Contribution ID: **33** Type: **Talk**

Gravitational waves from protoneutron stars and nuclear EOS

Thursday 13 September 2018 14:30 (20 minutes)

We focus on spacetime oscillations, the so-called w-modes, of gravitational waves emitted from a protoneutron star in the postbounce phase of core-collapse supernovae. By adopting numerical results from recent relativistic three-dimensional supernova models, we find that the w1-mode frequency multiplied by the radius of the protoneutron star is expressed as a linear function with respect to the stellar compactness insensitively to the nuclear equation of state. Combining with another universal relation of the f-mode oscillations, which are a kind of acoustic oscillations, it is shown that the time dependent mass-radius relation of the protoneutron star can be obtained by observing both the f- and w1-mode gravitational waves simultaneously. That is, the simultaneous detection of the two modes could provide a new probe into finite-temperature nuclear equation of state that predominantly determines the protoneutron star evolution.

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