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**Entanglement in the interaction between a linear and an angular momentum oscillator** ILKI KIM, GERALD J. IAFRATE[1], Dept. of Electrical and Computer Eng., NC State Univ., Raleigh, NC 27695 — A measure of entanglement is utilized to study the interaction between a linear oscillator and a non-linear, angular momentum oscillator. As an example of entanglement in the quantum analysis, with the linear oscillator in the ground state and the angular momentum oscillator in the "finite" uppermost excited state, it is observed that as the "finite" angular momentum value is increased toward an infinitely large angular momentum value, a limit that would go over to the classical picture for an uncoupled angular momentum oscillator, the measure of entanglement increases; this entanglement persists as the angular momentum increases because the uppermost excited state of the angular momentum oscillator remains coupled to the vacuum state of the linear oscillator. Also, it is observed that when the uppermost excited state takes on values $J = \frac{1}{2}$ and 1, the measure of entanglement is periodic, whereas for $J \geq \frac{3}{2}$, it is aperiodic, if not chaotic. This suggests intrinsic limitations on the robustness of angular momentum atoms with $J \geq \frac{3}{2}$ for use as multi-level quantum computation elements.

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