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High-density phase transition paves the way for supernova explosions of massive blue-supergiant stars

Blue-supergiant stars develop into core-collapse supernovae, one of the most energetic outbursts in the universe, when all nuclear burning fuel is exhausted in the stellar core. Previous attempts failed to explain observed explosions of such stars which have a zero-age main sequence (ZAMS) mass of 50 M or more. In a recent submission [1] we exploit the largely uncertain state of matter at high density, and connect the modelling of such stellar explosions with a first-order phase transition from nuclear matter to the quark-gluon plasma. The resulting very energetic supernova explosions yield stable remnant neutron stars with quark matter core, known as hybrid stars, of about 2 M at birth. A galactic event of this kind could be observable due to the release of a second neutrino burst. Its observation would confirm such first-order phase transition at densities relevant for astrophysics.

[1] Tobias Fischer, Niels-Uwe F. Bastian, Meng-Ru Wu, Stefan Typel, Thomas Klähn, David B. Blaschke, arXiv:1712.08788

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