

# **Erratum: Qudit-based quantum error-correcting codes from irreducible representations of $SU(d)$** **[Phys. Rev. A **112**, 042402 (2025)]**

Robert Frederik Uy  and Dorian A. Gangloff 



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In our original paper we established a general procedure for constructing quantum error-correcting codes for qudits, using the irreducible representations of  $SU(d)$  for any odd integer  $d \geq 3$ . It was recently pointed out to us that the sample 13-qutrit code we gave in Sec. V A does not in fact satisfy our definition of a sparse code (see Sec. IV A). This is due to the fact that the term  $\|S_{(3,5,5)}\rangle\rangle$  in the defining code word  $|\bar{0}\rangle$  gives us  $\sum_{\xi \in \mathbb{Z}_d} |u_\xi - u_{\xi+1}| = 4$ , which does not satisfy the  $>4$  condition for sparsity. Consequently, our framework does not apply to the given example. Indeed, we can check that  $\langle \bar{0} | \tilde{S}^{(0,1)} \tilde{S}^{(0,1)} | \bar{1} \rangle \neq 0$  and thus the code does not satisfy the condition (C2).

A genuine example of an error-correcting SDPI code for qutrits is the map  $\mathcal{C} : \mathbb{C}^3 \rightarrow \text{DSym}^{13}(\mathbb{C}^3)$  defined by

$$|\bar{0}\rangle = \frac{1}{9} \sqrt{\frac{35}{3}} \|S_{(13,0,0)}\rangle\rangle + \frac{1}{9\sqrt{33}} \|S_{(4,0,9)}\rangle\rangle + \frac{1}{9\sqrt{462}} \|S_{(1,6,6)}\rangle\rangle.$$

To arrive at this through our procedure in Sec. IV D, we choose  $N = 13$  and  $\mathcal{S} = \{(13, 0, 0), (4, 0, 9), (1, 6, 6)\}$ . It is clear that  $\mathcal{C}$  is an SDPI code. In order to satisfy the reduced Knill Laflamme conditions (QF1)–(QF3), the coefficients  $\alpha_{(13,0,0)}$ ,  $\alpha_{(4,0,9)}$ , and  $\alpha_{(1,6,6)}$  must satisfy the system of equations

$$\begin{aligned} 13\xi_1 - \xi_2 - 5\xi_3 &= 0, \\ 169\xi_1 - 121\xi_2 + 25\xi_3 &= 0, \\ 13\xi_1 + 71\xi_2 - 65\xi_3 &= 0, \end{aligned}$$

where we defined

$$\begin{aligned} \xi_1 &= \langle S_{(13,0,0)} | S_{(13,0,0)} \rangle \|\alpha_{(13,0,0)}\|^2, \\ \xi_2 &= \langle S_{(4,0,9)} | S_{(4,0,9)} \rangle \|\alpha_{(4,0,9)}\|^2, \\ \xi_3 &= \langle S_{(1,6,6)} | S_{(1,6,6)} \rangle \|\alpha_{(1,6,6)}\|^2. \end{aligned}$$

Using *Mathematica*, we find that  $(\xi_1, \xi_2, \xi_3) \propto (35, 65, 78)$ , which gives us the above code.

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