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What can heavy neutron stars tell us about the dense matter speed of sound?

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Functional forms of the neutron star Equation of State (EoS) are required to extract the viable EoS band from neutron star mergers. Typically, one of three methods are used– spectral functions, piecewise polytropes, or gaussian process. However, realistic nuclear EoS, containing deconfined quarks or hyperons, present nontrivial features in the speed of sound such as bumps, kinks and plateaus. These features in the speed of sound are not captured well by the currently used methods for the functional forms [1]. We modify gaussian processes by introducing spikes and plateaus in the speed of sound and check how those features impact the posterior distribution obtained using constraints from NICER and gravitational-wave observations. We find these new features play a role in understanding ultra-heavy neutron stars that support stellar masses compatible with the 2.5 $M_\odot$ object detected in GW190814.

[1] Tan et al, Phys.Rev.Lett. 125 (2020) 26, 261104

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