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The exotic remnants of compact object binary mergers¹

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The collision and merger of a neutron star with a black hole or another neutron star is a strong source of gravitational waves and a promising setup for the creation of bright infrared (kilonova) and gamma ray (gamma ray burst) transients. These violent events can be modeled by numerical simulations incorporating general relativity, fluid dynamics, and nuclear physics. In this talk, I will explain the findings of some of these simulations. Depending on the properties of the binary, the merger leaves a black hole, a black hole accreting matter from a torus at an incredible rate, or a massive spinning neutron star. The latter two cases are characterized by the importance of differential rotation, magnetohydrodynamic processes, and neutrino radiation. To understand these systems, I will focus on what we know of their dynamical and thermal equilibrium structure, what we know of the dynamical instabilities to which they might be prone, and what we can tentatively say about their subsequent secular evolution from outflow, magnetic, radiative, and other effects. Computer simulations are becoming ever more impressive but remain unequal to the problem at hand, so I will address the challenges still posed by small-scale magnetohydrodynamic effects and by radiation transport.

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