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Hydrogen Atom in *N* Dimensions

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Some aspects of the *N*-dimensional hydrogen atom are discussed. The complete solution for the energy eigenfunctions is presented and the radial distribution function is examined. Degeneracy of energy levels, expectation values ($\langle 1/r \rangle$ and $\langle 1/r^2 \rangle$), and the virial theorem are considered. It is shown that the effect of the effective potential manifests itself in some of the aspects being investigated.

1. INTRODUCTION

Over the past decade there has been much of discussion of problems involving *N* dimensions. Romeo (1995) studied the Wentzel–Kramers–Brilliouin (WKB) approximation in connection with hyperspherical quantum billiards. Yanez *et al.* (1994) investigated the position and momentum information entropies of *N*-dimensional systems. The generalization of Fermi pseudopotentials to higher dimensions was illustrated by Wo'dkiewic (1991). Random walks and moments of inertia in *N* dimensions have been considered by Bender *et al.* (1994) and Bender and Mead (1995). Fukutaka and Kashiwa (1987) considered the formulation of path integrals and their quantization on *N*-dimensional sphere. Recently the quantization of angular momentum in *N* dimensions has been described by Al-Jaber (1995).

It is the purpose of this paper to investigate some aspects of the hydrogen atom in *N*-dimensional space. In Section 2, the energy eigenfunctions of bound states are considered. In Section 3, the radial distribution function in *N* dimensions is examined, and in particular the one which corresponds to the maximum value of angular momentum. In Section 4, the degeneracy of any energy level of the *N*-dimensional hydrogen atom is determined. In

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