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Encoding One Logical Qubit Into Six Physical Qubits BILAL SHAW, MARK WILDE, OGNYAN ORESHKOV, ISAAC KREMSKY, DANIEL LIDAR, University of Southern California — We discuss several methods to protect one qubit against single- qubit errors by encoding it into six physical qubits. We first present a degenerate six-qubit quantum error-correcting code. We explicitly provide the stabilizer generators, encoding circuit, codewords, logical Pauli operators, and logical CNOT operator for this code. We then prove that a six-qubit code cannot simultaneously possess a Calderbank-Shor-Steane stabilizer and correct arbitrary single-qubit errors. We finally construct a six-qubit non-degenerate entanglement-assisted quantum error- correcting code that uses one bit of entanglement shared between the sender and the receiver. We discuss the advantages and disadvantages for each of our six-qubit quantum error-correcting codes.

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