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Importance of cooling in triggering the collapse of hypermassive neutron stars VASILEIOS PASCHALIDIS, ZACHARIAH ETIENNE, STUART SHAPIRO, University of Illinois — The inspiral and merger of a binary neutron star (NSNS) can lead to the formation of a hypermassive neutron star (HMNS). As the HMNS loses thermal pressure due to neutrino cooling and/or centrifugal support due to gravitational wave (GW) emission, and/or magnetic breaking of differential rotation it will collapse to a black hole. To assess the importance of shock-induced thermal pressure and cooling, we adopt an idealized equation of state and perform NSNS simulations in full GR through late inspiral, merger, and HMNS formation, accounting for cooling. We show that thermal pressure contributes significantly to the support of the HMNS against collapse and that thermal cooling accelerates its "delayed" collapse. Our simulations demonstrate explicitly that cooling can induce the catastrophic collapse of a hot hypermassive neutron star formed following the merger of binary neutron stars. Thus, cooling physics is important to include in NSNS merger calculations to accurately determine the lifetime of the HMNS remnant and to extract information about the NS equation of state, cooling mechanisms, bar instabilities and B-fields from the GWs emitted during the transient phase prior to BH formation.

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