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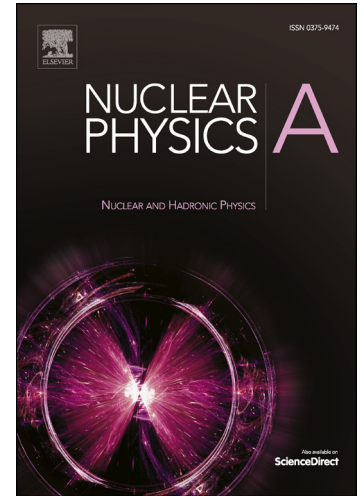
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Single-particle levels in cluster potentials

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Abstract

We calculate single-particle levels in potentials with Z_2 (dumbbell), D_{3h} (triangle) and T_d (tetrahedral) symmetry, appropriate to the α -cluster structure of ${}^8\text{Be}$, ${}^{12}\text{C}$ and ${}^{16}\text{O}$ respectively. We suggest that these can be used to study, within the framework of a cluster shell model (CSM), $k\alpha + x$ nucleon structures, with $k = 2, 3, 4$ and $x = 1, 2, \dots$, in particular the single particle ($x = 1$) structures ${}^9\text{Be}$, ${}^9\text{B}$; ${}^{13}\text{C}$, ${}^{13}\text{N}$; ${}^{17}\text{O}$, ${}^{17}\text{F}$.

Keywords:

Cluster model; Alpha-cluster nuclei; Cluster shell-model

1. Introduction

The cluster structure of light nuclei has a long history dating back to the seminal work of Wheeler [1] and Hafstad and Teller [2], followed by later work by Dennison [3] and Kameny [4]. In 1965 Brink [5, 6] suggested specific cluster configurations for nuclei composed of k α -particles, henceforth referred as $k\alpha$ nuclei. In particular, the suggested configurations of the ground states were for $k = 2$ (${}^8\text{Be}$) a dumbbell with Z_2 symmetry, for $k = 3$ (${}^{12}\text{C}$) an equilateral triangle with D_{3h} symmetry, and for $k = 4$ (${}^{16}\text{O}$) a tetrahedron with T_d symmetry. The latter was later investigated by Robson [7, 8].

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