

SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND  
SOLAR-SYSTEM SCIENCE MISSIONS (A7)  
Scientific Motivation and Requirements for Future Space Astronomy and Solar System Science Missions (2)

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KEYNOTE: THE FIRST DETECTION OF GRAVITATIONAL WAVES

**Abstract**

On September 14, 2015, the two LIGO detectors simultaneously observed a transient gravitational-wave signal, which was named GW150914. The signal fits very precisely the general relativistic prediction for the inspiral, merger, and ringdown of a pair of black holes, with component masses greater than was thought possible for stellar-mass systems. A second black-hole binary was detected on December 26. These were the first direct detections of gravitational waves and the first observations of binary black-hole mergers. I describe the mechanics of these detections, which represent the culmination of 50 years of experimental and theoretical efforts; I further discuss astrophysical implications and the tests of general relativity that can be performed with the signals. Last, I comment on the import of GW150914 for the field of gravitational-wave detection, and for current and future efforts to observe gravitational waves with dedicated space missions and with pulsar timing arrays.