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**Generalized Uhrig Dynamical Decoupling for Multi-Level Quantum Systems** SUJEET SHUKLA, LIANG JIANG, JOHN PRESKILL, Institute for Quantum Information, Caltech, ADILET IMAMBEKOV, Department of Physics and Astronomy, Rice University — Dynamical decoupling can efficiently suppress decoherence induced by the system-environment interaction. Recently, Uhrig proposed an efficient dynamical decoupling scheme, which uses only  $N$  pulses to suppress dephasing noise to  $O(T^{N+1})$  for a qubit system with total time evolution  $T$ . We generalize Uhrig's dynamical decoupling scheme from 2-level to  $L$ -level quantum systems. We find that  $M = (L - 1)N$  pulses are sufficient to suppress dephasing noise to  $O(T^{N+1})$ . We observe interesting patterns in the timing of these pulses, which depend on both  $L$  and  $N$  with various asymptotic forms for large  $L$  or large  $N$ .

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