

Quantum Physics

All the optimal stabilizer codes of distance 3

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Optimal quantum stabilizer codes of distance 3 are explicitly constructed for all lengths except for the following four families of lengths $8f_m - \{1, 2\}$ and $f_{m+2} - \{2, 3\}$ with $f_m = \frac{4^m - 1}{3}$ and $m \geq 2$ being integer, for which our codes are of the best parameters known and are only one logical qubit less than the quantum Hamming bound. The optimality of our codes is ensured by saturating either the quantum Hamming bound or a stronger bound for three families of lengths $8f_m + \{1, 2\}$ and $f_{m+2} - 1$ with $m \geq 1$ derived from the linear programming bound. For the lengths less than 128 three previously unknown codes $[[36, 29, 3]]$, $[[37, 30, 3]]$ and $[[81, 73, 3]]$ have been found.

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