LIGO Kicks into High Gear for Gravitational-Wave Search with 18-Month Observation Run

February 22 2006

The quest to detect and study gravitational waves with the NSF-funded Laser Interferometer Gravitational-Wave Observatory (LIGO) is now in the fourth month of its first sustained science run since achieving its promised design sensitivity, project personnel announced at the annual meeting of the American Association for the Advancement of Science (AAAS).

Fully operational since 2005, LIGO is a facility for the detection of cosmic gravitational waves and for scientific research using those waves as an astronomical tool for better understanding the cosmos. LIGO operates observatories at Hanford, Washington, and Livingston Parish, Louisiana. 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. and in 8 foreign countries.

At a press breakfast on Sunday, February 21, Michael Turner of the National Science Foundation and Professor Gabriela González of Louisiana State University discussed recent milestones of the LIGO project. These include 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.

The breakfast is a sponsored networking and information opportunity for reporters, and is supported by the National Science Foundation and LIGO.

During the breakfast, NSF will screen 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 that are gravitational waves, and so open a new window on the universe. Free DVD copies of the documentary will be available for reporters.

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; on the amount of gravitational radiation emitted by two merging neutron stars, or black holes; and on remnant gravitation radiation left over from the Big Bang.

Now that the LIGO is sensitive enough to detect changes in distance a mere thousandth the diameter of a proton, Marx adds, the science return should be even greater. Recent results from the Swift satellite pinpointing the location of short gamma-ray bursts (GRBs) have also heightened astronomers' interest in the results from LIGO's current observational run.

The current 18-month science run could lead to even more important discoveries, and if nature is very kind, to the first direct detection of gravitational radiation since Albert Einstein predicted the phenomenon's existence in 1916. "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," says Marx, who will also attend the press breakfast.

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 from the Big Bang, the project could eventually allow for an observation of the universe in its first few milliseconds.

González is an associate professor of physics at LSU, the closest major research university to the LIGO Livingston facility. She is a founding member of the LIGO Scientific Collaboration, and 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-taking science runs, and she is a co-leader of one of the four data analysis groups in the collaboration.

Turner is an assistant director of the NSF and heads the Mathematical and Physical Sciences Directorate.

Source: California Institute of Technology