
Seminario DSFC

14/10/2026 ore 14.30, Aula Signorelli, Coppito 1

“Towards fault-tolerant correction of not-diagonal errors in spin qudits”

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Abstract: We investigate the correction of quantum spin not-diagonal errors, as relaxation, in qudit systems, with the aim of exploiting their multi-level structure to embed error correction. The fundamental issue is to reconcile the anharmonicity necessary to control the qudit with the related decay of coherences during relaxation. In systems with significant anharmonicity, this results in an independent decay of each eigenstate which yields a number of relevant errors too large to be handled by a fully embedded quantum-error correction code. We overcome this hurdle by a hybrid fault-tolerant scheme which combines embedded error correction against the leading pure dephasing error with a concatenated code to fight not-diagonal errors. Thanks to the large suppression of dephasing by the embedded code and to the much larger relaxation time, we demonstrate the remarkable performance of our implementation compared to standard non-biased multi-qubit codes, even with a few small-size qudits per logical unit.