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Ground State of the One Dimensional Heisenberg Model with *NNN* Interactions J.D. MANCINI, Kingsborough Community College, V. FESSATIDIS, Fordham University, S.P. BOWEN, J. MALY, Chicago State University, R.K. MURAWSKI, Drew University — A great number of insights into a variety of complex physical many-body systems have been gleaned from the study of the of the one-dimensional Heisenberg model. There exists a number of quasi one-dimensional inorganic compounds such as $TTF - CUS_4C_4(CF_3)_4$, $SRCU_2O_3$, $VO_2P_2O_7$ and $CuGeO_3$ for which this Hamiltonian system is relevant. For this work we shall study the one-dimensional Heisenberg Model with nearest, next nearest and next -next nearest interactions. The Hamiltonian is given by:

$$H = J_1 \sum_k \mathbf{S}_k \cdot \mathbf{S}_{k+1} + J_2 \sum_k \mathbf{S}_k \cdot \mathbf{S}_{k+2} + J_3 \sum_k \mathbf{S}_k \cdot \mathbf{S}_{k+3}$$

where $\mathbf{S}_k$ represents the spin 1/2 operator along a chain of N sites and periodic boundary conditions is assumed for the closed chain. We note that it is further possible to describe the Coulomb interaction subject to the Pauli exclusion principle for two quantum dots an XY model. Here we shall study the ground-state energy as well as the energy gap of this system using both a Lanczos (tridiagonal) scheme as well as a generalized Moments approach.

Vassilios Fessatidis
Fordham University

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