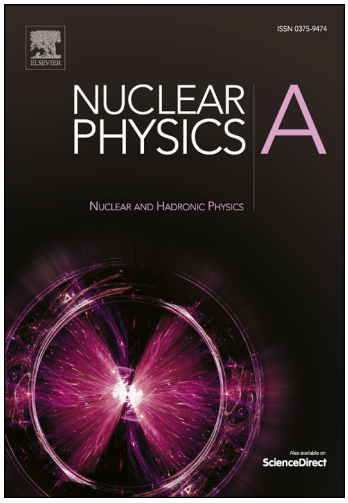
Accepted Manuscript



Single-particle levels in cluster potentials

V. Della Rocca, R. Bijker, F. Iachello

PII: S0375-9474(17)30293-2
DOI: http://dx.doi.org/10.1016/j.nuclphysa.2017.06.032
Reference: NUPHA 21049

To appear in: *Nuclear Physics A*

Received date: 1 March 2017
Revised date: 26 May 2017
Accepted date: 9 June 2017

Please cite this article in press as: V. Della Rocca et al., Single-particle levels in cluster potentials, *Nucl. Phys. A* (2017), http://dx.doi.org/10.1016/j.nuclphysa.2017.06.032

Single-particle levels in cluster potentials

V. Della Rocca[a,b,*], R. Bijker[c], F. Iachello[b]

[a] *Gran Sasso Science Institute, viale Francesco Crispi 7, 67100 L'Aquila, Italy*
[b] *Center for Theoretical Physics, Sloane Laboratory, Yale University, New Haven, CT 06520-8120, USA*
[c] *Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México, Apartado Postal 70-543, 04510 México D.F., México*

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 ^8Be, ^{12}C and ^{16}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 $x = 1, 2, \ldots$, in particular the single particle ($x = 1$) structures ^9Be, ^9B; ^{13}C, ^{13}N; ^{17}O, ^{17}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 $k = 2$ (^8Be) a dumbbell with Z_2 symmetry, for $k = 3$ (^{12}C) an equilateral triangle with D_{3h} symmetry, and for $k = 4$ (^{16}O) a tetrahedron with T_d symmetry. The latter was later investigated by Robson [7, 8].

*valeria.dellarocca@gssi.it, valeria.dellarocca@yale.edu
Email addresses: valeria.dellarocca@gssi.it, valeria.dellarocca@yale.edu (V. Della Rocca), bijker@nucleares.unam.mx (R. Bijker), francesco.iachello@yale.edu (F. Iachello)