Contribution ID: **70** Type: **Oral presentation**

Gravitational wave signal for quark matter with realistic phase transition

Thursday 28 July 2022 16:00 (25 minutes)

At extremely high densities, QCD predicts the possible liberation of quark degrees of freedom and the formation of quark matter. The cores of neutron stars (NS) may accommodate such high-density matter. Whether the quark matter exists inside NSs is still an open question. If the quark matter exists, then there should be the imprint of the hadron-to-quark phase transition in the equation of state (EoS). We expect that gravitational waves from the binary NS merger can further constrain the EoS with the help of future third-generation detectors.

In this talk, we show that gravitational waves in the post-merger phase can distinguish the theory scenarios with and without a hadron-to-quark phase transition. Instead of adopting specific phenomenological EoS as studied previously, we compile reliable EoS constraints from the ab-initio QCD calculations. We demonstrate that early collapse to a black hole after the NS merger signifies softening of the EoS associated with quark matter even without a strong first-order transition. We also explain that the electromagnetic counterparts may further constrain the nature of the hadron-to-quark phase transition; we need substantial mass ejection to energize the observed luminosity of the associated kilonova.

Authors: FUKUSHIMA, Kenji (The University of Tokyo); FUJIMOTO, Yuki (University of Washington); HOTOKEZAKA, Kenta (Hebrew University); KYUTOKU, Koutarou

Presenter: FUJIMOTO, Yuki (University of Washington)

Session Classification: Session