Abstract Submitted
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Manipulating trapped ions with ultrafast laser pulses to generate mesoscopic states and entanglement[1] STEVEN MOSES, DAVID WONG-CAMPOS, KALE JOHNSON, JONATHAN MIZRAHI, CHRISTOPHER MONROE, Joint Quantum Institute and University of Maryland Department of Physics, College Park, Maryland 20742 — The main requirements for a viable quantum computing platform include robustness to external perturbations and logical operations faster than the system's decoherence time. Trapped ions have met these requirements while maintaining high operation fidelities. Although extensive work has been done in the resolved sideband regime, ultrafast quantum state control promises an improvement to both clock speeds and scalability. Here we demonstrate the use of ultrafast laser pulses for generating high fidelity spin-dependent momentum kicks (SDKs) in $^{171}Yb^{+}$ ions. These SDKs are the building blocks used to create mesoscopic superpositions, or Schrödinger cat states, of motional states that enable sensing of thermal states up to room temperature. More recently, we have used a sequence of SDKs on two ions to realize a novel phase gate, which operates independent of temperature and is scalable to large system sizes.

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