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Modeling compact objects in the multi-messenger era

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The first detection of gravitational waves (GWs) from a binary neutron star merger (GW170817) by the LIGO-Virgo collaboration together with an electromagnetic counterpart has brilliantly given birth to multi-messenger astronomy. In the coming years, the GW detector network sensitivity will be further increased making this rapidly evolving new astronomy challenge our understanding of hot and dense nuclear matter in neutron stars and the structure of these compact stars themselves. In addition to binary mergers, future multi-messenger observations include the possibility of a galactic core-collapse supernova, where the GW and neutrino signal carry among others the imprint of dense matter properties. A complete understanding of these exciting observations will be achieved only once they can be modeled successfully. Many questions still remain open, among others on microphysics properties (equation of state, transport coefficients, neutrino reaction rates), or the influence of the magnetic field. In this talk I will concentrate on microphysics and present some examples of recent advances in the modeling and the resulting consequences for compact star physics.

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