June 13, 2011

UMass Amherst Astronomers, Partnering With Mexican Institute, Receive First Light Data from Giant New Telescope

AMHERST, Mass. – Astronomers at the University of Massachusetts Amherst and Mexico's Instituto Nacional de Astrofísica, Óptica y Electrónica announced today that a giant new millimeter-wave radiotelescope, one of the largest in the world designed to probe the history of star formation in the Universe, has collected its first light spectrum from a distant galaxy.

The Large Millimeter Telescope (LMT) can now begin the scientific work for which it was built, says UMass Amherst astronomer Peter Schloerb. The first spectrum was obtained using the new Redshift Search Receiver designed and built by his colleagues Neal Erickson and Gopal Narayanan. The spectrum is presented as a graph of the amount of light emitted at certain frequencies by the Messier 82 (M82) galaxy about 12 million light-years away.

"A radiotelescope works just like your car radio," Schloerb explains. "There is an antenna to pick up the signals and when we tune over the frequency band we come across a nice strong signal at some points. These signals arise from the tumbling of molecules in giant clouds of gas and dust in the source galaxy. The main difference from a car radio, of course, is that our antenna is really, really big and our receiver is not only very sensitive but it also looks at all the frequencies at the same time. Finally, we record our signals in the computer rather than playing them on a speaker."

The 50-meter (164-foot diameter) LMT is designed to be the largest, most sensitive single-aperture instrument of its kind in the world when fully operational. It is located on the summit of Sierra Negra, a 15,000-foot extinct volcano in the central state of Puebla, a companion peak to Mexico's highest mountain. Because the water vapor layer in Earth's atmosphere blocks the millimeter-wave light that scientists want to collect from distant objects in space, the LMT had to be located high enough to avoid it.

The Redshift Search Receiver spectrometer covers a full 38 GHz of frequency in a single observation and allows many molecular lines to be observed simultaneously, which is an improvement over narrower-view telescopes available up to now, says Narayanan, one of the builders of the new instrument. "Finding spectral lines in new sources is like finding a needle in a haystack. The ability to cover the whole frequency band makes searching a lot more efficient when we seek to measure the redshift of newly discovered galaxies for the first time. The redshift, which arises from the expansion of the Universe, tells us the distance to these systems and allows us to determine their intrinsic properties."

The LMT's first "target" galaxy, M82, is the prototypical starburst galaxy, a class notable for their unusually high rate of star formation. "A starburst is thought to be triggered after a collision or close encounter between two galaxies," says Min Yun, the

LMT project scientist for UMass Amherst. Their star formation rate is very, very high, so much so that it can't last long, the astronomer adds. "So you know it has to have been triggered by a recent event, such as a collision with another galaxy."

The recent milestone of receiving first light from distant space marks the completion of the initial phase for the LMT. The antenna is currently outfitted so the inner 32-meter diameter is being used as a collecting area. It will be completed to its full 50-meter diameter using funding provided by the Mexican government.

Final alignment of the primary mirror began in December 2010 and was completed in April to allow the recent first tests of the full system with its new millimeter-wave receivers, Schloerb says. The first light observation of M82 has already been followed up with successful observations of much more distant systems to demonstrate the telescope's capabilities even at this early stage in its observational lifetime. "These are clear demonstrations that the early scientific goals of the LMT are realistic," says David Hughes, the Project Scientist for Mexico's Instituto Nacional de Astrofísica, Óptica y Electrónica. "Although the LMT is not yet fully optimized, we are already able to detect star formation in the early distant universe, a few thousand million years after the big bang."

Scientists around the world are waiting for data from the new instrument while others are planning to visit Mexico to use it. "This is undoubtedly the starting point of many years of profitable scientific research for Mexico, the United States and other countries, where we will be able to study not only the most distant galaxies in the Universe, but even the conditions of the Universe right after its creation", says Alfonso Serrano, the Project's Principal Investigator in Mexico.

The LMT and redshift search receiver projects were supported by grants from the National Science Foundation and NASA.

Contact: Janet Lathrop, 413/545-0444; jlathrop@admin.umass.edu
F. Peter Schloerb, 413/545-4303; schloerb@astro.umass.edu

For more: www.lmtgtm.org