Magnetic fields created using nanotechnology could make computers up to 500 times faster

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Magnetic fields created using nanotechnology could make computers up to 500 times more powerful if new research is successful.

The University of Bath is to lead an international £555,000 three-year project to develop a system which could cut out the need for wiring to carry electric currents in silicon chips.

Computers double in power every 18 months or so as scientists and engineers develop ways to make silicon chips smaller. But in the next few years they will hit a limit imposed by the need to use electric wiring, which weakens signals sent between computer components at high speed.

The new research project could produce a way of carrying electric signal without the need for wiring. Wi fi internet systems and mobile phones use wireless technology now, but the electronics that create and use wireless signals are too large to be used within individual microchips successfully.

The research project, which involves four universities in the UK and a university and research centre in Belgium and France, will look at ways of producing microwave energy on a small scale by firing electrons into magnetic fields produced in semi-conductors that are only a few atoms wide and are layered with magnets.

The process, called inverse electron spin resonance, uses the magnetic field to deflect electrons and to modify their magnetic direction. This creates oscillations of the electrons which makes them produce microwave energy. This can then be used to broadcast electric signals in free space without the weakening caused by wires.

The possibility of using the special semi-conductors in this way was first pointed out by Dr Alain Nogaret, of the University of Bath's Department of Physics, in an important scientific paper in 2005 (Electrically Induced Raman Emission from Planar Spin Oscillator, in Physical Review Letters). The latest research is the first attempt to turn theory into practice.

"The work could be very important for the creation of faster, more powerful computers," said Dr Nogaret.

"We can only go so far in getting more power from silicon chips by shrinking their components – conventional technology is already reaching the physical limits of materials it uses, such as copper wiring, and its evolution will come to a halt.

"But if this research is successful, it could make computers with wireless semi-conductors a possibility within five or ten years of the end of the project. Then computers could be made anything from 200 to 500 times quicker and still be the same size.

"This research may also improve the accuracy and speed of medical diagnostic by gathering data from health monitoring sensors. The microwave emitters are small enough to be integrated on portable biological sensors which feed information out on faulty biological processes.

"The research is not only practical, but beautiful in its theoretical simplicity, which is one of the big attractions for the physicists working on it."

The project is the only one which aims to create wireless emitters and receivers that fit on semi-conductor wafers, where individual devices are one ten thousandth of a millimetre in size.

It will also allow the creation of integrated circuits which will still continue to work properly even if some of its connections fail – the system can be programmed to reroute itself so that it can continue working. At present a failure in a connecting wire can put an integrated circuit out of action.

In the manufacture of today's integrated circuits there is no room for error, and so manufacturers must spend large amounts of money to build dust-free clean rooms. The advantage of the new more flexible system is that only 95 per cent or so of the electronic components would need to work for the chip to work properly. Such chips would be many times cheaper to produce.

Source: University of Bath

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