alumna Sarah Caudill ('06)

Working in Dr. Grubbs' interferometry lab for summer research at Stetson.

As a high school student applying to colleges, I had a choice between Stetson and the University of Florida. I reasoned that I would receive a more personalized education from Stetson and, with the offer of an academic scholarship, the decision was made. I entered Stetson in 2002, initially as a pre-med. However, it soon became clear to me that I much preferred physics and physical chemistry. Dr. Grubbs from the chemistry department offered me a summer internship working with an interferometer to measure refractive indices of polymers. It was at this point that I decided I wanted to be a research scientist.

Of course I also enjoyed my physics classes at Stetson. So much so, that I decided to fully switch my major to physics. One of my favorite classes was Modern Physics with Dr. Riggs. There I learned about an experiment trying to detect a graviton. This was the coolest thing I had ever heard. I immediately went online and looked for opportunities to work with this experiment, which was called LIGO - the Laser Interferometer Gravitational-wave Observatory. I applied for LIGO's SURF (summer undergraduate research fellowship), and due to my experience working with Dr. Grubbs on interferometry, they accepted me.

Top: Visiting the LIGO Hanford site during my SURF project at Caltech. Bottom: Presenting the work I did on this project at Poster's on the Hill with Dr. Riggs.

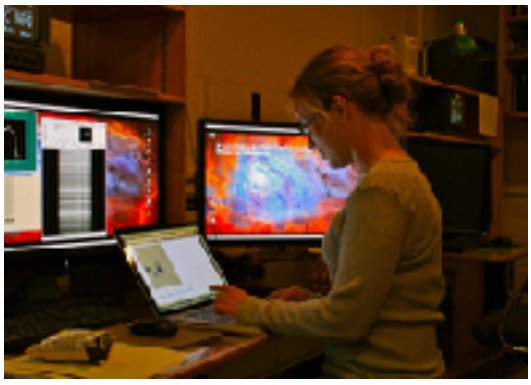
During the summer of 2005, I went to Caltech to work on data analysis for LIGO. I learned how colliding binary black holes or neutron stars can make actual ripples in spacetime that travel across the universe. And we can detect these ripples here on Earth using a giant interferometer to measure the strain they induce on two test masses. I made some great friends during this trip and also got a glimpse into the exciting world of cutting-edge scientific research. After returning to Stetson, I presented my work in Washington, DC at the

Council on Undergraduate Research's Posters on the Hill event.

I graduated from Stetson in 2006. I had decided that I wanted to go to graduate school but not right away. So I took a year off. I got a short internship at the University of Central Florida's CREOL lab, where I used atomic force microscopy to study patterns of quantum dots. I also used that time to study for the physics GRE and start a small tutoring business. In the fall, applications were due, so I applied to schools that had research related to LIGO. I had a few offers but what really stood out for me was a personal invitation from Louisiana State University to go work with Gabriela Gonzalez. I had not applied to LSU but they knew about me because of the SURF program and wanted me to join their group. Gaby even offered to hire me the summer before graduate school started so that I could get a head-start on research. I began working with LIGO's detector characterization group, understanding how the different parts of the instrument couple to the gravitational-wave strain measurement that the detector makes.

The LIGO Livingston detector, located about 45 minutes away from Louisiana State University.

I officially started graduate school at LSU in 2007. For the first few years, I continued work on detector characterization and grew well-acquainted with data quality issues and algorithms for search pipelines. But it still took a few years before I could formulate my thesis. Luckily, I had some help from a friend I had met during the Caltech SURF program. She was leaving the collaboration and needed someone to take over a project. This is how I ultimately put together a thesis on gravitational-wave ringdowns from perturbed black holes.



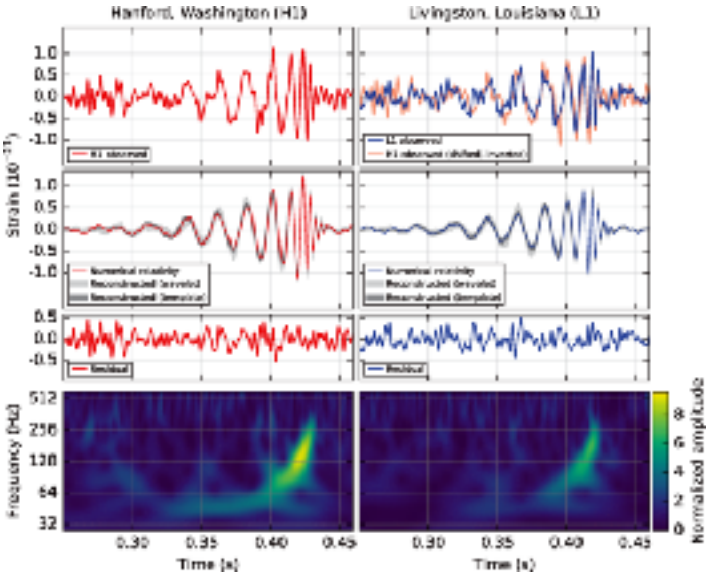
Analyzing some data late at night

I graduated from LSU in 2012 and accepted a post-doctoral research position at the University of Wisconsin-Milwaukee's Center for Gravitation, Cosmology, and Astrophysics. The UWM group is a powerhouse for gravitational-wave data analysis. I was really lucky to be working with this group

when LIGO made the first detection of gravitational waves, GW150914. I was on the front lines of the discovery, helping to provide one of the first significance estimates of the signal. It was hugely significant! Nearly 100 years after Einstein predicted that gravitational waves should exist, we proved him right and in the process, provided the first direct measurement in the strong-field gravity regime, proved that binary black holes exist in the universe, and showed that they merge together within a Hubble time. Because of my role in the detection, I was invited to attend the press release at the National Press Club in Washington DC. It was such a wonderful time for science; for once, my facebook news feed was filled with people loving science rather than arguing over politics. Our group at UWM even became local heroes, and we received requests for interviews from all sorts of popular science magazines.

The LIGO data analysis team at the University of Wisconsin-Milwaukee.

After this first exciting discovery, LIGO and the European detector Virgo have continued to make discoveries that are changing the way we think



The first gravitational wave detected, GW150914. The panels are showing different representations of the strain measured by the LIGO detectors as the signal passed by on September 14, 2015.

Top: Attending the announcement of the discovery of the first gravitational wave at The National Press Club. Bottom: The excitement in the room as journalists rushed to get interviews right after the announcement.

about gravity and the nature of extreme matter and spacetime. Because of new interest in this growing field, I have managed to secure a research scientist position at Nikhef in the Netherlands where I am able to continue my work with gravitational waves and even start my own research group.

I'll leave you with a few bits of advice regarding graduate school. It is never too early to start thinking if graduate school, in physics or something else, is right for you. Some basic questions you should ask include:

1) **Do I want to go to graduate school?** You should find out how long a PhD in your field typically takes. In the STEM fields, it can easily take 6 years. Are you willing to dedicate that time? You might also research what you can earn with a Bachelor's degree vs a Master's or PhD. Note, while in graduate school, you will likely not make very much. Is this something that matters to you? You should also consider personal situations such as your family and spouse, your current job or whether you'll be commuting.

Large computer clusters are my main analysis tool.

2) **What do I need to get into graduate school?** Make sure to meet application and fellowship deadlines. Prepare to take the GRE and subject test GRE. Try to get involved in a research project at Stetson and/or a SURF program through another school. If you're dedicated, you could even publish a paper and present your results at a conference. These are nice highlights on an application.

3) **Which school should I go to?** Focus on the schools that have a dedicated program for your field. And check how well-funded those programs are. This will determine whether money will be available to support you during grad school. Do some research on how difficult it is to get into a particular program at your preferred schools. Feel free to contact the schools, professors and current students with questions about their programs.

4) **What will graduate school be like?** It is hard! Scheduling will become very important if you want to be successful in grad school and have any time for outside activities. You'll have a lot more independence as a PhD student and a lot more time will be spent doing research rather than coursework. As always,

networking is important, particularly because you will be looking for a job afterward. My best advice is to become an expert on something and be "the expert" on that topic.

5) **What will I do after graduate school?** Often, there is no clear path set up for what you should do *after* grad school. Just as you have to prepare for going into graduate school, you will have to start preparing a few years before you graduate your PhD program, regardless of whether you want to stay in academia, do a post-doctoral research experience, or go into industry.

If you decide to go to graduate school, it can be a wonderful experience. You will get to travel all over the world to present your research and work with collaborators. You'll make lifelong friends over late-night study sessions. You'll "level up" in your knowledge and experience. You'll meet and learn from extraordinarily intelligent people. And perhaps most exciting, you could even participate in and lead ground-breaking research.