

The Challenge of Nanotechnology

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Sources: <http://www.almaden.ibm.com/vis/stm/corral.html>
Wikipedia

Origins of Nanotechnology

Richard Feynman's provocative 1959 talk There's Plenty of Room at the Bottom.

The term nanotechnology was coined by the Tokyo Science University Professor Norio Taniguchi in 1974 to describe the precision manufacture of materials with nanometer tolerances.

The term was unknowingly appropriated by Drexler in his 1986 book *Engines of Creation: The Coming Era of Nanotechnology* to describe what later became known as molecular nanotechnology (MNT).

Origins of Nanotechnology



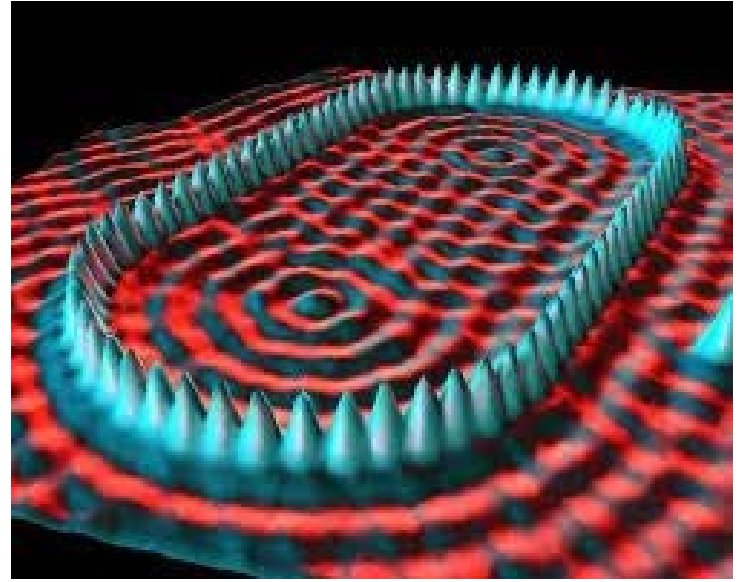
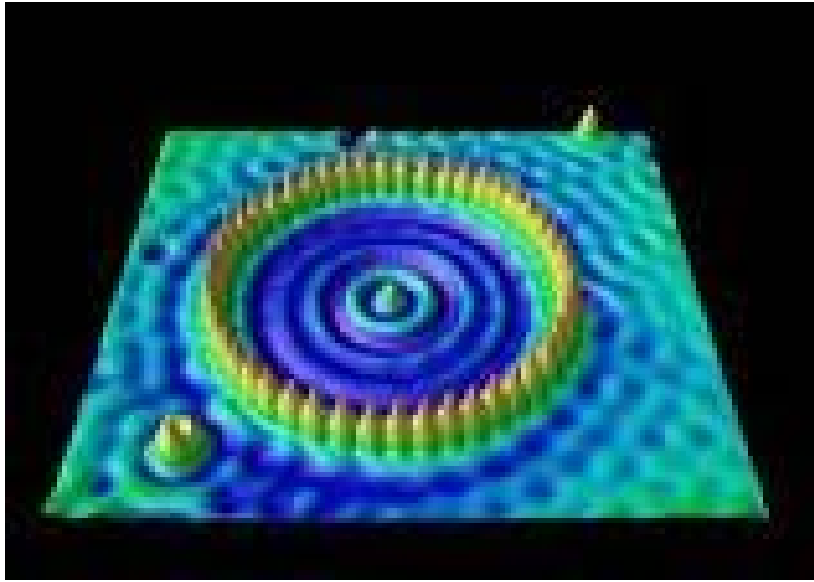
Eric Drexler

Nanosystems: Molecular Machinery Manufacturing and Computation (1992), which received the [Association of American Publishers](#) award for Best **Computer Science** Book of 1992.

Drexler introduced the idea of a creating a self-replicating nanodevice which then produced an infinite number of copies of itself .

He also coined the term [grey goo!](#)

The Beginning of the Dream



The quantum corral was demonstrated in 1993 by Lutz, [Eigler](#), and [Crommie](#)^[1] using an [elliptical](#) ring of [iron](#) atoms on a [copper](#) surface. The [ferromagnetic](#) iron atoms reflected the surface electrons of the copper inside the ring into a wave pattern, as predicted by the theory of [quantum mechanics](#).

[1] *Science* **262** (5131): 218–20

The Glib Extrapolation

‘IBM scientists are hoping to use quantum mirages to construct atomic scale processors in the future’.

BUT

The Challenges

The corral structures are not stable to thermal cycling!

Moving each Fe atom to create the quantum structures takes minutes!

A modern computer chip contains many billions of devices!

10s of billions of computer chips are made each year!

Nanotechnology requires stable atomic scale devices made using fast, quality-assured fabrication techniques – it is nothing to do with a single device made in a research laboratory.