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**Efficient quantum communication under collective noise**[1]

MICHAEL SKOTINIOTIS, University of Calgary, BARBARA KRAUS, WOLFGANG DÜR, University of Innsbruck — We propose a novel communication protocol for the transmission of quantum information via quantum channels subject to collective noise. Our protocol makes use of decoherence-free subspaces in such a way that an optimal asymptotic rate of transmission is achieved, while at the same time encoding and decoding operations can be implemented efficiently. In particular, for a quantum channel whose collective noise is associated with a discrete group, $G$, i.e. with a discrete number, $|G|$, of possible noise operators, our protocol achieves perfect transmission at a rate of $m/(m+r)$, where $r$ is a finite number of auxiliary systems that depends solely on the channel in question. In the case where the collective noise of the channel is associated with a continuous group, such as a collective phase noise channel, our protocol leads to efficient, approximate transmission of quantum data with arbitrarily high fidelity and optimal transmission rate. The coding and decoding circuit of our protocol requires a number of elementary gates that scale linearly with the number of transmitted qudits, $m$, in contrast to the best known protocols utilizing a decoherence-free subspace.

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