**Novel quantum charge coupled device and drive-through gate with trapped ions**

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In the quest for scalable quantum computing, a promising approach is the use of a quantum charge-coupled device (QCCD) based on ion shuttling. However, challenges arise due to ion detachment, merging, and non-uniform motion during transportation, leading to significant heating issues. This results in substantial time and laser power overhead for re-cooling and stabilization. To overcome these challenges, we propose a novel entangling scheme involving a stationary ion qubit and a mobile one in continuous uniform motion without generating heat. The scheme demonstrates a theoretical gate error of approximately 10^-4 using current technologies. This approach enables efficient and cost-effective quantum operations, facilitating long-distance entanglement distribution. It leverages stationary trapped ion arrays as memory units, with mobile ions serving as information carriers flying by them. This presents a revolutionary alternative to the current QCCD architecture, opening up new possibilities for scalable quantum computing.