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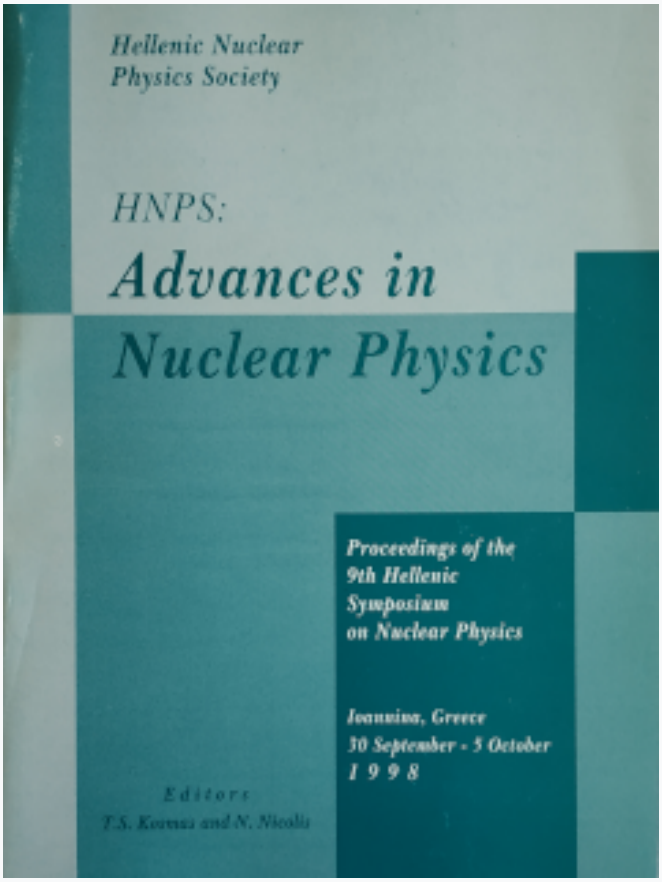

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A new application of the quantum mechanical hypervirial theorems technique *

M.E. Grypeos and Th.E. Liolios

Department of Theoretical Physics,
Aristotle University of Thessaloniki,
Thessaloniki 54006, Greece

Abstract

A new approach is proposed on the basis of the quantum mechanical hypervirial theorems technique for the approximate analytic (or semi-analytic) determination of bound state energy eigenfunctions for quite a wide class of central potentials. The accuracy of the method is tested for the Gaussian potential and is best for the ground state.

* This paper was published in Phys. Lett. A**252** (1999) 125.

The variation of the $\hbar\omega$ with the particle number and the appearance of "kinks" for atomic clusters *

B.A. Kotsos and M.E. Grypeos

Department of Theoretical Physics,
Aristotle University of Thessaloniki,
Thessaloniki 54006, Greece

Abstract

The dependence of the harmonic oscillator (HO) energy level spacing $\hbar\omega$ on the particle number N is studied analytically for atomic clusters on the basis of their electronic densities, parametrizing Ekardt's results (for sodium clusters) by means of a Fermi distribution. An interesting feature of such an approach is that it leads, under the assumptions made, to "kinks", that is to "marked discontinuities in the slope" of $\hbar\omega$ at the closed shells. These discontinuities diminish as N increases.

* Most of this work was been published in *Condensed Matter Theories*, Vol. **15**, p. 325, Edited by G.S. Anagnostatos, R.F. Bishop, K.A. Gernoth, J. Ginis and A. Theophilou, Nova Science Publishers, Inc., (2000).

On a single particle potential for atomic clusters *

B.A. Kotsos, Th.E. Liolios, M.E. Grypeos, C.G. Koutroulos and S.E. Massen

Department of Theoretical Physics,
Aristotle University of Thessaloniki,
Thessaloniki 54006, Greece

Abstract

The single-particle potential $V(r) = -V_0 \left[1 + (r/R)^\beta\right]^{-1}$, which has been proposed in the recent years for atomic (metal) clusters, is studied analytically in the case $\beta = 2$. By using perturbation-type techniques, approximate analytic expressions are obtained for the energy eigenvalues and other physically interesting quantities showing the variation of these quantities with the number of valence electrons. The accuracy is tested for Al clusters and is usually very good.

* This work has been published in Physica B**269** (1999) 424.