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Finite size effects in the thermodynamics of a free neutral scalar field

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Highlights

- The exact analytical lattice results for the partition function of the free neutral scalar field in one spatial dimension in both configuration space and momentum space were obtained
- The exact lattice results for the partition function were generalized to the three-dimensional spatial momentum space
- The finite volume corrections to the thermodynamic quantities of the free real scalar field both on the finite lattice and in the continuum limit were studied
- We revealed that in the finite volume both lattice and continuum physical thermodynamic quantities deviate essentially from their thermodynamic limit values due to the quantum effects related to the discrete energy spectra of particles

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