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Multimessenger Observations of Neutron Star Mergers: Probing the Physics of High-Density Matter

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Neutron star mergers are Nature's ultimate hadron colliders. They are extremely violent events resulting in gravitational-waves and electromagnetic emissions that could be detected at distances of several hundred mega-parsecs. Imprinted in these signals are important clues on the properties of high-density matter, waiting to be harnessed by us. In this talk, I will review our current knowledge of neutron star mergers from the theoretical side. I will discuss the prospects of measuring neutron star radii and masses using gravitational-wave observations of the late-inspiral of merging neutron stars. Then, I will show how multimessenger observations of the merger and post-merger evolution of merging neutron stars could be used to place further constrains on the nuclear equation of state at very high densities. Finally, I will discuss the possible role of neutron star mergers in the creation of the r-process nuclei in the Universe.