Abstract Submitted
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Occam's Quantum Strop[1] JOHN MAHONEY, CINA AGHAMOHAMMADI, JAMES CRUTCHFIELD, University of California, Davis — A stochastic process's statistical complexity stands out as a fundamental property: the minimum information required to synchronize one process generator to another. How much information is required, though, when synchronizing over a quantum channel? Recent work demonstrated that representing causal similarity as quantum state-indistinguishability provides a quantum advantage. We generalize this to synchronization and offer a sequence of constructions that exploit extended causal structures, finding substantial increase of the quantum advantage. We demonstrate that maximum compression is determined by the process's cryptic order—a classical, topological property closely allied to Markov order, itself a measure of historical dependence. We introduce an efficient algorithm that computes the quantum advantage and close noting that the advantage comes at a cost—one trades off prediction for generation complexity.

[1]John Templeton Foundation, U.S. Army Research Lab

John Mahoney
University of California, Davis

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