Nano radios for microchips

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Radios the size of bacteria employing nano-magnets could help microchips wirelessly communicate with one another, experts told UPI's Nano World.

"Wireless connections between microchips could offer possible benefits in terms of reduced system complexity and easier and less costly manufacturing requirements," said researcher Fred Mancoff, a magnetoelectronics-device scientist at chipmaker Freescale Semiconductor in Chandler, Ariz.

"One known problem that is out there is the speed bottleneck due to wired interconnects in semiconductor electronics. These devices that we are studying could be a valid solution for nano-sized transmitters and receivers for wireless communication between chips in a computer or even within a chip itself," said researcher Shehzu Kaka, a physicist formerly at the National Institute of Standards and Technology in Boulder, Colo., and now at Seagate Technology in Scotts Valley, Calif. "Chipmakers like Intel are pursuing wireless optical communications between chips, and our technology could be an inexpensive and perhaps more effective alternative."

Two research teams, one led by NIST, the other at Freescale, experimented with magnets each 50 to 80 nanometers wide. Applying electrical current to such magnets causes their poles to rotate. These oscillations then can be employed for radio signals.

The scientists wanted to synchronize the nano-magnet oscillations, making sure they all swung together in step. When the oscillations are synchronized, their combined output can be much greater than the sum of their parts.

Both research teams independently found when the magnets sit about 200 nanometers to 500 nanometers apart, they synchronize naturally, much as two pendulums will come into synchrony if they both are attached to the same support.

The result: The synchronized magnets generate a single signal with twice the intensity of an unsynchronized pair of magnets. The scientists report their findings in the Sept. 15 issue of the journal Nature.

"These devices are fully compatible with standard semiconductor manufacturing technology," Mancoff said.

In principle, this synchronization and the resulting amplification in output power should work not just with two nano-magnets, but also with series of them. Arrays of 10 nano-magnets could produce and receive microwatt signals, enough to serve in transmitters and receivers in cell phones, radar and microchips.

"Larger arrays, and higher powers are the clear next step for applications," said researcher Matthew Pufall, a NIST physicist. However, "from a basic research point of view, we need to understand the nature of the interaction between oscillators."

"A more practical issue involves the engineering of such a device into a working chip, which will be anything but trivial. But then, the researchers are from Freescale and NIST. They definitely have the resources and the know-how," said physicist Raj Mohanty of Boston University.