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Compact Binary Mergers as Multimessenger Sources of Gravitational Waves[1]

STUART SHAPIRO, University of Illinois at Urbana-Champaign

On the centennial anniversary of Einstein's theory of general relativity, we are on the verge of directly detecting one of its most remarkable predictions – gravitational waves (GWs). The inspiral and merger of compact binaries – binaries with black hole, neutron star or white dwarf companions – are among the most promising sources of GWs. Many of these sources are likely to generate observable electromagnetic (EM) and/or neutrino counterparts to the GWs, constituting a major advance in multimessenger astronomy. By way of illustration, we describe recent magnetohydrodynamic simulations in general relativity (GRMHD) that show how black hole-neutron star mergers can launch jets, lending support to the idea that such mergers could be the engines that power short-hard gamma-ray bursts. We also discuss other recent GRMHD simulations that show how an inspiraling, supermassive binary black hole in a galaxy core stirs and accretes magnetized plasma that orbits the holes in a circumbinary disk. This process can generate "precursor" and "aftermath" EM radiation with respect to the peak GW emission at merger. Computer-generated movies highlighting some of these simulations will be shown.

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