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Ensemble treatments of thermal pairing in nuclei NGUYEN QUANG HUNG, NGUYEN DINH DANG, Heavy-Ion Nuclear Physics Laboratory, RIKEN Nishina Center for Accelerator-Based Science, 2-1 Hirosawa, Wako City, 351-0198 Saitama, Japan — A systematic comparison is conducted for pairing properties of finite systems at nonzero temperature as predicted by the exact solutions of the pairing problem embedded in three principal statistical ensembles, namely the grandcanonical ensemble, canonical ensemble and microcanonical ensemble, as well as the unprojected (FTBCS1+SCQRPA) and Lipkin-Nogami projected (FTLN1+SCQRPA) theories that include the quasiparticle number fluctuation and coupling to pair vibrations within the self-consistent quasiparticle random-phase approximation. The numerical calculations are performed for the pairing gap, total energy, heat capacity, entropy, and microcanonical temperature within the doubly-folded equidistant multilevel pairing model. The FTLN1+SCQRPA predictions are found to agree best with the exact grand-canonical results. In general, all approaches clearly show that the superfluid-normal phase transition is smoothed out in finite systems. A novel formula is suggested for extracting the empirical pairing gap in reasonable agreement with the exact canonical results.

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