

PHYSICS COLLOQUIUM

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Progress Toward an Astronomy of Gravitational Waves

The LIGO interferometric gravitational-wave detectors are now observing at a sensitivity exceeding their original design target, and other similar detectors are observing or commissioning. The instrument science must confront fundamental physics -- quantum and thermal noise -- to achieve this sensitivity. The data from the LIGO science runs have been analyzed for gravitational-wave events and to put upper limits on gravitational-wave flux and to look for gravitational waves from a variety of sources. The present run, to end in Fall 2007, will be followed by some incremental advances in sensitivity and further science runs in coordination with the other worldwide gravitational-wave detectors. LIGO -- the combined Laboratory and Scientific Collaboration -- have also progressed with the Advanced LIGO upgrade, which will start observing in 2014, and will lead to more than a factor of 10 improvement in the sensitivity, covering a volume of space 1000x greater than initial LIGO. This will allow detailed studies of such astrophysical events as neutron-star or black-hole binary inspirals, pulsars, and supernovae from a unique perspective, and will push forward the search for the stochastic background from the Big Bang. Plans are being made for other instruments, both ground-based and space-based, to join this very promising field.

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