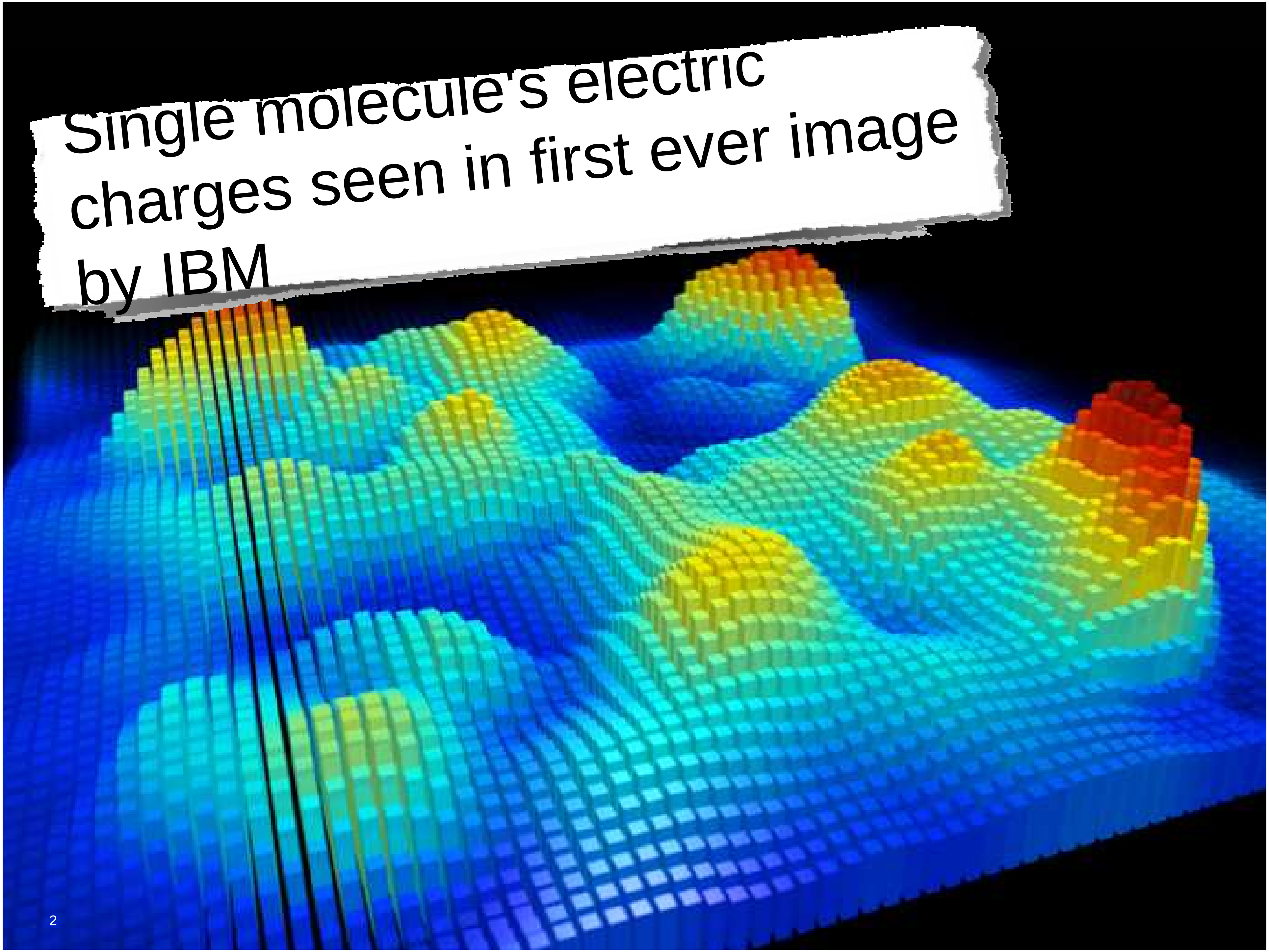
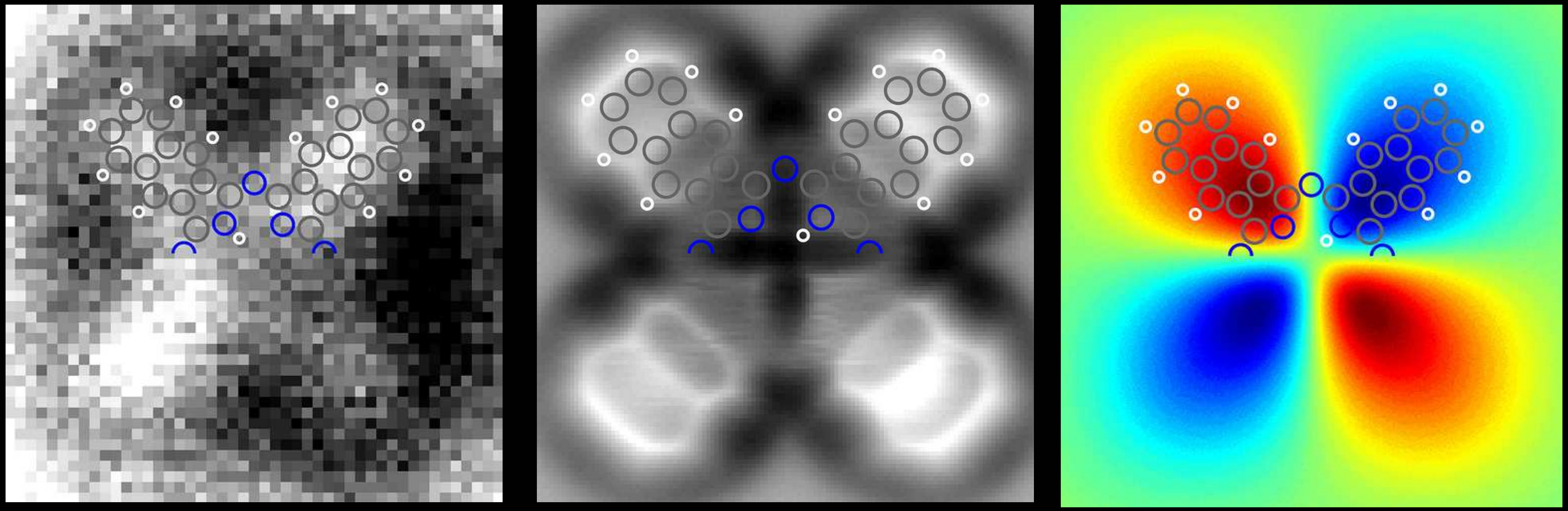
Ripped from the Headlines: Small Discoveries Lead to Big Innovations at IBM

Single molecule's electric charges seen in first ever image by IBM

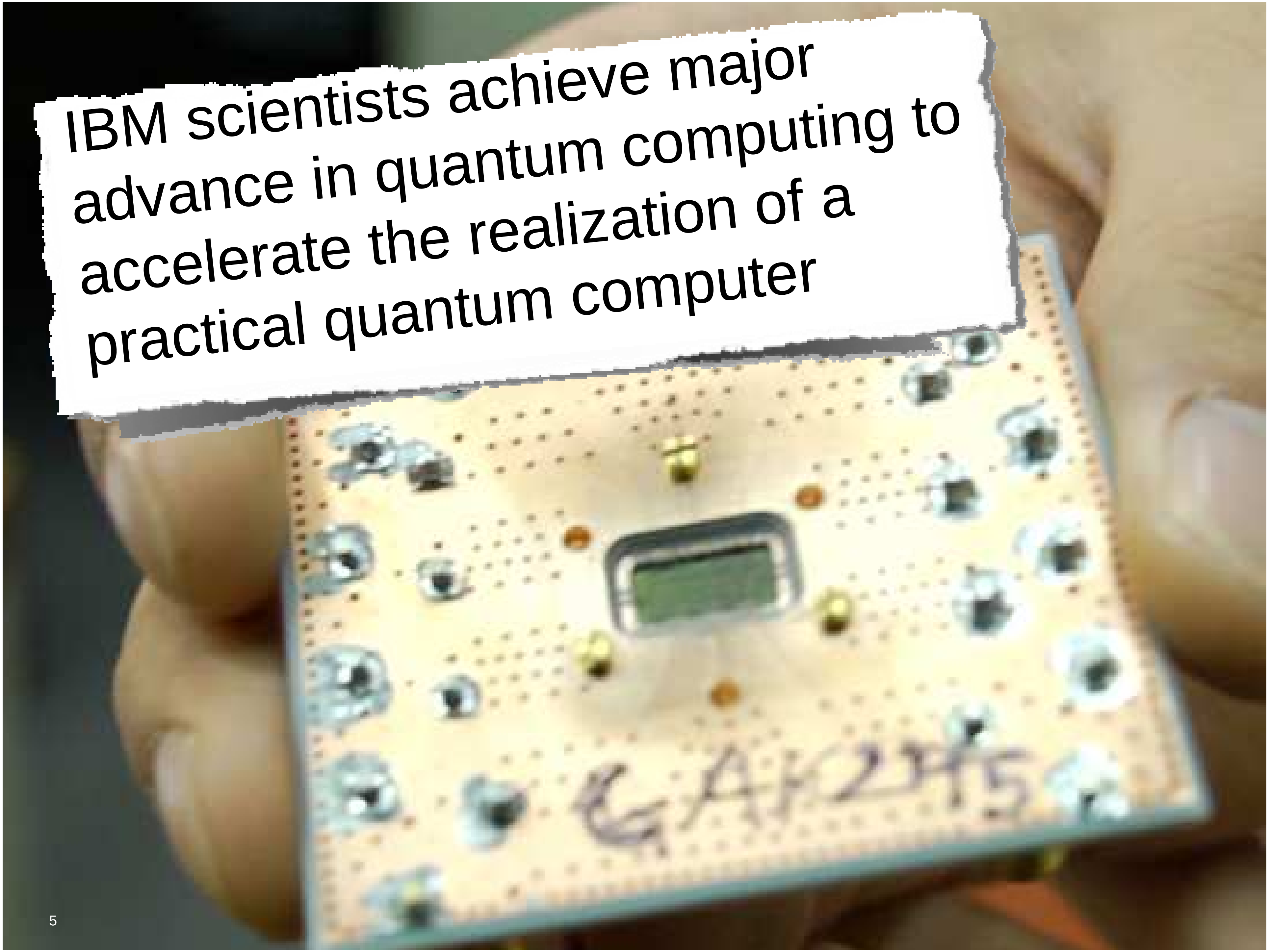


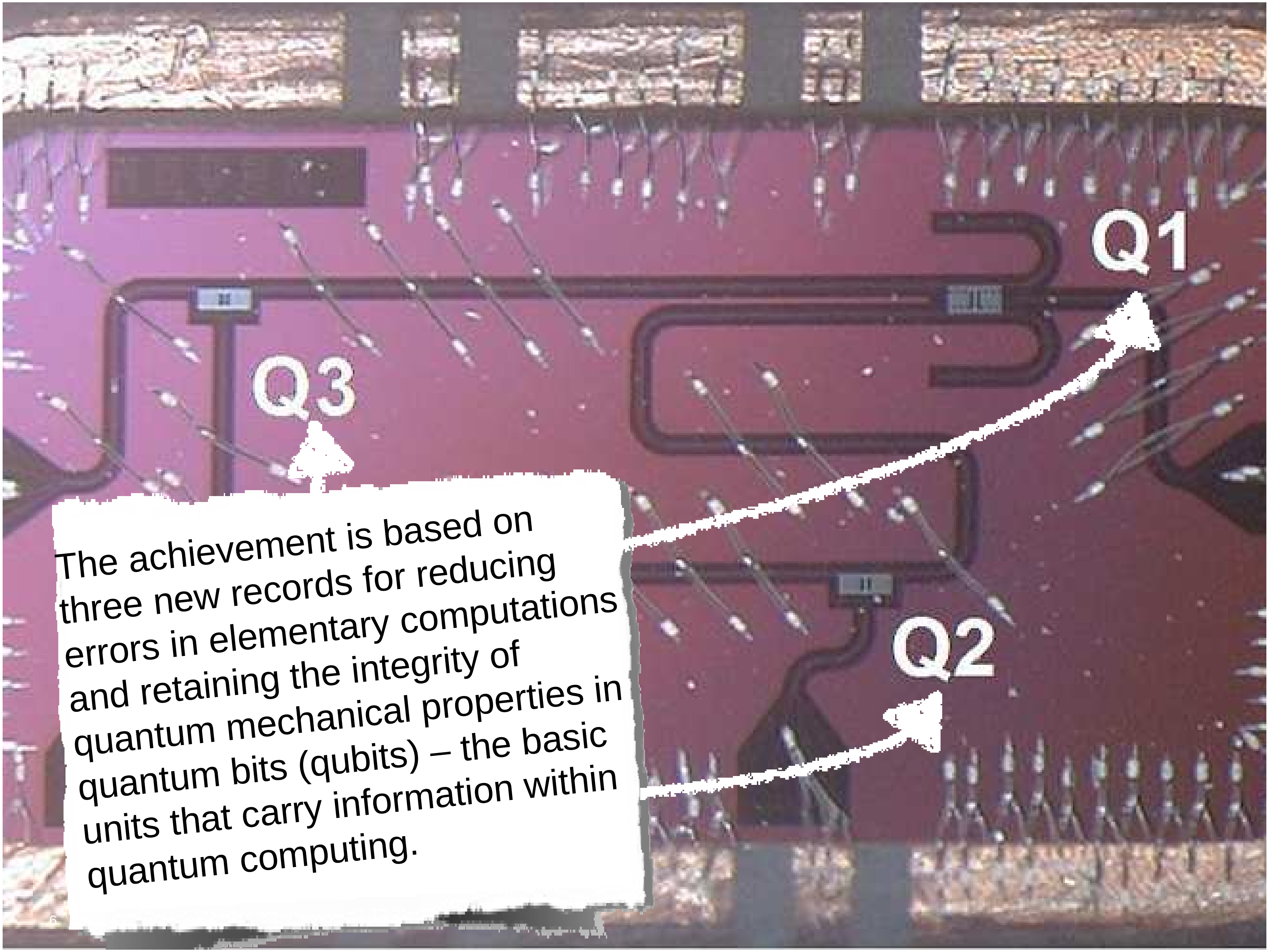
IBM’s technique could contribute to the design of molecular-sized transistors that enable more energy efficient computing devices ranging from sensors to mobile phones to supercomputers.



How it Works

To measure the charge distribution IBM scientists used a tool called a Kelvin probe force microscope (KPFM). Using a tiny probe tip above a conductive sample, an electric field is generated due to the different electrical potentials of the tip and the sample.


IBM scientists achieve major advance in quantum computing to accelerate the realization of a practical quantum computer



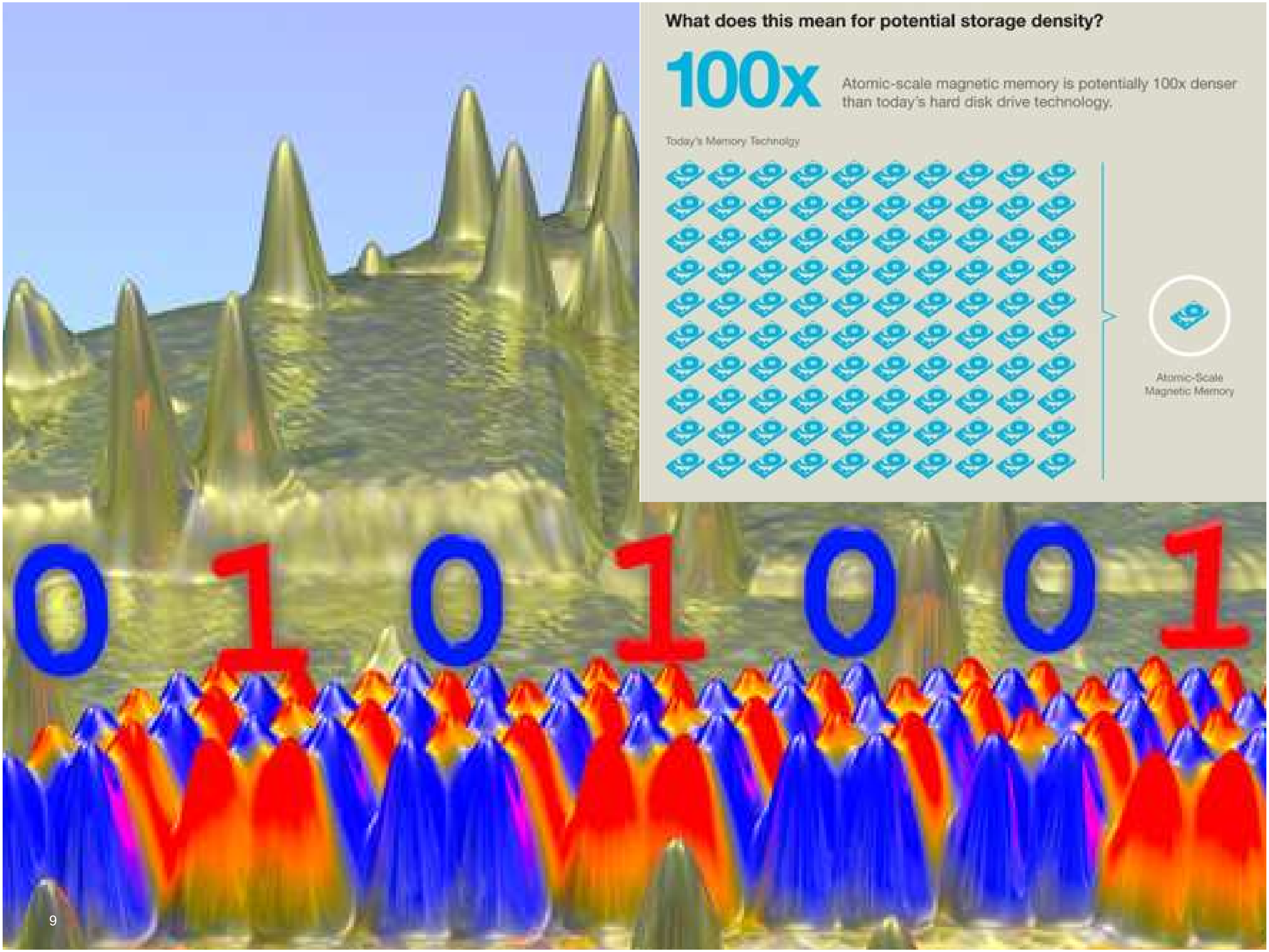
The achievement is based on three new records for reducing errors in elementary computations and retaining the integrity of quantum mechanical properties in quantum bits (qubits) – the basic units that carry information within quantum computing.

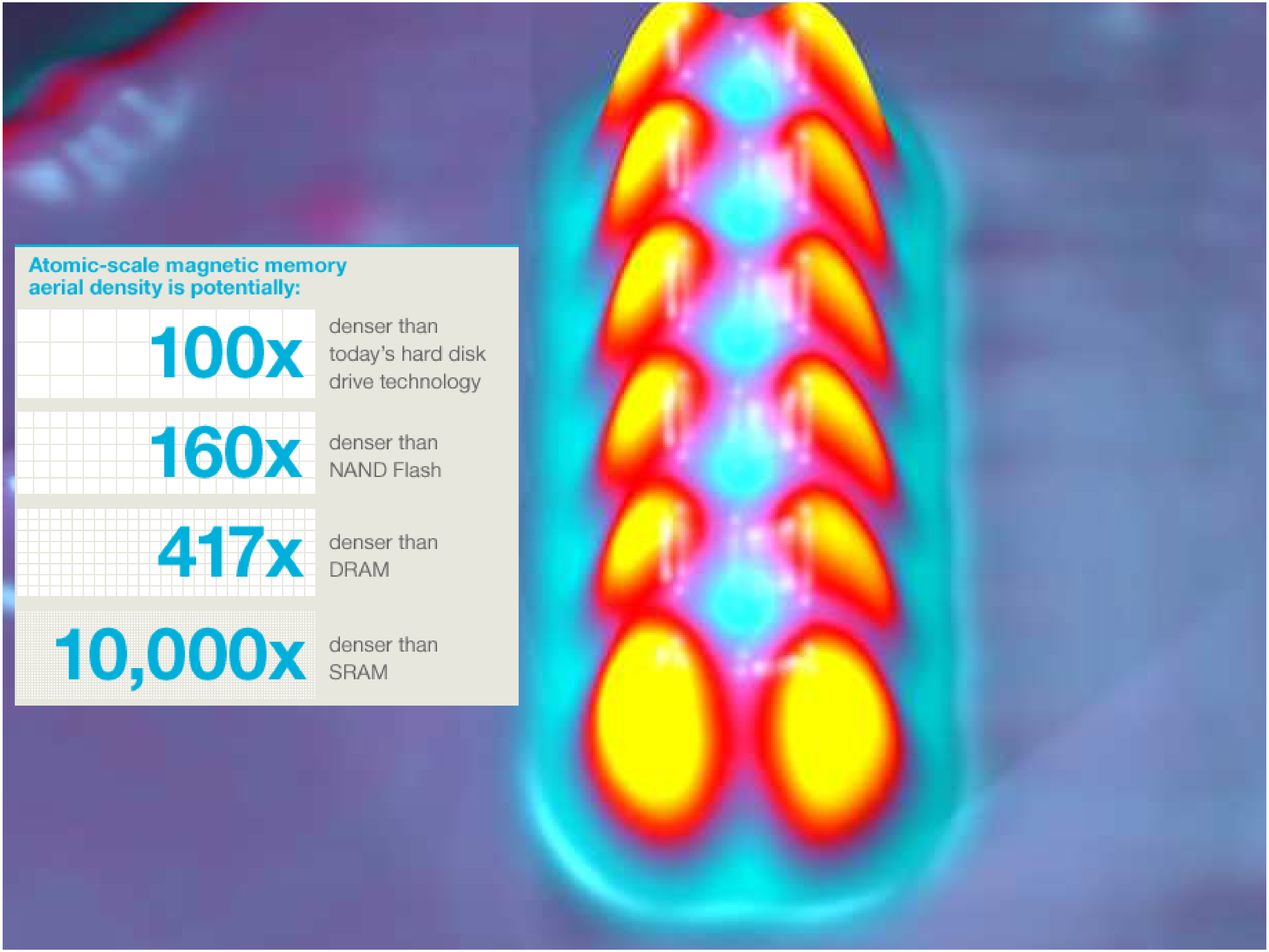
How it Works

Everything computers can understand are based on bits. Much like a light that can be switched on or off, a bit can have only one of two values: "1" or "0". For quantum bits, they can hold a value of “1” or “0” as well as both values at the same time. Described as superposition, this is what allows quantum computers to perform millions of calculations at once.

IBM Research Determines Atomic Limits of Magnetic Memory

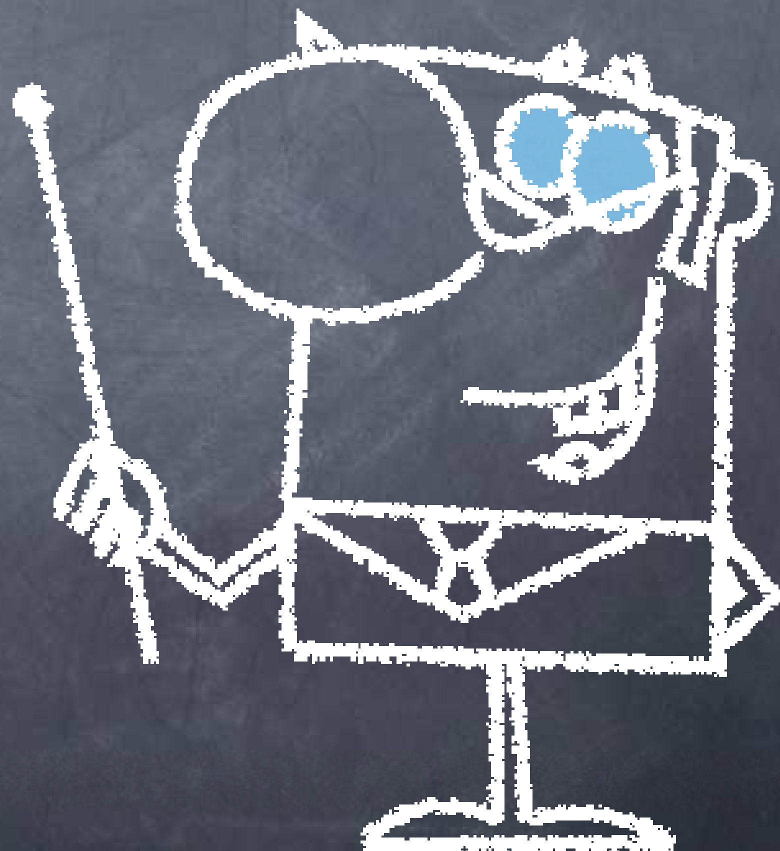
The computer you're working on stores one bit of data in about 1 million atoms. With atomic-scale magnetic memory, 12 is the new million.


What does this mean for potential storage density?
100x
Atomic-scale magnetic memory is potentially 100x denser than today's hard disk drive technology.
Today's Memory Technolgy
Atomic-Scale Magnetic Memory
0 1 0 1 0 0 1

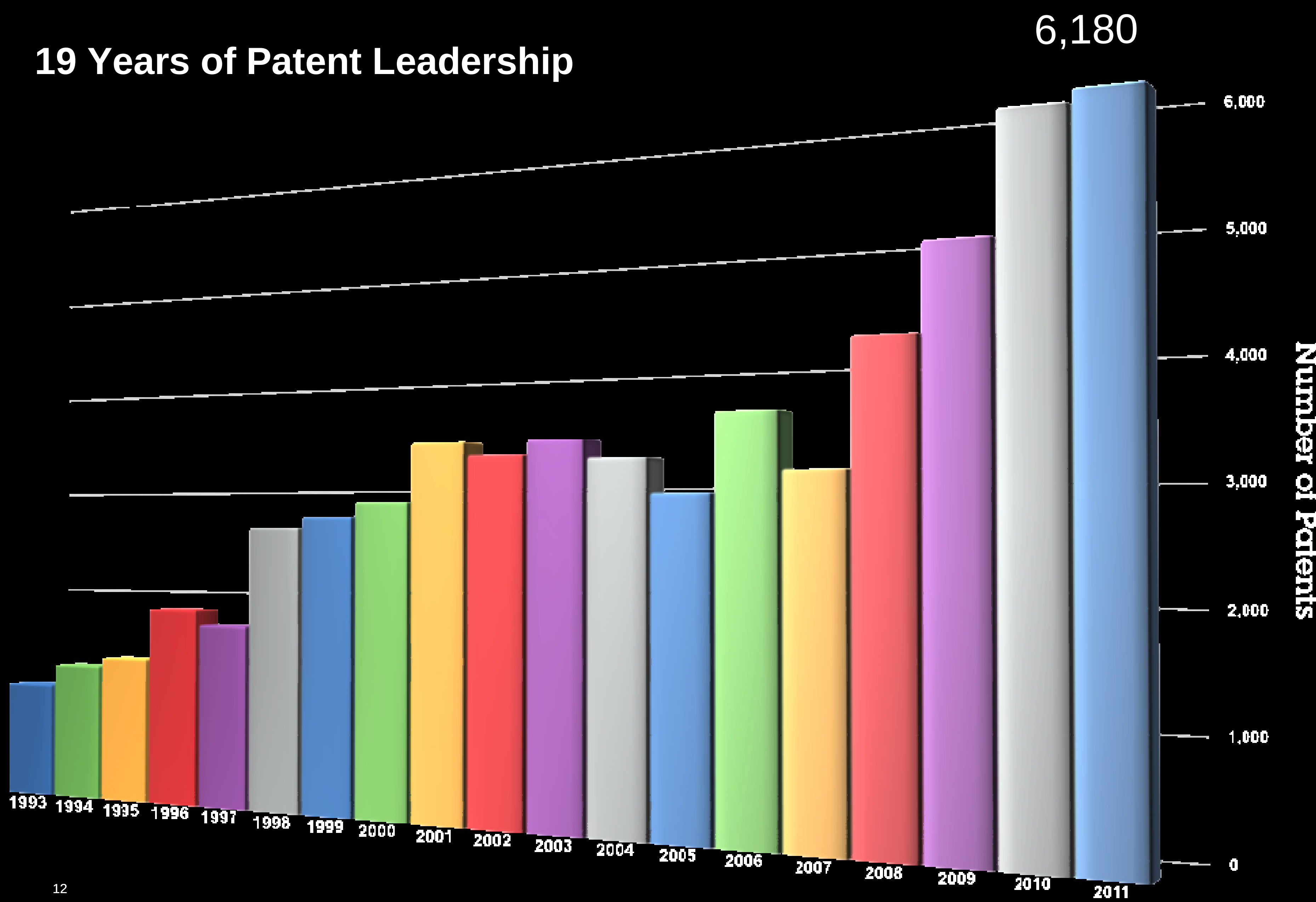

Atomic-scale magnetic memory
aerial density is potentially:
100x
denser than
today's hard disk
drive technology
160x
denser than
NAND Flash
417x
denser than
DRAM
10,000x
denser than
SRAM

How it works

Ferromagnets have worked well for magnetic data storage but a major obstacle for miniaturizing this down to atomic dimensions is the interaction of neighboring bits with each other. The magnetization of one magnetic bit can strongly affect that of its neighbor as a result of its magnetic field. The scientists at IBM used a scanning tunneling microscope to atomically engineer a grouping of twelve antiferromagnetically coupled atoms that stored a bit of data for hours at low temperatures.



19 Years of Patent Leadership



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