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Can gravitational waves prove the existence of the quark- gluon plasma?

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The long-awaited detection of a gravitational wave (GW) from the merger of a binary neutron star (BNS) in August 2017 (GW170817) marked the beginning of the new field of multi-messenger gravitational wave astronomy. By exploiting the extracted tidal deformations of the two neutron stars from the late inspiral phase of GW170817, it was possible to constrain several global properties of the equation of state of neutron star matter. With future gravitational wave detections we will be able to investigate the hadron-quark phase transition (HQPT) by analyzing the spectrum of the post-merger GW of the differentially rotating hypermassive hybrid star (HMHS). In contrast to hypermassive neutron stars (HMNS) these highly differentially rotating objects contain deconfined strange quark matter in their slowly rotating and rather cold inner region. HMHS live only a view seconds and during the collapse of the HMHS to a Kerr Black the color degrees of freedom of the pure quark core get macroscopically confined by the formation of an event horizon.

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