Moby electron: Trapping a whale of a charge

When a single electron hasn't the electric charge or mass to do the job, researchers may need to bring in reinforcements.

To measure a certain subtle effect that involves a moving electron, physicists have trapped and packed together 1,000 electrons to create a tiny, cold, dense ball of charge. This spherical droplet acts somewhat like a single particle with 1,000 times the charge and mass of an electron.

"We call it a kiloelectron," says Hans G. Dehmelt of the University of Washington in Seattle. By using such an electron ball, the researchers can magnify the effect they want to measure, making it readily detectable.

Dehmelt and Washington colleagues Richard K. Mittleman and Sander Kim describe their achievement in a paper to be published in PHYSICAL REVIEW LETTERS.

Over the years, Dehmelt and his collaborators have focused on elucidating the structure—if any—of the electron. To obtain clues that the electron itself may be composed of tinier components, they have made extremely precise measurements of such characteristics as an electron's magnetism, or magnetic moment. These studies have generally involved a single electron trapped by a web of magnetic and electric fields inside a copper chamber.

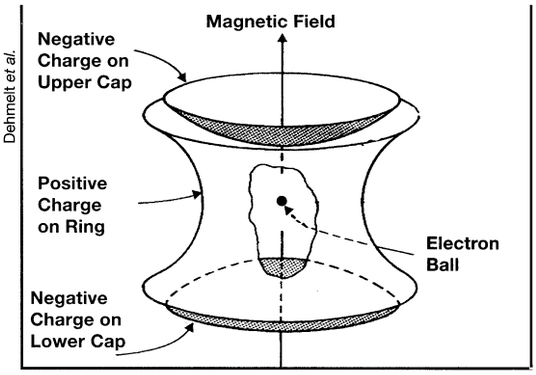
However, an electron inside such a trap induces an electric charge in its copper surroundings, which in turn affects the electron's motion. Thus, any measurements of the electron's movements must be corrected for the interaction between the electron and its "image" charge.

"To obtain the correction, you have to make an independent measurement of this effect, and you cannot do this on a single electron," Dehmelt says.

The researchers succeeded in loading their trap with 1,000 electrons, confining them to a ball having an initial radius of less than 140 micrometers at a temperature of 4 kelvins. This is "only a few times larger than the closest confinement reported for an individual electron," the researchers report.

By using droplets containing different numbers of electrons, Dehmelt and his team obtained the data needed to determine the correction factor for a single electron. Now, the researchers want to make the same measurements at different magnetic fields. These data can then go into a new, more accurate determination of the electron's magnetic moment.

— I. Peterson



Electron ball in Penning trap.

Blindsight in the lab: Eye on awareness

Damage to certain parts of the brain's visual cortex produces a puzzling disturbance of consciousness known as blindsight. In such cases, people deny having seen objects, moving lights, or other visible cues but can nevertheless guess correctly the location, orientation, and form of these "unseen" stimuli.

Blindsight can be induced in volunteers with healthy brains, scientists now report in the Sept. 28 NATURE. Further research with this new technique may yield insights into the anatomy of conscious visual experience, assert F. Christopher Kolb and Jochen Braun, both neuroscientists at the California Institute of Technology in Pasadena.

Kolb and Braun's procedure will also make possible "a much finer-grained analysis" of blindsight, writes Alan Cowey, a psychologist at the University of Oxford in England, in an accompanying comment. For instance, investigators can examine whether sights that do not pierce consciousness nonetheless trigger subtle eye movements that later guide guesses about what was seen.

The researchers asked three participants to look at a series of moving dot displays on a computer screen. After viewing each display for one-quarter of a second, volunteers tried to identify which quadrant of the screen contained a patch of "target" dots moving in a different direction from the rest.

One display contained pairs of dots that moved away from each other along a diagonal. A few pairs moved apart along the opposite diagonal, within a target area that changed quadrants from one presentation to another. These displays created the impression of a single field of flickering dots that obscured the target patch. Volunteers reported simply guessing at target locations.

In a second display, diagonal lines of single dots moved in alternating, opposite directions. Observers easily picked out the location of a few extra dots moving in a different direction.

Although the second task seemed much easier than the first, participants correctly noted the target's position on nearly three-quarters of the trials in both displays. Random guessing would yield only one in four correct responses.

Similar findings emerged for a second set of displays. On these trials, observers wore polarizing goggles that allowed researchers to present different images to the right and left eyes. Volunteers looked at two arrays of diagonally oriented bars simultaneously, one with each eye. When their right and left eyes saw bars oriented in opposite directions, they reported not seeing target areas bearing a few differently aligned bars. But again volunteers' guesses regarding target locations proved highly accurate.

The kinds of displays that induce blindsight may fail to stimulate adequately parts of the cortex that take secondary roles in handling visual information and that probably orchestrate visual awareness, Kolb and Braun suggest. These areas may maintain indirect connections to the primary visual cortex that help to guide behavior in the absence of awareness, they propose.

— B. Bower

Heart choice for diabetics

In response to the results of a government-sponsored study, federal health officials now recommend coronary bypass surgery rather than angioplasty for diabetics who need life-saving procedures to unclog arteries supplying blood to the heart. In angioplasty, a doctor inflates a balloon in a clogged artery to clear blockage.

Researchers from the National Heart, Lung, and Blood Institute (NHLBI) in Bethesda, Md., issued the alert last Thursday after the early release of findings from a study comparing bypass surgery to angioplasty in patients with two or more blocked coronary arteries. The study found that among diabetics taking either insulin or oral hypoglycemics, 35 percent of those who underwent angioplasty died within 5 years, compared to 19 percent of those undergoing surgery. Nondiabetics faced a 9 percent death rate over 5 years for either procedure.

"We knew that diabetics as a group were at greater risk," says NHLBI cardiologist and study program director George Sopko. "But the difference in survival was surprising."

Sopko suggests that differences in healing between diabetics and nondiabetics may account for the disparity. Angioplasty causes tears in the artery, which can result in excessive scarring and reclogging. He adds that the patients in the study had serious heart disease and that angioplasty may be acceptable for diabetics with less severe disease. *— L. Seachrist*