Next up: 'The Nano Lisa'

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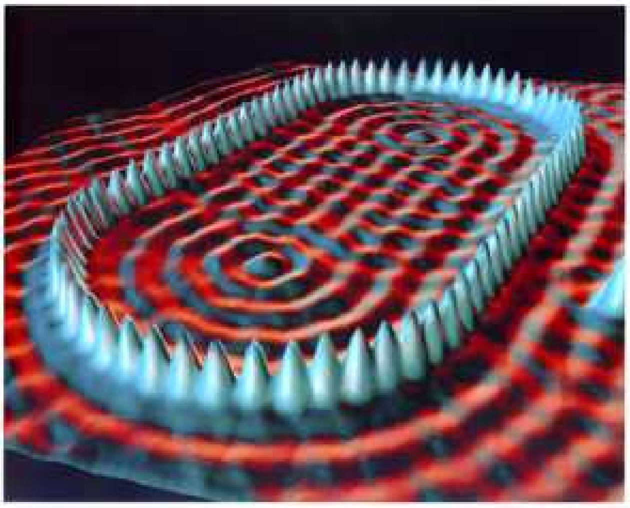

This atomic-sized image was created by IBM researchers and is part of an exhibit opening today at the United States Patent and Trademark Museum in Alexandria, Virginia. The image was made using scanning-tunneling microscope technology as part of an effort to pave the way for circuits made from atomic and molecular components. Credit: IBM

Two atomic-sized images resulting from scientific work at IBM's labs are part of an art exhibit opening today at the United States Patent and Trademark Museum in Alexandria, Virginia.

While experimenting with materials that might make up future computer chips and storage components, IBM scientists built beautiful structures out of individual atoms using a specialized microscope whose invention won two IBMers a Nobel Prize in 1986.

Two of the images created using IBM's low temperature Scanning Tunneling Microscope (STM) are featured in The Art of Invention, an exhibit co-created by The National Inventors Hall of Fame Foundation (NIHFF) and the United States Patent and Trademark Office (USPTO) for the USPTO Museum in Alexandria, VA. The exhibit opens today, highlighting more than 70 works of art that have emerged from inventions, patents and trademarks, and will be on view for one year.

In 1981, Gerd Binnig and Heinrich Rohrer of IBM's Zurich Research Laboratory in Switzerland developed a powerful new microscopy technique to visualize individual atoms on a metal or semiconductor surface. For this achievement, they shared the 1986 Nobel Prize in physics. Later, IBM Researchers used the STM to position individual atoms for the first time, spelling out "I-B-M" in Xenon atoms.

Now, some twenty years after the Nobel Prize was awarded, public fascination with the STM continues as people are amazed by the ability to image and manipulate the world on such a small scale. And IBM researchers continue using STM technology in an effort to pave the way for circuits made from atomic and molecular components. Such circuits could enable computers with hundreds of thousands of times more logic elements on a chip than today's state-of-the-art technology. That, in turn, could lead to smaller, faster, lower-power and even more portable computers and devices nobody has even imagined yet.

The two images on display are the result of work from IBM's labs in the early 1990s, including:

The Quantum Corral

Driven by their discovery of the STM's ability to image the wave patterns (more precisely known as the "density distribution") of electrons on the surface of a metal, IBM Scientists Michael Crommie, Chris Lutz and Don Eigler (the "artists") were compelled to take the next step -- building an electron's "quantum state" to their own design.

Here they have positioned 48 iron atoms into a circular ring in order to "corral" some of the surface electrons and force them into quantum states determined by the circular corral walls. The ripples in the ring of atoms are the wave patterns of some of the electrons that were trapped in the corral.

The mechanics-turned-artists were delighted to discover that they could quantitatively account for the behavior of the electrons by solving a classic problem in quantum mechanics -- a particle in a hard-wall box -- paving the way for building functional quantum states for potential use in future computer chips and other areas.

The Search For Quantum Chaos

Intrigued with the possibility of observing "Quantum Chaos," the artists -- IBM "quantum mechanics" Michael Crommie, Chris Lutz and Don Eigler -- constructed a stadium shaped Quantum Corral in the hope of observing a signature of Quantum Chaos known as "scarring."

Scarring of the electron wave patterns would lead to a build-up of waves along the classically periodic orbits of the stadium. No scarring was observed. The reason is quantum corrals are akin to any resonant structure, for instance, a bell. But this "quantum" bell doesn't ring very well, in fact it makes more of a thud than a ring.

To view even more images created using the STM, please visit www.almaden.ibm.com/vis/stm/gallery.html

Source: IBM