Technology

Illusions: The route to safer roads?

Undue speed appears to play a major role in up to one-fifth of all fatal traffic accidents, according to the AAA Foundation for Traffic Safety in Washington, D.C. Areas posing the greatest speed-related hazards include horizontal curves, exit ramps, traffic circles, and bridges. To lower the risks associated with such features, the foundation is planning a series of 3-year tests, to begin next year, using converging patterns of stripes on the road to give drivers the illusion of excessive speed.

A new report by the foundation finds that drivers tend to respond to areas emblazoned with certain patterns of chevrons or perpendicular bars spanning the lanes by slowing down and focusing more attention on the road. The pattern of these markings appears to be uniform, so by driving at a constant speed, drivers would expect to encounter them with the same regularity (every 2 seconds, say). In fact, the markings were painted with diminishing spacing, and sometimes size, suggesting to drivers a need to slow down. Chevrons make a lane appear to narrow, giving drivers an additional impetus to reduce their speed.

In some studies, the bars initially halved the average speed of drivers at critical portions of the marked run. However, within months, traffic often returned to speeds near those seen before the markings—except when the lines had been applied to rumble bumps or when the marking material was thick enough to cause vibrations that reinforced the visual cues. Chevrons, which are more expensive, were tested primarily in Japan. These appeared to create more dramatic and lasting reductions in speed and number of accidents.

Overall, most studies didn't follow up on markings long enough to verify any lasting changes in speed. Moreover, the markings tended to increase the range of speeds associated with a particular patch of road. Varying speeds can themselves pose problems, since fewer accidents occur when all vehicles drive at the same speed, notes Lindsay I. Griffin III of the Texas Transportation Institute at Texas A&M University in College Station, a coauthor of the report.

The foundation's upcoming studies are intended to investigate these issues and determine the most effective spacing for bars or chevrons.


H. Ito/AAA Found. for Traffic Safety

Chevrons cut crashes by nearly 75 percent on this road to Japan.

Beading up pesky traces of pesticides

Many sources of drinking water in the United States bear traces of toxic farm chemicals such as herbicides. Chemists at Virginia Polytechnic Institute and State University in Blacksburg have now come up with a novel way to sop up some of the most widely used of these pesticides. They've designed microscopic cellulose-based spheres whose surfaces are loaded with the equivalent of chemical hooks to snatch and bind pollutants for disposal later.

The hooks, known as thiol groups, strongly and permanently bind to portions of a compound that are deficient in electrons. In the July ENVIRONMENTAL SCIENCE & TECHNOLOGY, Duane F. Berry and his coworkers describe a prototype bead that collects metolachlor, a common herbicide. Their data suggest that it should also remove alachlor and atrazine, two other common pesticides, as well as many heavy metals.

The beads currently work well only in a moderately alkaline environment. While no problem for farmers, who can tinker with the pH of the water they use to clean up pesticide application equipment, this feature could prevent the beads' near-term use in neutral or acidic waters, such as most lakes and rivers.

Physics

Communicating with trits, not bits

Digital communication involves transmitting information encoded as strings of 0s and 1s, or bits. Often, these bits are sent as electric pulses in wires, but the information can also be conveyed by particles that can exist in two different states. For example, the electric field of a photon may be polarized so that it vibrates either vertically or horizontally, enabling each particle in a stream of photons to carry one bit of information.

Theorists have pointed out that quantum mechanics actually allows the possibility of sending more than two bits per pair of two-state photons. "We report the first experimental realization of quantum communication," Harald Weinfurter and his coworkers claim in the June 17 PHYSICAL REVIEW LETTERS.

Weinfurter and his colleagues at the University of Innsbruck in Austria have demonstrated a technique that exploits quantum effects to send information encoded as 0s, 1s, and 2s. The researchers call these data units "trits."

The scheme calls for pairs of two-state photons. Such photon pairs may both be vertically or horizontally polarized, or one photon may have a vertical polarization and the other a horizontal polarization. Quantum mechanics allows the alternative possibility of encoding information as different combinations, or superpositions, of the states of the two photons.

The researchers begin by splitting a beam of laser-generated ultraviolet photons into two new beams consisting of photons of half the original energy and double the wavelength. The photons of each pair created by the splitting have opposite polarizations but are quantum mechanically linked.

One beam goes to the sender, and the other travels directly to the receiver. The sender encodes information by manipulating the polarization of the photons in one beam to select among different superpositions available to the photon pair.

These photons are then passed along to the receiver, where they interfere with the photons in the other, direct beam to create distinctive patterns. The receiver can decode the sender's message by noting which of three different detection possibilities each linked photon pair produces. Moreover, because the two photons can represent three states, they carry more information than the usual one bit per photon.

Using their apparatus, Weinfurter and his coworkers were able to transmit three letters of the alphabet, which normally require 24 bits, in just 15 trits.

"It's a remarkably clever piece of work," says Rolf Landauer of the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y. However, it's not the only conceivable way to send more than one bit per photon, he notes (SN: 6/29/96, p. 404).

At the Gammasphere nuclear frontier

Researchers are now starting to take advantage of a new, highly sensitive instrument for detecting gamma rays emitted by atomic nuclei. Located at the Lawrence Berkeley (Calif.) National Laboratory and known as Gammasphere, this nuclear detector consists of a metal sphere more than 2 meters wide, honeycombed with 110 individual sensors.

The array enables physicists to study gamma rays from atomic nuclei created in high-energy collisions that fuse different ions together. These fused nuclei typically spin at high rates and often assume unusual shapes, ranging from football to pancake forms (SN: 7/8/95, p. 21).

A team led by Cyrus Baktash of the Oak Ridge (Tenn.) National Laboratory has now detected examples of short-lived, rapidly rotating, football-shaped nuclei among the elements strontium, yttrium, zirconium, and niobium. "They are the fastest-spinning nuclei yet observed," Baktash says.

The nuclei were synthesized by bombarding a nickel-58 target with beams of silicon-28 or sulfur-32 ions.