

Through the Telescopic Lens

BY TOMMY NEWTON

WESTERN'S DEPARTMENT OF PHYSICS AND ASTRONOMY IS THE LAUNCHING PAD FOR MANY STUDENTS TO REACH THEIR GOALS IN SCIENTIFIC RESEARCH OR OTHER CAREER OPTIONS.

"All of our work is predicated on the engagement of students," said Dr. Michael Carini, associate professor. "We never lose the student focus."

Since 1992, Western faculty and students have received sixty-five awards for research in astronomy, chemistry and physics through programs like the NASA Kentucky Space Grant Consortium and the Kentucky NASA Experimental Program to Stimulate Competitive Research.

Those NASA-funded programs, administered by Drs. Karen and Richard Hackney, laid the foundation for STARBASE, a NASA-funded program launched in the late 1990s.

STARBASE (Students Training for Achievement in Research Based on Analytical Space-science Experiences) has received attention for refurbishing and automating two telescopes, the 24-inch telescope at the Bell Observatory in Warren County and the 50-inch telescope at Kitt Peak National Observatory in Arizona, but the focus remains on training students to operate the telescopes by remote control from Western's campus.

"Our goal was never just to operate telescopes," Dr. Carini said. "Our goal was to operate telescopes to assist in the education of students."

Students like Noel Simms, Whitney Wills, Allen Glass, Earl Wood, Robert Zimmerman, and Charles Poteet are working alongside professional scientists and using equipment that is not available to undergraduates at most other schools.

"Most other schools have nothing like a high-tech robotic telescope," said Poteet, a Bowling Green junior.

Wills came to Western from Mount Sterling because of the 24-inch Bell Observatory telescope. "I knew I would get some sort of experience here," she said. "Most people don't get to see a telescope like this until graduate school."

In the past three years, Wills has become a trained telescope operator, gained experience in data reduction and analysis, and made presentations at national conferences. The hands-on research has prepared her for graduate school or for jobs at professional observatories.

"I've gotten a lot out of it. More than I thought I would," said Wills.

The telescope operators, who normally work one night a week from sunset until 2 a.m., depending on



As they develop knowledge and skills, students take ownership of projects, said Dr. Richard Gelderman. "By the time they graduate, they're not just seniors, they're our junior colleagues."

Charles Poteet, Noel Simms and Whitney Wills are students in Western's physics and astronomy program.

PHOTO BY SHERYL HAGAN-BOOTH

weather conditions, control the observatory and telescope from a lab in Thompson Complex. They follow an observation plan, take images, collect and analyze the data, and distribute the information to faculty or other researchers.

Glass, a sophomore from Metcalfe County, is excited that he's seeing objects, such as active galactic nuclei or quasars, that other people see only in books. "Whenever you stop and think about it, it's pretty cool," he said.

Dr. David Barnaby, research astronomer, has trained all the students who have become telescope operators. "This is professional astronomy, not amateur astronomy," he said. "This isn't a telescope you set up in your back yard." Western students are actively participating in research that leads to original results, he said.

"There's a real opportunity at Western to run a professional observatory," Dr. Barnaby said. "If you want a career in observational astronomy, it is an excellent opportunity. If you go on to graduate school or a job in astronomy, you've already learned what it takes to operate a research observatory. Most undergraduates can't get that opportunity."

In their research with Dr. Sergey Marchenko, students Wood and Zimmerman are getting an opportunity to participate in projects that involve international scientists and observatories from Canada, France, India, Great Britain, and Spain.

Dr. Marchenko's work has focused on very massive, very luminous, and very rare stars. His three most recent projects have involved binary stars, super giant stars, and dust-emitting Wolf-Rayet stars.

The projects have allowed his students to learn standard research processes and advance toward the non-standard processes and problems, said Dr. Marchenko, a visiting research professor. "If you're training in physics, astronomy, or basic sciences, you have to have good long-term research projects," he said. "It's just absolutely necessary. It sets the students in the right direction."

By their second year of participation in the research program, the students are given more freedom on the projects to develop their creativity and inventiveness, Dr. Marchenko said. "We're training the best minds. It is a must to involve those minds and engage them with active research projects."

In the summer of 2003, Wood and Zimmerman worked on a technique to detect the Wolf-Rayet stars that are producing dust. Of 227 Wolf-Rayet stars known in the galaxy, only thirty produce dust. "That's a pretty small percentage in a galaxy of a billion stars," said Wood, a senior from Simpson County.

For the project, Wood wrote a computer program that reduces the data from 10,000 stars to the few needed for research. Wood and Zimmerman then plot the data to identify the dust-producing stars. Dr. Marchenko said the results of the project have the potential to provide a better understanding of the early universe.

Zimmerman said the students also benefit from the research. "When we're applying to graduate school, the research we've done looks good on an application," the Owensboro junior said.

Their names have even appeared in research abstracts for scientific journals. "Just the fact that you did something for a paper in a scientific journal is pretty nice," Wood said. "It feels like you're doing something different from the classroom experience."

As they develop knowledge and skills, students take ownership of projects, said Dr. Richard Gelderman, associate professor. "By the time they graduate, they're not just seniors, they're our junior colleagues," Dr. Gelderman said.

For example, the telescope operators are responsible for the telescope and equipment, and for making the correct observations. They also get to experience the frustrations of equipment failures or weather problems. "Our students are getting experiences that other schools aren't providing," Dr. Carini said.

If students don't attend graduate school or stay in science, they can use the knowledge and experience in industry, the military, or business, Dr. Marchenko said, because science trains students to solve problems. "A good understanding of science is something that they'll carry through life," he said.

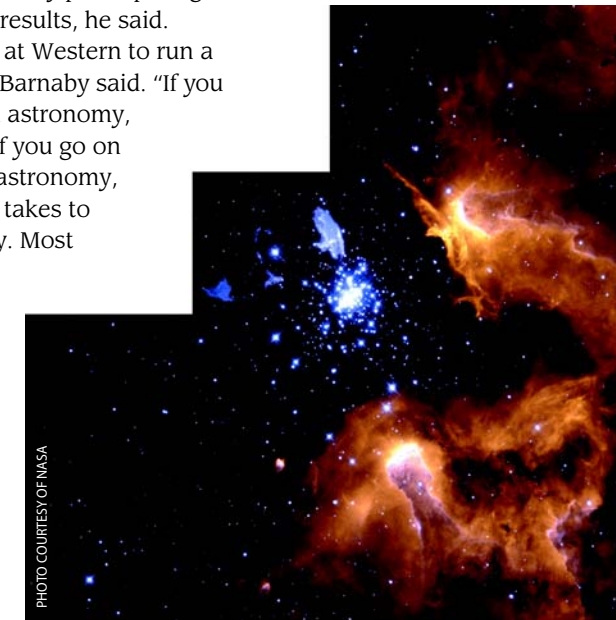


PHOTO COURTESY OF NASA

NASA's Hubble Space Telescope captures various stages of the life cycle of stars in one single view. To the upper left of center is an evolved blue supergiant. Near the center is a so-called starburst cluster dominated by young, hot Wolf-Rayet stars and early O-type stars. Dark clouds at the upper right are so-called Bok globules, which are probably in an earlier stage of star formation.

“There’s a real opportunity at Western to run a professional observatory... If you want a career in observational astronomy, it is an excellent opportunity. If you go on to graduate school or a job in astronomy, you’ve already learned what it takes to operate a research observatory.”



Through STARBASE and other initiatives, Western’s Department of Physics and Astronomy is making sure students of all ages gain a better understanding of science.

“Astronomy opens the door to science,” Dr. Gelderman said. “Astronomy can excite younger students and show them science can be fun and it has applications in physics and chemistry.”

Western’s astronomy group provides workshops for elementary, middle, and high school teachers. Faculty and students make presentations to K-12 classrooms. Public viewing nights, such as last fall’s close encounter with Mars, bring community members to campus.

Educational and entertaining presentations at the Hardin Planetarium attract astronomy classes, other WKU students (3,700 last year), the general public (more than 2,000 last year), and K-12 students (more than 4,500).

“The planetarium serves an important role in enhancing the education of K-12 students in the state,” said Dr. Roger Scott, planetarium director.

But the astronomy group’s education mission is reaching far beyond Kentucky. STARBASE could develop an international outreach, even beyond a network of telescopes around the globe, thanks to the program’s “long history of involvement of students in astronomy,” Dr. Charles McGruder said.

In 2003, Dr. McGruder, the William McCormack Professor in Physics, was invited to participate in telescope and educational projects in South Africa and Rwanda. Like STARBASE at Western, the Rwandan telescope project would provide students with opportunities for hands-on research. “I think it is very interesting that our first telescope outside the United States may be in a developing nation where we can make an impact far beyond science,” Dr. McGruder said.

That impact is already happening on Western’s campus. “Astronomy has always been a passion of mine,” Poteet said. “I never had the opportunities until I came to Western. A big part that contributes to my passion is the faculty here. They get you involved and they keep you involved.”

The family-atmosphere of the small department provides support in challenging times, Simms said. “I started at the bottom and am working my way up,” she said. Simms is determined to succeed in astrophysics, a field with few African American females. “I would tell young students to always follow your heart.”

Simms often thinks of her late grandmother who sparked her interest in astronomy. “You can’t stop,” she said. “It would be easy to throw in the towel, and I’ve had a hard time getting here, but I finally made it.”

Like the other students in the physics and astronomy program, Simms and Wills are determined to succeed, but they face the additional challenges of being women in a field traditionally dominated by men. Thanks to the hands-on experience gained at Western, they have become role models for girls who are interested in science.

Whitney Wills explains, “I tell girls — and boys — all the time that science isn’t hard if you apply yourself!”