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Observation of Gravitational Waves from a Binary Black Hole Merger

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抄録

On September 14, 2015 at 09: 50: 45 UTC the two detectors of the Laser Interferometer Gravitational-Wave Observatory simultaneously observed a transient gravitational-wave signal. The signal sweeps upwards in frequency from 35 to 250 Hz with a peak gravitational-wave strain of 1.0×10^{-21} . It matches the waveform predicted by general relativity for the inspiral and merger of a pair of black holes and the ringdown of the resulting single black hole. The signal was observed with a matched-filter signal-to-noise ratio of 24 and a false alarm rate estimated to be less than 1 event per 203 000 years, equivalent to a significance greater than 5.1 sigma. The source lies at a luminosity distance of $410^{(-180)(+160)}$ Mpc corresponding to a redshift $z = 0.09^{(-0.01)(+0.03)}$. In the source frame, the initial black hole masses are $36^{(-4)(+5)} M_{\odot}$ and $29^{(-4)(+4)} M_{\odot}$, and the final black hole mass is $62^{(-4)(+4)} M_{\odot}$, with $3.0^{(-0.5)(+0.5)} M_{\odot} c^2$ radiated in gravitational waves. All uncertainties define 90% credible intervals. These observations demonstrate the existence of binary stellar-mass black hole systems. This is the first direct detection of gravitational waves and the first observation of a binary black hole merger.

キーワード

KeyWords Plus: [INSPIRALLING COMPACT BINARIES](#); [COALESCING BINARIES](#); [MASS](#); [RADIATION](#); [GRAVITON](#); [STELLAR](#); [SYSTEM](#); [PULSAR](#); [FIELD](#); [DETECTORS](#)

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