Manipulating quantum signal transmission lines

arXiv:1604.08350

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J. Preskill, Lecture Notes for Physics 229: Quantum Information and Computation (1998) M.A. Nielsen and I.L. Chuang, "Quantum Computation and Quantum Information" (Cambridge University Press, 2000)



Evolution of a system, e.g. through a communication line



A. S. Holevo, Russian. Math. Surveys 53, 1295 (1999); M. Horodecki, P.W. Shor, M. B. Ruskai, Rev. Math. Phys 15, 629 (2003)

Quantum Channels



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Classification of Quantum Channels



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cut-and-paste protocol

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What happens if we have at disposal **only** EB channels ?



cut-and-paste protocol

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cut-and-paste protocol

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What happens if we have at disposal **only** EB channels ?



IT IS POSSIBLE TO TRANSMIT ENTANGLEMENT HAVING AT DISPOSAL **ONLY** EB MAPS!!!

Amplitude damping channel: theory and experiment

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$$-\Phi_{\rm EB} = -\mathcal{A}_2 \circ \mathcal{U}_{\theta} - \mathcal{A}_2 \circ \mathcal{U}_{\theta} - \mathcal{A}_2 \circ \mathcal{U}_{\theta} - \mathcal{U}_{\varphi} \circ \mathcal{$$

$$-\mathcal{A}_2 \circ \mathcal{U}_{\theta} - \mathcal{U}_{\varphi} \circ \mathcal{A}_1 - \mathcal{A}_2 \circ \mathcal{U}_{\theta} - \mathcal{U}_{\varphi} \circ \mathcal{A}_1 - \mathcal{U}_{\varphi} \circ \mathcal{A}_1 - \mathcal{U}_{\varphi} \circ \mathcal{U}_{\theta} - \mathcal{U}_{\varphi$$





Experimental data



propagation of polarization qubits in optical fibers

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polarization qubits in optical fibers









propagation of polarization qubits in optical fibers

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polarization qubits in optical fibers











FUTURE

- novel opportunity towards quantum information <u>networks of</u> <u>increasing complexity</u>
- new perspectives in quantum channel theory and error correction protocols