4CS20-2020-000120

Abstract for an Invited Paper
for the 4CS20 Meeting of
the American Physical Society

Breaking Heisenberg: Controlling the Quantum World

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The quantum information revolution has taught us that quantum mechanics is not a paler version of its classical counterpart, hindered by intrinsic uncertainty and random measurement outcomes. Au contraire! A machine whose operation takes full advantage of the laws of quantum mechanics has information processing capabilities well beyond those that are restricted to essentially classical laws. To harness this power requires new methods for control and measurement, so that we can make quantum systems do our bidding, rather than what comes naturally. In this seminar, I will give an introduction to the basics of quantum information science and progress in the control/measurement tools that make this possible. In particular, I will describe one particular platform based on storing quantum bits in individually trapped ultracold atoms. It's a Back-to-the-Future vacuum-tube technology!