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(POS-39) Building an open access quantum information processor using Barium Ions

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We present our progress towards developing a trapped ion quantum information processor and describe our robust hardware and software architecture. Our platform for storing and processing quantum information is trapped Barium ions. Because of long-lived ground and metastable atomic states and transitions in the visible wavelengths, Ba^+ offers exciting possibilities to encode quantum information in flexible ways and to employ low-loss, waveguide-based optical engineering for high-precision and programmable controls. We discuss our progress towards high efficiency isotope-selective loading of ions, especially $^{133}\text{Ba}^+$ that is radioactive ($t_{1/2}=10.6$ years) and hence can only be used in miniscule quantities, in a surface electrode trap. Furthermore, we remark on generating long chains of Barium ions, cooling them, and individually addressing them by a waveguide based optical addressing system with ultra-low ($<1\text{E-}4$) relative intensity crosstalk for precise and programmable control for individual Ba^+ qubits. In the long run, we expect the processor to be an open-access system for academic use.

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Keyword-1

Ion Trap

Keyword-2

Quantum Information

Keyword-3

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