Iranian Journal of Physics Research, Vol. 26, No. 1, 2026
DOI: 10.47176/ijpr.26.1.62128

Thermodynamic analysis of ^{89}Y and ^{166}Er nuclei using the nuclear level density parameter within the framework of the GBCS and Ignatiuk models

Khosro Benam*

Department of Physics, Faculty of Basic Sciences, Shahrekord University, Shahrekord, Iran

E-mail: kh.benam@sku.ac.ir

(Received 23 June 2025 ; in final form 17 October 2025)

Abstract
In this research, the thermodynamic properties of the nucleus have been investigated using the temperature-dependent level density parameter. Calculations have been carried out based on the BSC and Ignatyuk models. A well-known limitation of the BCS model is that the gap parameter drops to zero at the critical temperature, which leads to discontinuities and the appearance of singular points in the heat capacity curve. To overcome this problem, the gap parameter in the BCS model has been replaced with an order parameter derived from the generalized Ginzburg-Landau theory, and the resulting improved model was introduced as GBCS. Subsequently, the temperature-dependent level density parameter has been calculated using the GBCS and Ignatiuk models. Finally, by utilizing the temperature-dependent level density parameter, the thermodynamic quantities of the nucleus such as the nuclear level density, entropy, and heat capacity have been obtained using the mentioned models and compared with available experimental data.

Keywords: Temperature-dependent level density parameter, Nuclear level density, BCS model, Ginzburg-Landau theory

For full article, refer to the Persian section