

Abstract Submitted
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Optimal experiment design for parameter estimation as applied to dipole- and exchange-coupled qubits¹ KEVIN YOUNG, MOHAN SAROVAR, BIRGITTA WHALEY, University of California - Berkeley, ROBERT KOSUT, SC Solutions — We consider the problem of quantum parameter estimation with the constraint that all measurements and initial states are separable. Two qubits are presumed coupled through the dipole and exchange interactions. The resulting Hamiltonian generates a unitary evolution which, when combined with arbitrary single-qubit operations, contributes to a universal set of quantum gates. However, while the functional form of the Hamiltonian is known, a particular experimental realization depends on several free parameters - in this case, the position vector relating the two qubits and the magnitude of the exchange interaction. We use the Cramer-Rao bound on the variance of a point estimator to construct the optimal series of experiments to estimate these free parameters. Our method of transforming the constrained optimal estimation problem into a convex optimization is powerful and widely applicable to other systems.

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