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Microphysical Aspects of Supernova and Compact Object Merger Modeling

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This talk will review the microphysics components essential to the modeling of compact object mergers (binary neutron stars and neutron star-black holes) as well as the birth place of neutron stars, core-collapse supernovae. I will begin with core-collapse supernovae. For these systems, the microphysics modeling has arguably matured to a level where basic consequences of the microphysics such as the baseline neutrino signal and black hole formation properties of failed supernovae are accurately reproducible by independent modelers. However, there are still many areas of core-collapse supernova modeling that are less established. This is especially true in multidimensional simulations, which are accompanied by many fluid instabilities. There is still not consensus between modelers on the explosion outcome (i.e. success or failure) of core collapse, and in cases where there is agreement on the outcome, the explosion properties (e.g. energy, explosion time, ...) are often disparate. I will briefly review the current status of state-of-the-art, multidimensional, computational models of core-collapse supernovae. For binary neutron star and neutron-star black hole mergers on the other hand, only recently are there simulations that use full general relativity and incorporate neutrino and nuclear microphysics in earnest. This has lead to higher fidelity predictions of the ejected material and its composition, the accretion disk formation and early evolution, and the gravitational wave signal and its dependence on the nuclear equation of state, and the neutrino signal. I will also review these microphysical aspects.