Single-atom transistor developed

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Paris - Researchers in Australia said on Sunday they had made with pinpoint accuracy a working transistor consisting of a single atom, marking a major stride towards next-generation computing.

The device comprises a single phosphorus atom, etched into a silicon bed, with "gates" to control electrical flow and metallic contacts that are also on the atomic scale.

"Our group has proved that it is really possible to position one phosphorus atom in a silicon environment, exactly as we need it, with near-atomic precision, and at the same time (incorporate) gates," said lead scientist Martin Fuechsle.

Transistors, which switch or amplify electrical flow, are the building blocks of computer chips.

For more than 50 years, the semi-conductor industry has been upholding Moore's Law, the celebrated prediction by Intel pioneer Gordon Moore that the number of transistors on a chip would double every 18 months or so.

But the astonishing run of success could hit a wall by the end of this decade without a breakthrough in miniaturising transistors.

The team made the transistor from a silicon crystal that was placed in a vacuum.

To etch it, they used a device called a scanning tunnelling microscope, which is able to see atoms and manipulate them using a super-fine metal tip.

Proof-of-principle

Phosphorus atoms were deposited in a nano-scale "trench," covered with an inert layer of hydrogen, and the unwanted ones were then weeded out. A chemical reaction welded the "transistor" atom to the silicon surface.

The minute device operates in ultra-cold temperatures provided by liquid helium.

It is not a finished product but proof-of-principle, designed to show that single-atom devices can be built and controlled.

Scientist have made atomic-scale transistors in the past, but through a chance find rather than by design, said Michelle Simmons, director of the Centre for Quantum Computation and Communication at the University of New South Wales, where the work was carried out.

"But this device is perfect," she said.

"This is the first time anyone has shown control of a single atom in a substrate [chip base] with this level of precise accuracy."

The research is reported in the specialist journal Nature Nanotechnology.

- AFP