Relativistic Random-Phase Approximation with Density-dependent Meson-nucleon Couplings at Finite Temperature

Yifei Niu[1,2],* Nils Paar[2], Dario Vretenar[2], and Jie Meng[1]
[1]*State Key Lab Nucl. Phys. & Tech., School of Physics, Peking University, Beijing 100871, China and*
[2]*Physics Department, Faculty of Science, University of Zagreb, Zagreb 10000, Croatia*

The fully self-consistent relativistic random-phase approximation (RRPA) framework based on effective interactions with a phenomenological density dependence is extended to finite temperatures. The RRPA configuration space is built from the spectrum of single-nucleon states at finite temperature obtained by the temperature dependent relativistic mean field (RMF-T) theory based on effective Lagrangian with density dependent meson-nucleon vertex functions. As an illustration, the dependence of binding energy, radius, entropy and single particle levels on temperature for spherical nucleus ^{208}Pb is investigated in RMF-T theory. The finite temperature RRPA has been employed in studies of giant monopole and dipole resonances, and the evolution of resonance properties has been studied as a function of temperature. In addition, exotic modes of excitation have been systematically explored at finite temperatures, with an emphasis on the case of pygmy dipole resonances.

*Present address: Physics Department, Faculty of Science, University of Zagreb