



Iranian Journal of Physics Research, Vol. 22, No. 2, 2022
DOI: 10.47176/ijpr.22.2.91324

Investigation of the statistical fluctuations of the electric quadrupole transition rates of spherical nuclei by kernel density estimation method

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(Received 28 September 2021 ; in final form 30 March 2022)

Abstract

In this study, the statistical correlation of the electric quadrupole transition probabilities in the spherical nuclei is investigated. To this aim, the spherical even-even nuclei in the $100 < A < 126$ mass region are selected and the electric quadrupole transition rates of different levels in the ground band are determined by the interacting boson model in the U(5) dynamical limit. A non-parametric kernel density estimation method is used in the framework of nearest neighbor spacing distribution of random matrix theory to consider the statistical correlation of these quadrupole transition rates. Also, the Kullback-Leibler divergence is used to describe the regular or chaotic behavior of the considered sequences. The results show the correlation of the electric quadrupole transition probabilities between different levels of the ground band. Also, the correlation increased for such transitions that the angular momentum of the initial state of quadrupole transitions increased.

Keywords: statistical correlation, electric quadrupole transition probability, interacting boson model (IBM), kernel density estimation (KDE) method, Kullback-Leibler divergence (KLD)

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