

# Gamow-Teller Excitations in Open-Shell Nuclei at Finite Temperatures

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Spin-isospin excitations are known as fundamental modes of excitation in nuclei that gained considerable attention with the advances in experimental facilities and progress in theoretical models. The detailed knowledge about their structure is important, not only for nuclear physics but also for the nuclear astrophysics. Especially, in the calculation of nuclear weak interaction processes (beta decay, electron capture, neutrino-nucleus scattering etc.), accurate knowledge on the spin-isospin excitations is necessary. The proton-neutron quasiparticle random phase approximation (PNQRPA) based on the relativistic energy density functionals provides a consistent and reliable approach for the description of the spin-isospin excitations over the nuclide map.

On the other hand, it is known that the nuclear weak interaction processes in stellar environments mainly take place at finite temperatures ranging from several hundreds of keV to MeV. Recently, the effect of the temperature on the electron capture cross sections and rates was studied with the finite temperature proton-neutron random phase approximation, using the relativistic and non-relativistic functionals. However, the calculations were limited because the pairing correlations were not taken into account. Therefore, for a complete understanding of the nuclear weak interaction processes at finite temperatures, it is necessary to extend the current theoretical models to include both the temperature and pairing effects in the calculations of the spin-isospin excitations for open-shell nuclei.

In this work, we established the finite temperature proton-neutron QRPA based on the relativistic nuclear energy density functional with density dependent meson-nucleon couplings, and pairing correlations are taken into account in the BCS scheme. Within this framework, we have performed calculations for the Gamow-Teller excitations in open-shell nuclei using the DD-ME2 functional. The effect of the temperature on the strength functions and excitation energies of the Gamow-Teller excitations is investigated for the selected open-shell nuclei. In addition, the interplay between the temperature and pairing effects is discussed at low temperatures, where both effects are relevant.

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