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From Complexity to Quantum Mechanics: Nonlinearities Underlying Quantum Mechanics WM. C. MCHARRIS, Michigan State University — Many of the apparent paradoxes resulting from the (linear) Copenhagen interpretation of quantum mechanics can be resolved through parallel constructs from nonlinear dynamics/chaos. Had the founders of quantum mechanics had access to modern chaos theory, quantum mechanics could well have developed along different lines. Indeed, many of those who objected to the Copenhagen interpretation (especially de Broglie and Bohm) toyed with concepts that are close to those found in chaos theory. I shall delve into just two of these, demonstrating that exponential decay laws can be derived by iterating unimodal maps in their chaotic regimes (extreme sensitivity to initial conditions) and that the so-called classical (or hidden variables) side of Bell's inequality can be made to overlap with the quantum mechanical (entangled) side if one considers statistics of nonlinear systems, e.g., using Tsallis' nonextensive entropy. All of this has implications concerning the viability of quantum computing.

Wm. C. McHarris
Michigan State University

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