

# The making of ASTRONOMERS:

Program encourages  
professional collaboration,  
research



*Katelyn O'Brien '11 and Ana Mikler '12 tour the reflecting dish of the world's largest and most sensitive telescope, located at the National Astronomy and Ionosphere Center near Arecibo, Puerto Rico in August.*

The most impressive piece of machinery most of us will ever get our hands on is our own car. It could be a reliable Honda, a sleek little BMW or even a \$1.7 million Bugatti Veyron. But for Katelyn O'Brien '11, a Bugatti hardly counts as impressive machinery. Not when she's steered the world's largest and most sensitive telescope reflector. Spanning more than 1,000 feet in diameter—an area as big as 26 football fields—it has a replacement value of \$220 million.







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*–Katelyn O’Brien ’11*

*Above: The world’s largest and most sensitive telescope reflector, at the National Astronomy and Ionosphere Center in Puerto Rico.*

“Being able to actually control Arecibo Observatory, as a student astronomer, was incredible and exciting,” said O’Brien, a physics major with minors in Spanish and astronomy. “It’s a pretty impressive thing to brag about too. Just being able to say you know how to do something like this is an amazing feeling!”

“And what’s equally nice is that this experience makes my research more personal,” she added. “I’ve had an even greater role in what I’m studying than I otherwise would have.”

O’Brien’s studying star formation in a group of galaxies called NGC5846. Her work, which began her sophomore year and included her first trip to the observatory in Arecibo, Puerto Rico for a workshop, has evolved into her senior thesis. It was on her second trip this summer that she got to run the telescope, housed at the National Astronomy and Ionosphere Center, and collect data herself.

## **The research**

Her research and both her visits are funded by a five-year National Science Foundation grant to associate professor of physics and astronomy Rebecca Koopmann ’89, who accompanied O’Brien to Arecibo. The monies promote undergraduate research within the Arecibo Legacy Fast ALFA survey (ALFA is the name of the detector), on a project called the Undergraduate ALFALFA Team. The Legacy survey is headed by Cornell University astronomers Riccardo Giovanelli and Martha Haynes, both of whom work closely with Koopmann and faculty at 17 other institutions across the country, to involve undergraduates in the effort.

“The survey is designed to find galaxies by searching for neutral hydrogen—the raw material of star formation,” Koopmann said.

This means they’re not relying on light emitted by

stars to locate galaxies, which is how the more well-known optical wavelength surveys find them.

“We’re detecting different kinds of galaxies than have been discovered in the past,” Koopmann said. “Namely gas-rich galaxies, often with relatively few stars, that may be entering their most active period of star formation.”

“And by searching for low mass, ‘starless’ galaxies that contain hydrogen gas but haven’t yet formed stars, we’re finding objects that would never be picked up in an optical study,” she continued. “The abundance of these ‘dark’ galaxies, their characteristics and locations, are key clues to understanding how galaxies form and evolve throughout the universe.”

Koopman also organizes a yearly undergraduate workshop at Arecibo Observatory that is attended by about 35 students and faculty from other colleges involved with the effort. Over the last three years, several Union students have participated in these workshops, during which they learn about the observatory and interact with students and faculty from other schools.

Collaborative grants awarded to Koopmann and her colleagues at Colgate and Georgia Southern fund further activities, including the observing trip O’Brien and Ana Mikler ’12 made with Koopmann in August.

But it’s not just students who go to Arecibo who have access to the amazing telescope. Koopmann regularly does remote observation from her on-campus laboratory, and invites students from her classes to join her.

## Remote access

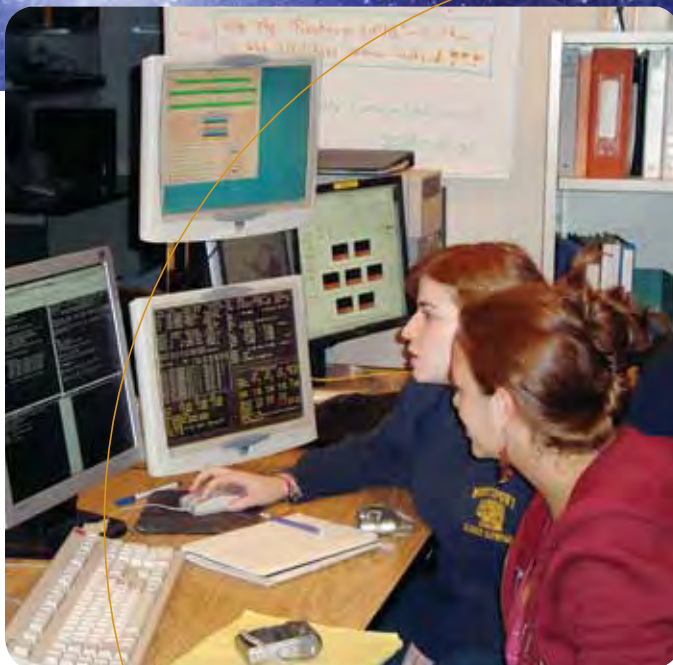
"We are connected virtually to Arecibo via computers, which means we can control the Arecibo computers using our local mouse and keyboard," Koopmann said. "We can steer the telescope and monitor the observations in real time as they are recorded by the electronics in Puerto Rico."

Union's remote laboratory is a particularly important part of the physics freshmen seminar. During the class, students conduct a remote observing run and then analyze collected data.

"As far as I know, Union is unique in offering this type of course. Other schools may offer a freshmen seminar, but it's based on a particular topic and taught by one faculty member," Koopmann said. "Our class introduces freshmen to five physics and astronomy faculty, and their research specialties. Several of our modules teach students to use equipment like our accelerator, or national facilities like Arecibo."

This linkage between the College and observatory makes it possible for students to experience the collaborative nature of modern scientific survey projects. As part of the Undergraduate ALFALFA Team, for instance, participating schools are working together to study how the environment around a group of galaxies might affect their evolution. It marks the first time astronomers have been able to investigate a large number of galaxy groups, each over a large expanse of sky.

Four Union students, O'Brien, SreyNoch Chin '12, Halley Darling '13 and Mikler, took part in the effort this past summer. They met and worked



cooperatively with their counterparts at other schools via telecom, from their lab here on campus. O'Brien presented results of the work at the American Astronomical Society meeting in January.

"Union is unique as far as access to research goes," O'Brien said. "I don't think many other students at other undergraduate institutions would have had the opportunity to work on such a project, let alone go and use such a well-known observatory."

"It's helped me realize every aspect of astronomy interests me—there's still so much to learn and everything we study has such an impact on our understanding of the universe," she added. "I would love to work in the astronomy field."

## For the students


And that's the whole point, the whole reason for these programs. Actively contributing to cutting-edge investigations is the kind of thing that just might inspire young people to embrace careers in science.

Indeed, of the more than 80 students involved in the program across the nation so far, 63 have carried out at least

one major research project based on ALFALFA data.

"We're seeing a high retention rate of these students in science, engineering, technology and math fields," Koopmann said. "Half of those who have graduated were enrolled in graduate school in science or math in fall 2010—fifty-seven percent of them women. Others are teaching, pursuing industry jobs or considering additional education in the STEM disciplines."

O'Brien, who graduates in June, is applying to graduate schools now and has her sights set on a doctorate in astronomy. And she knows what she's done here in Schenectady will only aid her along the way.

"I'm so grateful to Union and to Becky. I'm grateful for these last few years working with her on the ALFALFA project, for my two experiences at Arecibo, for the encouragement Becky gave me to present my work twice at a major astronomical conference," O'Brien said. "The experiences I've had, because of Becky, have helped me become an astronomer, not just an astronomy student." 

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*Above: Katelyn O'Brien '11 and Ana Mikler '12 in the control room of Arecibo Observatory in Puerto Rico in August. Together, they ran the world's largest and most sensitive telescope reflector, collecting data for their research.*

## On the Web

To learn more about the ALFALFA project, visit <http://alfalfasurvey.wordpress.com/>