Contribution ID: **650** Type: **Talk in the parallel session**

Gravitational-wave signatures of the hadron-quark phase transition in binary compact star mergers

Monday, 5 July 2021 17:50 (20 minutes)

The long-awaited detection of a gravitational wave from the merger of a binary neutron star in August 2017 (GW170817) marked the beginning of the new field of multi-messenger gravitational wave astronomy. Reaching densities a few times that of nuclear matter and temperatures up to 100 MeV, such mergers also represent potential sites for a phase transition from confined hadronic matter to deconfined quark matter (HQPT). Gravitational-wave signatures of the HQPT can be subdivided according to the phase in which they are generated. A strong HQPT can already be detected in the late inspiral phase if the equation of state gives rise to a twin star property in the mass-radius curve [1]. Depending on the properties of the HQPT, a signature can be created promptly after the merger or during the post-merger evolution. Especially during the postmerger evolution of the produced hypermassive/supramassive hybrid star the occurrence of a "delayed HQPT" might give a clear gravitational wave signature of the production of quark matter, if the HQPT is strong enough [2,3]. The appearance of a HQPT in the interior region of the remnant and its conjunction with the spectral properties of the emitted gravitational wave have been computed by fully general-relativistic hydrodynamic simulations.

[1] Gloria Montana, Matthias Hanauske, and Luciano Rezzolla. "Constraining twin stars with GW170817." Physical Review D 99.10 (2019): 103009.
[2] Lukas R. Weih, Matthias Hanauske, and Luciano Rezzolla. "Postmerger gravitational-wave signatures of phase transitions in binary mergers." Physical review letters 124.17 (2020): 171103.
[3] Hanauske, Matthias, Lukas R. Weih, Horst Stöcker, and Luciano Rezzolla. "Metastable hypermassive hybrid stars as neutron-star merger remnants." The European Physical Journal Special Topics (2021): 1-8.

Primary authors: HANAUSKE, Matthias (Goethe University Frankfurt, Institute for Theoretical Physics); MONTANA, Gloria; WEIH, Lukas; Prof. REZZOLLA, Luciano

Presenter: HANAUSKE, Matthias (Goethe University Frankfurt, Institute for Theoretical Physics)

Session Classification: Numerical Relativity and Gravitational Wave Observations

Track Classification: Gravitational Waves: Numerical Relativity and Gravitational Wave Observations