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**RAINER WEISS**, MIT, on behalf of the LIGO Scientific Collaboration

*Exploration of the Universe with Gravitational Waves*

The observations of gravitational waves from the merger of binary black holes and from a binary neutron star coalescence followed by a set of astronomical measurements is an example of investigating the universe by "multi-messenger" astronomy. Gravitational waves will allow us to observe phenomena we already know in new ways as well as to test general relativity in the limit of strong gravitational interactions – the dynamics of massive bodies traveling at relativistic speeds in a highly curved space-time. Since the gravitational waves are due to accelerating masses while electromagnetic waves are caused by accelerating charges, it is reasonable to expect new classes of sources to be detected by gravitational waves as well. The lecture will start with some basic concepts of gravitational waves, then briefly describe the instruments and the methods for data analysis that enable the measurement of gravitational wave strains of the order of  $10^{-21}$  and will then present the results of recent runs. The lecture will end with a vision for the future of gravitational wave astrophysics and astronomy.