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High-fidelity transport of trapped-ion qubits in a multilayer array

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Chip-based trapping technology has emerged as a promising approach for multi-dimensional quantum simulations and entanglement using individually controllable trapped ion qubits arrays. Previous studies have demonstrated successful local control, inter-site coupling, and floquet-engineered couplings in such architectures[1-3]. Here we present the extension of the existing toolbox by introducing tools from the QCCD architecture[4], enabling deterministic transport of a single trapped ion qubit across a three-dimensional landscape. We also showcase the preservation of quantum coherence in the electronic degrees of freedom throughout the transport process[5]. Additionally, we address technical limitations, such as anomalous heating through Argon-ion bombardment and challenges related to the dephasing of motional and electronic degrees of freedom[6].

[1] Mielenz et al., Nat. Commun. 7, 11839 (2016).
[2] Hakelberg et al., Phys. Rev. Lett. 123, 100504 (2019).
[3] Kiefer et al., Phys. Rev. Lett. 123, 213605 (2019).
[4] Kielpinski et al., Nature (London) 417, 709 (2002).
[5] Palani et al., Phys. Rev. A 107, L050601 (2023).
[6] Warring et al., Adv. Quantum Technol. 3, 1900137 (2020).

Primary authors: PALANI, Deviprasath (University of Freiburg); Mr HASSE, Florian (University of Freiburg); Mr DAS, Apurba (University of Freiburg); Dr WARRING, Ulrich (University of Freiburg); Dr SCHAETZ, Tobias (University of Freiburg)

Presenter: PALANI, Deviprasath (University of Freiburg)

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