IBM, Stanford Collaborate on World-Class Spintronics Research

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SAN JOSE, Calif. -- April 26, 2004 -- IBM and Stanford University are joining forces on the advanced research and creation of new high-performance, low-power electronics in the emerging field of nanotechnology called "spintronics." To formalize the effort, scientists at IBM's Almaden Research Center and Stanford University today announced the formation of the IBM-Stanford Spintronic Science and Applications Center (SpinAps, for short).

"SpinAps researchers will work to create breakthroughs that could revolutionize the electronics industry, just as the transistor did 50 years ago," said Dr. Robert Morris, IBM VP and director of the Almaden Research Center.

Since its inception, the microelectronics industry has progressed by shrinking circuitry. This approach is becoming much more difficult, time-consuming and expensive, and there is now a worldwide search for new ideas that can deliver improved performance in smaller sizes than is possible with conventional designs. Spintronics is an exciting possibility because controlling the spin -- or magnetic orientation -- of electrons within tiny structures made of ultra-thin layers can produce such advantageous properties as low-power switching and nonvolatile information storage.

"The SpinAps scientists will dramatically hasten progress from theoretical concept to experimental verification and from new-device ideas to product prototypes," said Stanford Dean of Engineering Dr.

James D. Plummer.

About Spintronics

Electron spin is a quantum property that has two possible states, either "up" or "down." Aligning spins in a material creates magnetism. Moreover, magnetic fields affect the passage of "up" and "down" electrons differently. Understanding and controlling this property is central to creating a whole new breed of electronic properties.
In fact, the promise of this technology was demonstrated earlier by IBM. The first mass-produced spintronic device has already revolutionized the hard-disk drive industry. Introduced in 1997, the giant magnetoresistive (GMR) head, developed at the IBM Almaden lab, is a super-sensitive magnetic-field sensor that enabled a 40-fold increase in data density over the past seven years. Another multilayered spintronic structure is at the heart of the high-speed, nonvolatile magnetic random access memory (MRAM), currently being developed by a handful of companies.

SpinAps scientists envision creating new materials and devices with entirely new capabilities -- such as reconfigurable logic devices, room-temperature superconductors and quantum computers -- that would create dramatically new computational paradigms. Commercial products from SpinAps research are not expected for at least five years.

SpinAps scientists
SpinAps will be directed by IBM Fellow Dr. Stuart Parkin and Stanford professors Dr. James S. Harris (Electrical Engineering, Applied Physics and Materials Science) and Dr. Shoucheng Zhang (Physics and Applied Physics). These individuals bring to the Center very different but complementary backgrounds, expertise and perspectives.
Parkin is a pioneer in the science and application of spintronic materials. His discovery of oscillatory interlayer coupling in magnetic multilayers led to IBM's development of the GMR head. He also proposed using

spintronic magnetic tunnel junction elements in MRAM. Parkin's group has unique capabilities for rapidly preparing a wide variety of magnetic thin-film materials.

Harris is an expert in developing new and artificially structured materials by molecular beam epitaxy and applying them in useful electronic devices. His lab has several machines for making semiconducting materials with exquisite precision. He will focus on creating ultra-thin multilayered semiconducting building blocks for new spin-based devices.

Zhang is a theoretician who has made a number of contributions to understanding superconducting, magnetic and correlated electron phenomena in solids. For example, while Ohm's Law describes the inevitable dissipation of power as charge currents flow, a recent generalized theory by Zhang and colleagues predicts that generating a spin current by an electric field can be reversible and non-dissipative. SpinAps Center researchers will attempt to demonstrate this exciting possibility.

Research at the SpinAps Center will involve about a half-dozen Stanford professors, a similar number of IBM scientists, up to 10 graduate students working at both IBM Almaden and Stanford, three or more postdoctoral researchers and two or more visiting faculty. Initial funding for the Center is from IBM and Stanford. Participating scientists' research projects are also funded by agencies such as the Defense Advanced Research Projects Agency, the U.S. Department of Energy and the National Science Foundation. The center will begin operation immediately.

SpinAps is the latest example of IBM's long-standing tradition of partnering with world-class universities to help shape the future of technology and of learning. IBM and Stanford are increasing the depth of study and accelerating the practical applications of academic research while providing invaluable opportunities and experiences for university scientists and students.

More information: [IBM Press Room]