the atoms can be selectively addressed in a quantum register; and coherences made to live much longer than the expected gate-operation times[6,7].

Beugnon and colleagues[1] now complete the toolbox of routines available to experimenters for manipulating single neutral atoms. They show how an atomic qubit can be moved around without losing its precious information. Beugnon *et al.* use a set-up where two laser beams are tightly focused by a single aspheric lens with high numerical aperture. One of the beams is directed into the lens via a tilt mirror, allowing computer-controlled motion of these optical tweezers. The practical value of moving optical tweezers in future quantum processors hinges on two questions, both concerning the preservation of coherence of the stored qubits. First, can heating processes — which are inevitable — be kept at a minimum? And second, can we hand over a neutral atom qubit from one trap to another with controlled evolution of the quantum phase?

Moving an atom by optical tweezers requires force. The motional state of the atom in the tweezers remains unaltered if the acceleration is slow enough. Such adiabaticity is preserved if the force exerted through the acceleration is small compared with the trapping force. Because of the very tight trap, the acceleration limit in the experiment of Beugnon *et al.*[1] is 10^4 m s^{-2}, much larger than the applied acceleration. And indeed, the heating throughout the experimental procedure — which involved moving the qubit over total distances of several tens of micrometres — was found to be negligible[1].

To address the second question, Beugnon *et al.* looked at the coherence properties of atoms when they are taken from one trap to another and back. For this experiment, quantum superpositions of the qubit states were induced with a short pulse in one trap, then the qubit was moved over to — and held in — the second trap. After returning the qubit to the first trap, the superposition state was interrogated and read out, a method equivalent to performing a Ramsey experiment of a single atom clock with interim storage in a different trap. The authors found that the amplitude of the quantum coherence is no more affected than if the atom just sits in the one trap[1]. They furthermore observed a phase shift during the transportation protocol that is fully understood and predictable — a crucial finding to implement controlled interactions.

The experiments of Beugnon and colleagues[1] clearly demonstrate that single-atom clocks can be shuffled around. But we shouldn't take a rest — it is now essential to show that coherent interactions between two and more atoms can be induced. In this way, neutral atoms should progress further along the lines of the quantum information roadmaps[8,9].

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LUNAR SURFACE

Shades of grey

APOLLO IMAGE ARCHIVE/NASA

In December 1972, Eugene Cernan became the last man to walk on the Moon. Cernan commanded Apollo 17, the last of NASA's manned missions in the Apollo programme. Apollo 17, like Apollo 15 and 16 before it, carried the Apollo Mapping (or Metric) camera, which was used to photograph the lunar surface. The negatives of the developed film have been stored in a freezer at the Johnson Space Center in Texas ever since. Concerned for the future of the films, and the legacy of the Moon landings, the JSC, with Arizona State University and the Lunar Planetary Institute, are now creating the 'Apollo image archive' (http://apollo.sese.asu.edu), scanning the ageing film to create digital images that will be available to scientists and the public alike.

These are no ordinary scans, however. To preserve valuable information, the scanned images are produced with exceptionally high resolution, 200 pixels per millimetre, and with a 14-bit grey scale — corresponding to 16,384 shades of grey. The first five images are now available. Although before you download them, be warned that the raw-scan files run to 1.3 gigabytes...

Alison Wright