as a "quantum corral," reflecting the copper's surface electrons within the ring into a wave pattern predicted by quantum mechanics.

The size and shape of the elliptical corral determine its quantum states—the energy and spatial distribution of the confined electrons. The scientists used a quantum state that concentrated large electron densities at each focus point of the elliptical corral. When the scientists placed an atom of magnetic cobalt at one focus, a mirage appeared at the other focus: the same electronic states in the surface electrons surrounding the cobalt atom were detected even though no magnetic atom was actually there. The intensity of the mirage is about one-third of the intensity around the cobalt atom. See Figure.

"We have become quantum mechanics, engineering and exploring the properties of quantum states," Eigler said. "We're paving the way for the future nanotechnicians." The operation of the quantum mirage is similar to how light or sound waves can be focused to a single spot by optical lenses, mirrors, parabolic reflectors, or "whisper spots" in buildings.

"The quantum mirage technique permits us to do some very interesting scientific experiments such as remotely probing atoms and molecules, studying the origins of magnetism at the atomic level, and ultimately manipulating individual electron or nuclear spins," said Manoharan." But we must make significant improvements before this method becomes useful in actual circuits. Making each ellipse with the STM is currently impracticably slow. They would have to be easily and rapidly produced, connections to other components would also have to be devised, and a rapid and power-efficient way to modulate the available quantum states would need to be developed."

The researchers have built and tested elliptical corrals up to 20 nm long with the width as little as half that. The electron density and intensity of the mirage depends on the quantum state, not the distance between the foci.

APS Division of Materials Physics Names 2000 Award Recipients and Fellows

The American Physical Society's (APS) Division of Materials Physics (DMP) has awarded the 2000 James C. McGroddy Prize to **M. Brian Maple**, the Bernd T. Matthias Professor of Physics at the University of California—San Diego, for the synthesis of novel *d* and *f* electron materials and for the study of their physics. This prize recognizes and encourages outstanding achievement in the science and application of new materials. Maple received an AB degree in mathematics and a BS degree in physics from San Diego State University (SDSU) in 1963, and a PhD degree in physics from UCSD in 1969. His research interests include superconductivity, magnetism, strongly correlated electron phenomena, high-pressure physics, and surface science. Maple is a Fellow of APS and the American Association for the Advancement of Science and served as chair of the APS Division of Condensed Matter Physics in 1987. He has served on advisory committees for seven national laboratories and has served on review committees for the Department of Energy, the National Science Foundation, and numerous universities. He has received many honors and awards.

Bertram Batlogg of Bell Labs, Lucent Technologies, received the 2000 David

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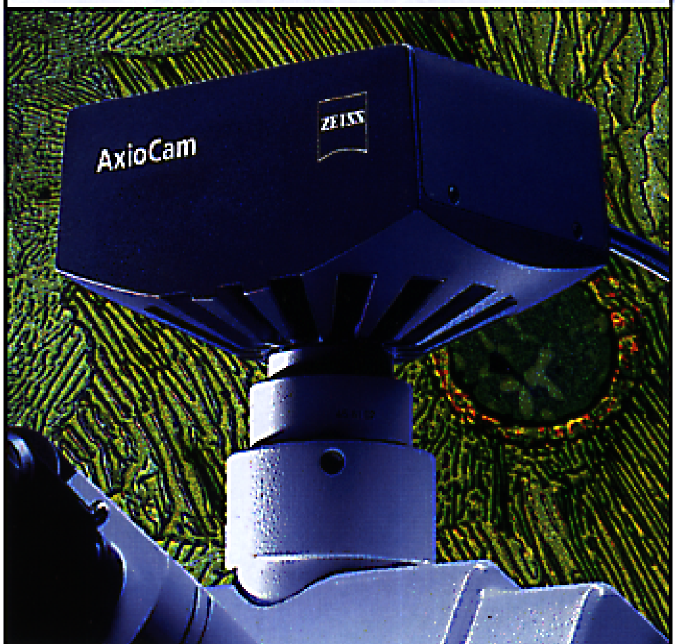

Adler Lectureship Award for his contributions to materials physics, including superconductivity, colossal magnetoresistance, heavy fermions, and organic semiconductors, and his excellence in lecturing on materials science and industrial research to both scientific and lay audiences. This award recognizes outstanding contributors to the field of materials physics, who are noted for the quality of their research, review articles, and lecturing. Batlogg received his higher education at ETH in Zurich, Switzerland, where he earned a diploma in physics in 1974 and a doctorate in natural sciences in 1979. He then joined AT&T Bell Laboratories to work on materials-based condensed-matter physics in the Physical Sciences Research Division. Since 1986, he has been head of the Materials Physics Research department, and he served as a director of the Consortium for Superconducting Electronics (1990–1996) that developed superconducting microwave filter systems for wireless communication. Batlogg's research has been focused mainly on highly correlated electron systems, including mixed-valence rare-earth compounds, heavy fermion actinide compounds with magnetic or superconducting ground states, bismuthate superconductors, cuprate high-temperature superconductors, and colossal magnetoresistance manganites. Batlogg is a Fellow of APS, has received numerous awards, and is a member of several scientific societies, including the Materials Research Society.

DMP has sponsored the following APS Fellows for 2000: **Norman Charles Bartelt** (Sandia National Laboratories), for his pioneering work on the theory of thermal fluctuations and dynamic surface structure; **Peter John Collings** (Swarthmore College), for his fundamental work in liquid-crystal research, particularly the optical properties of chiral liquid crystals and his leadership in the area of undergraduate education; **Paul Henry Fuoss** (AT&T Laboratories), for pioneering contributions to the science of x-ray scattering, including anomalous scattering for amorphous materials, grazing incident scattering to study monolayers on surfaces and *in situ* scattering during chemical vapor deposition; **Gene Emery Ice** (Oak Ridge National Laboratory), for advances in x-ray resonant scattering techniques to study the many body problems of atomic electron rearrangements, local atomic disorder, and magnetism, and for innovations in synchrotron x-ray optics; **Purusottam Jena** (Virginia Commonwealth University), for his pioneering contributions to the understanding of electronic structure, equilibrium geometries, stability, and electronic and magnetic properties of atomic clusters; **Jacqueline Krim** (North Carolina State University), for her pioneering contributions to surface science and nanotribology, especially studies of kinetic roughening and the development of the quartz-crystal microbalance as a major tool for probing atomic-scale friction; **Chun-Keung Loong** (Argonne National Laboratory), for pioneering work in the development of chopper spectrometers at spallation neutron sources and their exploitation for important problems in materials physics and applied materials science; **William T. Oosterhuis** (Department of Energy), for his steady support of materials condensed-matter physics and large national user facilities; **Colin E.C. Wood** (Office of Naval Research), for pioneering and original contributions to the crystal growth of III-V materials by molecular-beam epitaxy, including the discovery of reflection high-energy electron diffraction (RHEED) oscillation, delta-doping, and low-temperature GaAs; and **Alex Zunger** (National Renewable Energy Laboratory), for his work on the theoretical basis for first-principles electronic structure theory of materials, and for its imaginative use in the advancement of knowledge of alloys, nanostructures, and prediction of new materials. □

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