

Exhibit 3

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The new chip that will let an iPod store 500,000 songs

A new storage technology will pave the way for MP3 players and other gadgets to store a hundred times more information

Jonathan Richards

Mobile phones, iPods and other consumer devices may soon be able to hold a hundred times more information than they do at present thanks to a breakthrough in storage technology.

Scientists at IBM say they have developed a new type of digital storage which would enable a device such as an MP3 player to store about half a million songs - or 3,500 films - and cost far less to produce.

In a paper published in the current issue of *Science*, a team at the company's research centre in San Jose, California, said that devices which use the new technology would require much less power, would run on a single battery charge for "weeks at a time", and would last for decades.

So-called 'racetrack' memory uses the 'spin' of an electron to store data, and can operate far more quickly than regular hard drives.

Like flash memory - the most advanced type of memory for small devices such as mobile phones - it has no moving parts, meaning that the problems associated with mechanical reliability are dramatically reduced.

Unlike flash, however, it can 'write data' - or store information - extremely quickly, and does not have the 'wear out' mechanism that means flash memory drives can only be used a few thousand times before they wear out.

"The promise of racetrack memory - for example, the ability to carry massive amounts of information in your pocket - could unleash creativity leading to devices and applications that nobody has imagined yet," Stuart Parkin, the IBM fellow who led the research, said.

At present the most capacious iPod - the 160GB iPod Classic - can store 40,000 songs.

Dr Parkin said that racetrack memory could lead to the development of 'three-dimensional micro-electronics', breaking with the tradition of scientists trying to fit an ever greater number on transistors on an ultra-thin piece of silicon shaped like a wafer.

"The combination of extraordinarily interesting physics and spintronic materials engineering, one atomic layer at a time, continues to be highly challenging and very rewarding," he said.

The breakthrough also potentially paves the way for a radical re-writing of one of the most basic laws of computing - so-called Moore's Law, the maxim coined in 1965 by the co-founder of Intel, Gordon Moore, according to which computing speed doubles roughly every two years.

In September, Mr Moore himself said that the continued application of his law would come up against some fundamental laws of physics by about 2020 - laws which forced Mr Parkin and his team to rethink how silicon chips operate.

For nearly fifty years, scientists have explored the possibility of storing information inside the walls that exist between magnetic domains, but to date manipulating such walls has been too expensive and complicated to achieve significant results.



In his paper, Mr Parkin describes a milestone in which he and his team were able to store data in columns of magnetic material arranged on the surface of a silicon wafer. The information moves around the columns at high speed, giving the technology its racetrack name.

IBM said the technology was still "exploratory" at this stage, but that it expected devices which used it to be on the market within ten years.

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