Clustering Phenomena In Beryllium-8 Nucleus

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Since the previous experimental reports about Clustering Phenomena in light alpha-conjugate nuclei have open lots of discussions for theoretical calculations, in this article, using a proper non-microscopic approach, the molecule-like picture of ^{8}Be nucleus as a two-alpha-cluster structure is discussed. The main purpose of this work is to search a unified way to utilize the alpha-cluster model for all the other alpha-conjugate nuclei such as ^{12}C, ^{16}O, ^{20}Ne, ^{24}Mg and so on. The potential which is assumed for the interaction between clusters is the Coulomb plus Yukawa potential suggested by Hellmann. The effective potential is a composition of Nuclear, coulomb and centrifugal terms. First of all, the clusterization energy range for ^{8}Be is studied. Then, the radial part of time-independent Schrödinger equation in the presence of this interaction is analytically solved for an N-identical system. Afterwards, using the generalized Nikiforov-Uvarov (NU) technique, the clusterization energy for ^{8}Be nucleus is calculated. It is revealed that the considered non-microscopic cluster model is in a form that can meet the necessities of the quantum system and the presented formulation for clustering phenomenon reproduces the results obtained in previous experimental and theoretical attempts.
Finally, it is worth mentioning that the consistency of the obtained results with the previous experimental and theoretical predictions for clustering phenomenon in ^{8}Be indicates the reliability of this formulation for various types of light alpha-conjugate nuclei.