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Do-it-yourself quantum spooky action

By George Musser <<http://www.scientificamerican.com/blog/observations/index.cfm?aut=or=109>> | Mar 17, 2011 06:45 PM | 13 <<http://www.scientificamerican.com/blog/post.cfm?id=do-it-yourself-quantum-spooky-action-2011-03-17#comments>>

<<http://www.scientificamerican.com/media/inline/blog/1Image/qutools.jp>> DRESDEN, Germany-How cool would it be not just to read about the craziness of quantum mechanics, but to see it-even better, do it-for yourself? Several years ago I asked virtuoso experimental physicist Paul Kwiat whether he could develop a simple demonstration anyone could do at home, and he and his undergraduate student Rachel Killmer came up with a "quantum eraser"

<<http://www.scientificamerican.com/article.cfm?id=a-do-it-yourself-quantum-eraser>> . This week I got to see another big step toward the era of quantum homebrewers. Tucked away in a booth in the exhibit tent at the German Physical Society conference, Munich-based start-up company qutools <<http://www.qutools.com>> showed off the world's cheapest kit for seeing quantum entanglement: spooky action at a distance

<<http://www.qutools.com/products/quED/index.php>> . Though still out of reach of a DIYer (20,000 euros, or \$28,000), the kit is cheap enough to become standard equipment in Physics 101 courses, and when you consider what physicists had to go through in the 1970s to see spooky action for the first time, it's a marvel of miniaturization. "I'm so excited by what they're doing," says physics education innovator David Van Baak

<<http://www.calvin.edu/academic/phys/faculty/van-baak/>> of Calvin College in Grand Rapids, Mich. "We're past the stage where entanglement is a research-university-only affair. It's getting out to the masses."

The main reason I came to the conference was for a symposium of some of the world's leading quantum physicists and philosophers (pdf <<http://www.dpg-verhandlungen.de/2011/dresden/symp.pdf>>), organized by experimentalist Uwe Becker <http://w3.rz-berlin.mpg.de/mp/AG_Becker/home.html> of the Fritz Haber Institute in Berlin. I got to meet, among others, Alain Aspect <<http://www.institutoptique.fr/en/recherche/Le-laboratoire-Charles-Fabry/Optique-Atomique>> of the Institut d'Optique on the outskirts of Paris-one of the first ever to see spooky action for himself. Science writer Louisa Gilder dramatically describes what he and other pioneers had to go through in her book The Age of Entanglement <<http://www.ageofentanglement.com/>> . Their experiments filled entire basement labs, had to be largely custom-built, and looked almost steampunk. Aspect and others had to do all this against a backdrop of skepticism or even outright hostility among most of their colleagues.

Their contraptions produced pairs of particles that acted like magic coins: when flipped in unison on opposite sides of the lab, both coins always came up with the same side, either heads or tails. Aspect's apparatus produced about 100 spooky coincidences per second. The qutools kit, which would fit on a living room end table, sees more than 10 times as many.

These contraptions can do the flipping in a way that rules out obvious explanations-for example, that the particles were somehow preprogrammed to behave as they did, or that some hidden signal passed between them. Through means that

physicists have yet to grasp, the particles act as an indivisible unit despite the distance that separates them. Quantum pioneer Nicolas Gisin of the University of Geneva thinks understanding will come as physicists gain familiarity with the phenomenon. He says he already notices that his students feel more comfortable with entanglement than his generation does. "Young guys find it fascinating, but are not totally amazed," he says. "The kids here say, that's just the way it is." So kits such as qutools's hasten the day when we finally figure out what the theory really means, and the crazy becomes the quotidian.

Photo by George Musser

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"Hope your life is filled with wonderful music, too. See you soon."

-Ajay Sreekanth

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