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Chaos as a Bridge between Classical Determinism and Quantum Probability WM. C. MCHARRIS, Michigan State University — Chaos provides the fundamental determinism so dear to Einstein, yet for all practical purposes it must be treated statistically, as proposed by the Copenhagen school. Thus, both Einstein and Bohr could have been correct in their debates. In a series of papers I have demonstrated that a number of the so-called imponderables or paradoxes generated in the Copenhagen interpretation of quantum mechanics have parallel explanations in the realm of nonlinear dynamics and chaos theory [i.a., J. Opt. B: Quantum and Semiclass. Opt. **5**, S442 (2003)]. These include exponential decay laws, interpretations of Bell-type inequalities, spontaneous symmetry breaking, and even diffraction. I give a brief overview of these, concentrating on the interpretation of the CHSH inequality (an experimentally friendly Bell-type inequality), demonstrating that here one is comparing correlated versus uncorrelated statistics more than quantum versus classical mechanics— nonlinear classical dynamical systems have been shown to have sufficient long-range correlations, as codified by the entropy of nonextensive thermodynamics, to raise the upper bound imposed by Bell-type inequalities into the range of quantum mechanics. As a result, many of the experiments ruling out "local reality" are perhaps moot.

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