

Quantum LTC With Positive Rate

David Ponarovsky

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preamble. preamble.

Claim for any $[[n, k, d]]$ CSS code property 1 holds

. **Proof.** let $y \in \{0, 1\}^n$ be a vector such $y \in G_z^\delta$, let assume that $|y|_{c^{x^\perp}} \leq C_2 d$ then for any $c \in C_x^\perp$:

$$\delta r_z \geq |H_z y| = |H_z (y + c)|$$

Robusstness Let $\omega \leq \Delta^2$. Let C_A and C_B be codes of length Δ with minimum distance d_A and d_B . We shall say that the dual tensor code $C = C_A \otimes \mathbb{F}_2^B + \mathbb{F}_2^A \otimes C_B$ is ω -robust, if for any codeword $c \in C$ of Hamming weight $|c| \leq \omega$, there exist $A' \subset A, B' \subset B, |A'| \leq |c|/d_B, |B'| \leq |c|/d_A$, such that $c_{ab} = 0$ whenever $a \notin A', b \notin B'$.

Claim. Subcode Robusstness. Consider the subspaces $C'_A \subset C_A, C'_B \subset C_B$, such that the dual tensor of C_A, C_B is ω -robust then the dual tensor of C'_A, C'_B is also ω -robust.

Proof. Let c be a codeword in the dual tensor of C'_A, C'_B then it's clear that c is also in the dual tensor of C_A, C_B and therefore there exists V, U subsets of A, B respectively such that c supported only on them, and their size is less then $|c|/d_B, |c|/d_A$.