U.S. funding boosts accelerator project

Slated for completion in the year 2005, the Large Hadron Collider will send protons into head-on collisions at higher energies than any previously achieved.

This week, U.S. officials agreed to help pay for the new particle accelerator, now under construction at the European Laboratory for Particle Physics (CERN) near Geneva. The agreement calls for a contribution of materials and services worth $531 million over 8 years, which would cover about a tenth of the collider's estimated cost.

The decision to participate in the project marks the first time that the U.S. government has agreed to contribute significantly to the construction of an accelerator outside the United States. "Increasingly in fundamental research, no country can go it alone," says John H. Gibbons, the president's assistant for science and technology. "International collaborations have become an integral part of all our domestic science programs."

The U.S. contribution will speed completion of the collider by 3 years, says CERN's Christopher Llewellyn Smith.

Several hundred U.S. physicists have already formed collaborative groups to participate in designing and building the massive detectors, each about five stories tall, that will record particle paths and energies (SN: 4/6/96, p. 214). Eventually, a quarter of the U.S. experimental high-energy physics community may end up doing research at the facility, according to the Department of Energy.

Under the terms of the agreement, the Energy Department pledges to provide materials and services valued at $200 million for the accelerator. Another $331 million in components will be contributed to the detector effort.

The new collider is being built inside CERN's existing circular tunnel, about 27 kilometers in circumference, which originally housed an electron-positron collider. The design calls for radio-frequency energy to accelerate two beams of protons to nearly the speed of light. Powerful superconducting magnets would guide the beams around the ring.

When the collider's two adjacent proton beams, circulating in opposite directions, are brought together, protons will smash into each other at a combined energy of 14 teraelectronvolts. That's seven times the collision energy possible at the Fermi National Accelerator Laboratory's Tevatron collider, located near Batavia, Ill.

The CERN collider's energy should be high enough for researchers to investigate such questions as what physical mechanism or process determines the masses of the known fundamental particles. —*I. Peterson*

Butterfly sparkle characterized for chips

Many tropical butterfly species are iridescent: Their wings flash bright, shimmery hues that arise not from pigments but from the way the wings reflect light. Although the insects use their striking colors to lure mates and confuse predators, their iridescence has also caught the attention of a group of engineers.

Researchers at Tufts University in Medford, Mass., are studying the optical properties of butterfly wings to determine how they collect and distribute heat. Ultimately, they hope to apply what they learn from the insects to computer chip manufacturing and the assembly of microelectromechanical systems (SN: 7/26/97, p. 62). Haruna Tada presented the group's latest results last week at a meeting of the Materials Research Society in Boston.

The Tufts researchers compared the iridescent wings of two butterfly species, the Brazilian *Morpho menelaus* and the Indonesian *Papilio blumei*. The wings consist of overlapping scales made of chitin, a carbohydrate also found in crustacean shells and insect exoskeletons (SN: 7/31/93, p. 72).

The complex structure of the scales determines their color. Each scale contains thin layers of chitin and air, which reflect light in such a way that one wavelength emerges while the others are canceled out (SN: 11/4/95, p. 296).

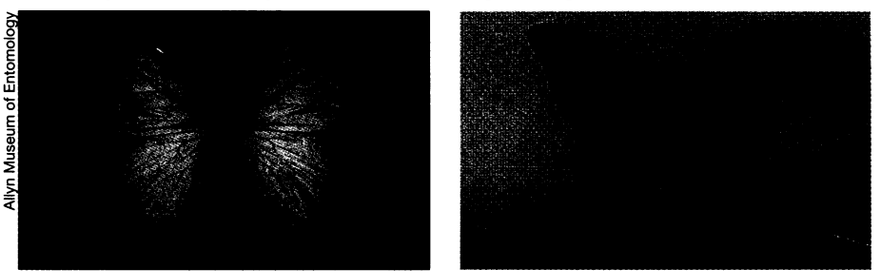
M. menelaus scales consist of folded stacks of chitin lying side by side to form long, parallel ridges. The wings glitter an intense blue. In the vividly blue-green bands on *P. blumei* wings, the chitin layers are flat and separated by a raised, gridlike structure.

The researchers measured how much light individual wing scales reflect over a range of wavelengths. Although the reflectivity of butterfly wings has been well studied, says Peter Y. Wong, "what we're looking at is what's absorbed."

As expected, the butterfly scales reflect light most strongly in the range of wavelengths corresponding to their observed colors. The scales reflect very little infrared light and must therefore absorb most of it as heat.

Knowledge of butterfly wings might help in understanding the optical and thermal properties of computer chips, which likewise consist of finely structured thin films. Chip manufacture demands reliable control of heating and cooling steps.

"Hopefully, when we go to model microelectronics processing," Wong adds, "we'll have better insight into what are the important phenomena." —*C. Wu*



The Brazilian butterfly Morpho menelaus *(left) shimmers bright blue. Bands on the wings of the Indonesian* Papilio blumei *(right) glitter blue-green.*

From fleas to brain tumors

Hints that certain types of pesticides may play a role in triggering brain cancers—the most common solid tumors in children—have popped up in a number of recent studies. New research now strengthens that association and ties it most closely to sprays and foggers used to treat homes for fleas and ticks.

Janice M. Pogoda of Statology in Truckee, Calif., and Susan Preston-Martin of the University of Southern California in Los Angeles reestablished contact with almost 450 mothers who had taken part in an earlier study of pediatric brain tumors. More than half of them had a child with a brain tumor.

This time, the researchers examined the use of pesticides in the home during pregnancy. Although they asked about a host of pesticides, including those used to exterminate snails, lice, and termites, only flea-and-tick foggers and sprays showed a strong statistical link to children's brain cancer, they report in the just-published November ENVIRONMENTAL HEALTH PERSPECTIVES.

Among the women who used such products, the likelihood that a child would develop brain cancer increased with the number of pets treated. Risks proved highest among children of women who prepared, applied, or cleaned up these products themselves while pregnant—especially if they had ignored some application instructions.

Overall, prenatal exposures to these products were twice as likely to have occurred in children who developed a brain tumor—and five times as likely in those whose tumor showed up before the age of 5. —*J. Raloff*