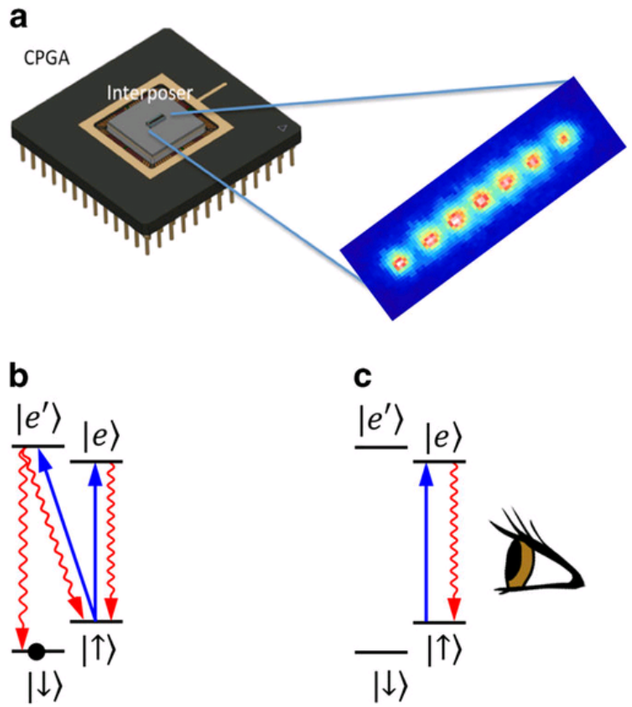
Ion Trap Quantum Device



(**a**) Schematic of silicon chip-trap mounted on a ceramic pin grid array carrier with raised interposer, confining atomic ions that hover ~75 μm above the surface. The inset is an image of 7 atomic ytterbium ($^{171}Yb^{+}$) ions arranged in a linear crystal and laser-cooled to be nearly at rest. The few-micrometre separation between ions is determined by a balance between the external confinement force and Coulomb repulsion. (**b**,**c**) Reduced energy level diagram of a single $^{171}Yb^{+}$ atomic ion, showing the atomic hyperfine levels $|\uparrow\rangle$ and $|\downarrow\rangle$ that represent a qubit. The electronic excited states $|e\rangle$ and $|e'\rangle$ are separated from the ground states by an energy corresponding to an optical wavelength of 369.53 nm, and applied laser radiation (blue arrows) drives these transitions for (**b**) initialisation to state $|\downarrow\rangle$, and (**c**) fluorescence detection of the qubit state ($|\uparrow\rangle$, fluorescence, $|\downarrow\rangle$, no fluorescence).

Co-designing a scalable quantum computer with trapped atomic ions, Kenneth R Brown, Jungsang Kim & Christopher Monroe, Nature 2016.