SCIENCE

University of Milwaukee-Madison plays a major role in in construction of world's largest optical telescope

By John Fauber
KRT WIRE SERVICE

For astronomers at the University of Wisconsin-Madison and around the world, the stars just got a lot brighter.

The first stunning images from the world's largest optical telescope, which UW scientists played a major role in building, were released recently.

Perched atop a remote 5,000-foot plateau in South Africa, the $28 million device is expected to be a dominant player in the world of astronomy for at least a decade, a device that should reveal new clues about everything from the most distant galaxies to comets that streak through our own solar system.

"It will make a huge difference to Wisconsin astronomy and a major impact on world astronomy," said John Mathis, an emeritus professor of astronomy at UW. "It will allow us to do research on objects that are too faint for other telescopes."

Known as the Southern African Large Telescope, or SALT, the device is made up of 91 hexagonal mirror segments. It is 11 meters across at its widest. At 10 meters in diameter each, the two W.M. Keck Observatory telescopes in Hawaii had been the largest optical telescopes in the world.

SALT is located about 220 miles from Cape Town near the Kalahari Desert in one of the "darkest" regions of the world with no nearby cities or other sources of light pollution.

Astronomers say it will provide an unprecedented view of the Southern Hemisphere sky. Its rotating design will allow it to peer into three-quarters of the visible sky.

An 11-member consortium that includes UW, the South African government and Rutgers University financed and built SALT. UW's contribution, second only to the South African government, is $5 million.

Several UW scientists still are in South Africa putting the finishing touches on SALT, including installation of its primary scientific instrument, a sophisticated spectrograph that sits six stories above the mirrors.

The spectrograph breaks light into thousands of colors and wavelengths, which allows astronomers to learn a tremendous amount more than if they were looking at a traditional optical image.

That will allow the device to analyze light from a variety of objects, including parts of our own galaxy, the Milky Way, nearby galaxies, and galaxies so distant they were formed a billion years after the Big Bang.

"That's a region of space that we are very unfamiliar with," said Amy Barger, an associate professor of astronomy at UW.

"Everything we learn about distant galaxies tells us something about our own galaxy and how we were formed. We are learning something about our own evolution," she said.

SALT also will delve into the nature of mysterious phenomena such as dark matter, black holes and gamma-ray bursts.

Closer to home, the telescope's light-polarizing capability will allow astronomers to study comets and discern their composition, said Eric Wilcots, a UW professor of astronomy.

"Whenever there is a comet anywhere nearby, we'll point SALT at it," Wilcots said.

The images released Thursday are so-called first light pictures, done without the spectrograph analysis.

They show newly born stars, clusters of stars 2,000 light years away that are more than twice the size and age of the sun, and a spiral galaxy similar to the Milky Way that is 30 million light years away.

When the spectrograph is in operation in about a month, astronomers will be able learn about the physical properties of distant objects, such as their age, mass and chemical composition, whether they are made of elements like hydrogen, helium, sodium and iron, said Theodore Williams, a professor of physics and astronomy at Rutgers.

"The universe started out being made up of hydrogen and helium and essentially nothing else," Williams said.

All the other elements were made in stars later, after the Big Bang, he said.

Williams said he would be amazed if the telescope does not produce important new discoveries.

"As it becomes clear what this telescope can do, many astronomers will want to use it," he said. "It will be a very popular telescope."

However, SALT's astronomical supremacy over the southern sky may last only a decade.

Scientists at the University of Arizona are building a 22-meter telescope, twice the size of SALT. The $500 million design, an entirely new breed of device known as the Giant Magellan Telescope, will be built in Chile and is expected to be operational between 2014 and 2016.

It will be made of seven 8.4-meter mirrors and is expected to produce images 10 times sharper than those of the Hubble Space Telescope.

"It's the largest telescope we are fairly confident that can be built," said Nick Woolf, a professor of astronomy at the University of Arizona.

It is expected to have four times the light-gathering ability of any existing telescope, including SALT.

Woolf said SALT's true performance probably won't be known for another year or two. He said the new device pushes the limits of what can be done with a limited amount of money.

For instance, he said, getting all the telescope's mirrors to work together may be tricky at first and could result in some fuzzy images.

"You are not really sure what the performance will be until you are actually observing with it," Woolf said. "You would expect it to be a major player among the big telescopes.

Photo courtesy of KRT Wire Service

The formation of the Lagoon Nebula, about 3,800 light years from Earth, is a long-standing mystery of astronomy. The Southern African Large Telescope may help astronomers learn how the nebula was formed.

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For example, if she walks a half mile to campus and the same back to her car every day she participates in nearly 20-30 minutes of exercise, almost half the recommended amount-a big boost in her fitness level and a serious reduction in her risk for disease.

In addition to improving fitness, she expends approximately an extra 100 calories per day. While this expenditure of calories may seem insignificant, its additive effect is not. In order to lose one pound of body weight, Rhonda must expend an additional 3,500 calories over her current caloric consumption, meaning after 35 days of parking in the periphery lots, Rhonda would lose one pound, and after one academic year, she could be nearly 10 pounds lighter— not a bad reward when bikini season is just a round the corner.

Improved fitness, reduced risk for disease, and lower weight are tremendous benefits from such a small lifestyle change like parking in the periphery lots and walking to class every day.