Contribution ID: **68** Type: **Oral presentation**

Investigation of binary neutron star merger remnants with equilibrium models

Transient compact remnants briefly supported by differential rotation and thermal pressure are a possible outcome of binary neutron star (BNS) mergers, with the post-merger phase expected to yield pivotal constraints for the equation of state of high density matter. Modelling remnants as equilibrium configurations can aid in interpreting the post-merger gravitational wave (GW) signal, deducing the threshold mass for prompt collapse to a black hole, constructing universal or empirical relations for remnant properties and understanding processes relevant for multi-messenger follow-up studies of GW observations. Here, we will summarize recent results obtained using equilibrium models to describe merger remnants. Employing a realistic differential rotation law, we construct sequences of remnant-like configurations with rotational profiles resembling those of numerically simulated remnants. Using specific equations of state we infer the threshold mass for prompt collapse and reproduce key predictions of BNS coalescence simulations. Finally, we conjecture a possible correlation between the compactness of quasi-equilibrium remnant models at the threshold mass and the compactness of maximum mass non-rotating models.

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