LIGO once again looking for gravitational waves

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The quest to detect and study gravitational waves with the National Science Foundation-funded Laser Interferometer Gravitational-Wave Observatory, or LIGO, is on again. LIGO is currently conducting its first sustained observational run since achieving its promised design sensitivity, project personnel announced last week at the annual meeting of the American Association for the Advancement of Science.

LIGO researchers said they hope this run will lead to the first direct detection of gravitational radiation since Albert Einstein predicted its existence in 1916.

During the AAAS conference, Michael Turner, an assistant director of the National Science Foundation, and LSU Associate Professor Gabriela González presented details of recent LIGO project milestones, including an update on the current status of LIGO, the current 18-month science run that began in November 2005, and the plan for the next generation of LIGO.

González is an associate professor of physics at LSU, the closest major research university to the LIGO Livingston facility. She has been closely involved in the commissioning of the Livingston detector, particularly in matters pertaining to alignment sensing and control. Her group at LSU has worked on the data-collecting science runs, and she is a co-leader of one of four data analysis groups within the collaboration. Joseph Giaime, also an associate professor of physics at LSU, is Chief Scientist at the LIGO Livingston Observatory. LSU faculty have been carrying out

research in gravitational wave science since the early 1970s and LSU is a charter member of the LIGO Scientific Collaboration.

Fully operational since 2005, LIGO is a facility for the detection of cosmic gravitational waves and for scientific research that uses those waves as an astronomical tool for better understanding the cosmos. LIGO operates observatories in Livingston Parish, La., and in Hanford, Wash.

The project was designed and is operated by the California Institute of Technology and Massachusetts Institute of Technology, with funding from the National Science Foundation. Research is carried out by the LIGO Scientific Collaboration, a group of 500 scientists at universities around the U.S. (including 15 faculty, students and postdoctoral researchers from LSU), and in eight foreign countries.

During the conference, NSF screened its new video production, titled "Einstein's Messengers," a 20-minute documentary about LIGO. Designed especially for the general public, the documentary examines how LIGO will be able to observe the incredibly tiny ripples in space-time known as gravitational waves, and open a new window on the universe.

According to Jay Marx, the executive director-designate of LIGO, earlier science runs have already led to new knowledge about the cosmos, including limits on the deformation of spinning neutron stars; the amount of gravitational radiation emitted by two merging neutron stars, or black holes; and remnant gravitation radiation left over from the Big Bang.

Now that LIGO is sensitive enough to detect changes in distance a mere thousandth the diameter of a proton, the science return should be even greater, Marx explained. Recent results from the Swift satellite that

pinpointed the location of short gamma-ray bursts, or GRBs, have also heightened astronomers' interest in the results of LIGO's current observational run.

"This run will allow us to accumulate substantial amounts of data with the instruments operating at their design sensitivity, and so should produce many new and interesting insights," said Marx.

In addition to serving as a new and unique astrophysical observatory, LIGO will also be used to delve into the fundamental nature of gravity, hence serving both the physics and astronomy communities. Also, depending on the nature of the gravitational background left over fro m the Big Bang, the project could eventually allow for an observation of the universe in its first few milliseconds.

For more about information the entire LIGO project, including a streaming version of "Einstein's Messengers," visit www.ligo.caltech.edu .

Source: Louisiana State University