

The multi-messenger picture of merging neutron stars

With the detection of the binary neutron star merger GW170817, a new era of multi-messenger astronomy started. GW170817 demonstrated that neutron star mergers are ideal laboratories for constraining the equation of state of cold supranuclear matter, to study the central engines of short GRBs, and to understand the origin and production of heavy elements. We discuss how the last milliseconds before and after the merger can be investigated with full 3D numerical relativity simulations. We present results from state-of-the-art numerical relativity simulations covering large areas of the binary neutron star parameter space and we explain how these simulations help to develop gravitational wave and electromagnetic models. These models allow us to constrain the unknown equation of state of cold supranuclear matter and in the future might even be helpful to determine the dark matter content in our Universe. We conclude with a short review of the first two months of the ongoing observing run of the LIGO and Virgo gravitational wave detectors.