demanded three-quarters and blue agents one-quarter of the total.

At the end of a trial that began with a different array of random strategies, yellows shared the pot evenly among themselves, while individual blues made either consistently high or low demands of fellow blues, often yielding little or nothing from their exchanges. In mixed pairs, yellows routinely made high demands that were balanced out by low demands from blues.

Overall, this situation appears comparable to "a divided blue underclass oppressed by a unified yellow elite," Young theorized at the recent symposium. He plans to study how the social order of simulated groups might change after, say, a few renegade blue agents hike their demands in interactions with yellow agents.

The idea that collective preferences and moral codes form as individuals adjust their decisions to others' behavior is not new, but until recently it has been relegated to the fringes of economics research, remarks Joseph Harrington, an economist at Johns Hopkins University in Baltimore, Md.

"Now there seem to be a lot more open minds toward alternative economic theories," he says. □

Physics

From a meeting in Los Angeles of the American Physical Society

Chemistry smooths silicon surface

To the naked eye, a silicon wafer looks as shiny as a mirror, but under a microscope, its surface resembles the pitted, cratered landscape of the moon. Treating the wafer with ammonium fluoride can smooth out that roughness, leaving the surface perfectly flat, says Melissa A. Hines of Cornell University.

In the multistep chip-manufacturing process, "half of the stages involve cleaning the wafer off," says Hines. She and her colleagues are trying to understand why some chemicals used for cleaning leave the surface flat, while others damage it.

Ammonium fluoride, an acid, etches away jagged kinks on one face of the crystal, "unzipping" lines of atoms from the edges of the overlapping silicon layers. Within a minute, the layers smooth out, forming large, flat steps only one atom high.

Steps only four atoms high would halve the mobility of electrons in very thin components, says Hines, so atomic-level control can improve silicon's performance. By 2010, scientists will want to pack billions of transistors one-fourth the size of current ones onto a computer chip, says Yves J. Chabal of Bell Labs Lucent Technologies in Murray Hill, N.J.

Hines and her colleagues hope to apply their technique to other faces of silicon crystals, including the one used as the foundation of computer chips. —*C.W.*

Silk foam eases structure studies

Shi-Juang He and her colleagues at the University of Massachusetts at Amherst have found a new way to study the structure of silk. By blowing bubbles of nitrogen gas into a solution of silk proteins, they generate a foam that they examine using electron diffraction. This technique, says He, provides insight into a form of silk whose structure has remained elusive despite nearly 50 years of study.

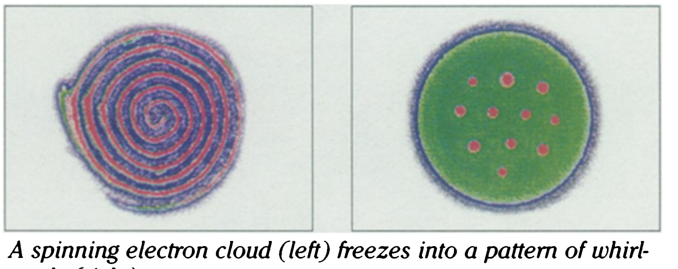
Silk fiber starts out as a liquid solution of protein in the gland of the silkworm. The worm spins out a thin strand of the solution, which dries into a strong, crystalline fiber. Scientists would like to know how silk solidifies from the poorly understood wet form stored inside the gland to the well-characterized fiber.

From their studies, the Amherst researchers propose that the protein in the silkworm gland has a repeating sequence of six amino acids. —*C.W.*

Electrons swirl into crystal array

Spinning a cloud of electrons within a superconducting magnet creates groups of whirlpools that "cool" into geometric patterns, says C. Fred Driscoll of the University of California, San Diego in La Jolla. He and his colleagues use this system to study turbulence, the seemingly random churning that occurs in fluids ranging from storm winds to cups of coffee.

However, "these whirlpools are not random at all," Driscoll notes. Through experiments and computer simulations, the San Diego team is trying to determine how and why these patterns of vortices form. —*C.W.*



Driscoll/UCSD

A spinning electron cloud (left) freezes into a pattern of whirlpools (right).