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Monolithic Segmented 3D Ion Trap

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We demonstrate the fabrication and operation of a linear Paul trap made from a single piece of fused silica. The glass is machined using a femtosecond laser assisted etching technique and subsequently coated with a conductive layer of gold. T-shaped trenches along the surface of the glass ensure insulation between neighbouring electrodes, without the use of shadow masks during the coating procedure. The monolithic design does not require alignment of individual components, reducing potential geometric imperfections and resulting anharmonicities.
The trap is designed to contain up to 50 ions for quantum computing and simulation experiments. The width of the electrode segments is optimised to facilitate strings of equidistant ions, which we demonstrate by confining strings of calcium ions. The trap geometry is versatile and designed to be suitable for other applications. Notably, the highly symmetric structure and axial access enables trapping of externally generated ions for spectroscopic experiments.

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