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Limiting temperature of nuclei within effective relativistic mean-field theory

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The recent detection of the gravitational wave GW170817, accompanied by a γ-ray burst and electromagnetic afterglow from the merger of neutron-star binary, has opened a new era of nuclear astrophysics. With neutron stars as a predominant laboratory for testing infinite nuclear matter, it has become easy to fine-tune the equation of the state (EoS) of nuclear matter using observational constraints. The nuclear matter EoS is of utmost importance for calculating infinite matter properties besides giving reasonable input about finite nuclei. Understanding the ground state of nuclear matter is essential, but its behaviour at finite temperature is equally significant for various terrestrial and astrophysical processes such as multi-fragmentation in nucleus and supernova explosion [1]. The estimation of limiting temperature T_l (the maximum temperature that a nucleus can sustain) of a nucleus is extremely important to extract relevant nuclear properties. The analysis of this limiting temperature helps to understand the qualitative behaviour of liquid-gas phase transition in an excited nucleus and astrophysical processes such as the structure of proto-neutron star and supernova explosion etc.

We have used the effective relativistic mean-field theory (E-RMF) to analyze the limiting temperature of the excited nucleus using several parameter sets which satisfy various observational constraint of EoS [2]. We add the Coulomb interaction and surface tension due to the finite size effect of the nucleus and solve the coexistence equation for phase equilibrium. Surface tension is a function of the critical temperature (T_c) of infinite matter [3], which is not a good constraint variable [4], unlike other infinite nuclear matter saturation properties. Therefore, we look for the possible correlation of the limiting temperature of nuclei with zero and critical temperature properties. These correlations might help to understand observables that could not be measured directly in experiments.

[1] Vishal Parmar et al., Phys. Rev. C 103 055817 (2021).
[2] M. Dutra et al., Phys. Rev. C 90 055203 (2014).
[3] S. S. Avancini et al., Phys. Rev. C 78 015802 (2008).
[4] Vishal Parmar et al., J. Phys. G: Nucl. Part. Phys. 48 025108 (2021).

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