

LIGO/VIRGO Observations of Neutron Star Merger GW170817

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Neutron stars host the densest stable matter in the universe. Accurately modeling their multi-messenger astrophysics relies on a detailed description of the equation of state above nuclear density. Astronomical observations, including binary pulsar dynamics, x-ray bursts and timing, and gravitational-wave observations, can in turn be used to constrain the properties of this dense matter.

On August 17, 2017 the Advanced LIGO and Advanced Virgo detectors discovered the first gravitational-wave signal consistent with a binary neutron star inspiral. A gamma-ray burst detected 1.7 seconds after merger confirmed the long-held hypothesis that neutron-star mergers produce short gamma-ray bursts, and the three-dimensional localization of the source using LIGO and Virgo data enabled a successful electromagnetic follow-up campaign that identified an associated kilonova in a galaxy ~ 40 Mpc from Earth.

Using the observed gravitational waves we are able to constrain the equation of state of dense matter in neutron stars. I will outline how these constraints are made, how they connect with other astronomical observations, and outline future prospects for connecting gravitational-wave astronomy with above-nuclear-density physics.

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