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Physics from the Gravitational and Electromagnetic Waves of a Neutron Star Merger

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The recent detection of gravitational waves and associated electromagnetic emission from a binary neutron star merger has illuminated the physics of strong gravity and dense matter, and addressed long standing questions as to the origin of the heaviest elements in the universe. I will review our physical understanding of compact object mergers —grounded in theoretical calculations and numerical simulations —and will describe how observations of gravitational waves, high energy photons, and radioactively powered optical emission have important physical implications, including constraints on the speed of gravity, the expansion rate of the universe, the equation of state of nuclear matter, and the nucleosynthesis of the heavy elements. I'll highlight the successes and limitations of models of neutron star mergers, and anticipate what we may see and learn in a hopeful future of numerous, diverse joint gravitational + electromagnetic wave detections.

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