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UA Researchers Make Positive Spin In Computing

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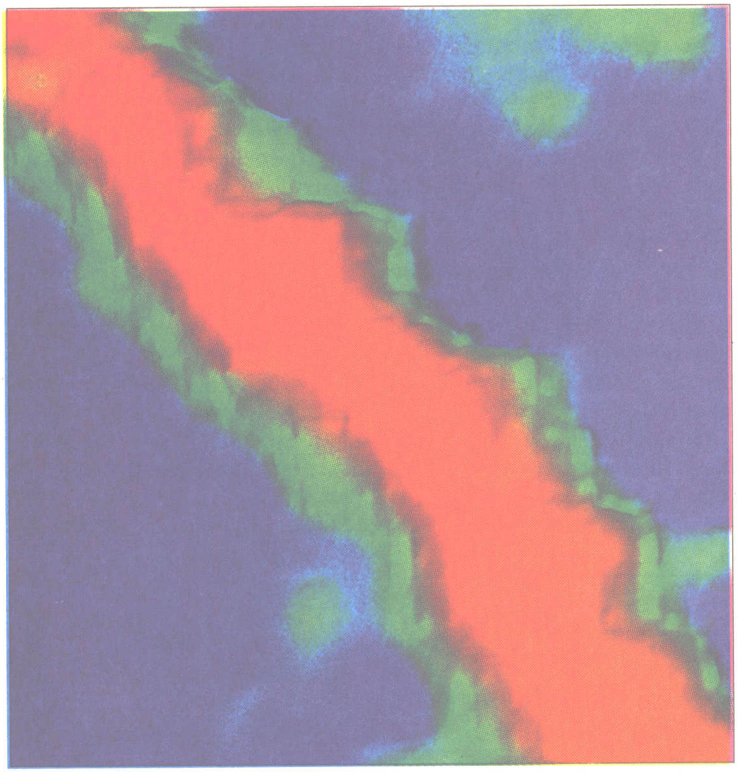

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A computer-enhanced image generated from data provided by a scanning, tunneling microscope shows where the spins of electrons are scattered in red, an area that is about 10 nanometers wide. The blue area shows where the electron spins are not scattered.

FAYETTEVILLE — Researchers at the University of Arkansas say they've made an advance that could one day help make computers smaller by improving a method used to place spin-polarized electrons onto a superconducting surface.

Vincent P. LaBella, a research professor, said he and a team of researchers have been studying how best to transfer the particles for almost three years and have now done it with greater efficiency and at a higher temperature than ever before.

The achievement is significant, LaBella said, because of the use spinning electrons could have in electronic devices. Whereas modern electronics use only the charge of electrons in their operation — positive or negative, on or off — spinning electrons can encompass a greater range of values designated by their orientation in space.

That greater range could one day result in devices that can perform more operations with fewer parts, he said. Such devices would be smaller and faster. "You can make one device that can have many functions instead of ... a single function," he said.

Excitement over the possibility is fueled by the general belief that technology used today to make smaller and faster devices will reach its limit in about 10 years, he said.

The field is called spintronics, LaBella said. It was first suggested about 10 years ago but has only begun to draw the serious attention of scientists.

UA researchers were able to inject spin-polarized electrons onto a semiconductor with an efficiency of 92 percent at a temperature of 100 degrees Kelvin. The temperature is most significant, LaBella said, because such efficiencies had previously only been reached at much lower temperatures. The temperature used in the UA experiment is in the range of liquid nitrogen, which is a commonly used substance in the semiconductor industry, he said.

The researchers used a magnetic nickel-scanning, tunneling microscope tip to inject electrons that were 100 percent oriented in one direction. They were injected onto a gallium arsenide surface. The researchers used polarization measurements to determine whether the electrons retained their spin.

The researchers also discovered one of the mechanisms that have prevented other researchers from successfully performing the injection in the past. They found that areas where the atoms do not form an even surface cause spin disruption. The material they used has few breaks in it.

The team of researchers on the project included LaBella, D.W. Bullock, Z. Ding., C. Emery, A. Venkatesan, William F. "Lin" Oliver, Greg Salamo and Paul Thibado from the UA. M. Mortazavi of the University of Arkansas at Pine Bluff also participated. The team reports its findings in today's issue of *Science*. The research was supported by the National Science Foundation and the Office of Naval Research.