

## Description of Additional Supplementary Files

**File Name:** Supplementary Movie 1

**Description:** Readout of a 192-bit atomic-scale memory from a Scanning Tunneling Microscope image. The information stored in the 192-bit memory can be read directly as the Scanning Tunneling Microscope (STM) scans over the structure or from previously recorded STM images, as in this case ( $V=-1.8$  V,  $I=50$  pA,  $T=4.5$  K,  $21.5 \times 10.7$  nm<sup>2</sup>). Image recognition software is used to identify the presence of dangling bonds (DBs) in fixed locations on the surface to determine if the value of a bit is zero (no DB present) or one (DB present). Each line of the memory consists of 8 bits.