MAR05-2004-000835

Abstract for an Invited Paper
for the MAR05 Meeting of
the American Physical Society

Pseudo-Random Operators for Quantum Information Processing: Theory and Applications

JOSEPH EMERSON, Perimeter Institute for Theoretical Physics

I will review some important applications of random operators for quantum communication tasks and then describe the usefulness of random operators for efficiently characterizing noise sources and the degree of coherent control present on a quantum processing device. Since the exact implementation of random unitary operators is infeasible in practice on a large quantum processor, I will describe a random circuit method for generating pseudo-random unitary operators and clarify the relationship between these pseudo-random operators and (uniformly) random operators. I will also describe a recent implementation of pseudo-random unitary operators on an scalable NMR quantum processor in which the pseudo-random operators were applied to efficiently simulate a complex dynamical environment and study the generic features of decoherence resulting from different system-environment couplings.