Abstract Submitted
for the HAW09 Meeting of
The American Physical Society

The general relativistic harmonic oscillator[1] JOSEPH GINOCCHIO, Los Alamos National Laboratory — The relativistic harmonic oscillator has been solved analytically in two limits. One is the spin limit for which the scalar potential, V_S, is equal to the vector potential, V_V, plus a constant, and the other is the pseudospin limit in which the scalar potential is equal in magnitude but opposite in sign to the vector potential plus a constant [1,2]. Like the non-relativistic harmonic oscillator, each of these limits has a higher symmetry. For example, for the spherically symmetric oscillator, these limits have a SU(3) and pseudo-SU(3) symmetry respectively [3]. Atomic nuclei are close to the pseudospin limit. However, the analytic solutions in this limit are those of the Dirac "negative" energy states. In the exact pseudospin limit there are no bound Dirac valence states. For this reason we have started to investigate the general spherically symmetric relativistic harmonic oscillator for which $V_S = \frac{m}{2}\omega_S^2 r^2$ and $V_V = \frac{m}{2}\omega_V^2 r^2$. We report on the progress made in solving analytically the Dirac Hamiltonian with these potentials.

[1] Joseph N. Ginocchio, Phys. Rev. C **69**, 034318 (2004).
[2] Joseph N. Ginocchio, Phys. Rep. **414**, 165 (2005).
[3] Joseph N. Ginocchio, PRL **95,** 252501 (2005).

[1]This work was supported by the U S Department of Energy under Contract No. W-7405-ENG-36.

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Date submitted: 25 Jun 2009 Electronic form version 1.4