unique chance to compare something that happened with something that did not.

The Aspect work was a laboratory realization of a thought experiment proposed in 1935 by Einstein, Boris Podolsky, and Nathan Rosen. The three actually offered the thought experiment as an argument against quantum theory, because they believed that the predictions of quantum mechanics—as illustrated by the experiment—were too outlandish to accept. Forty-six years later, however, Aspect's data supported the predictions of quantum physics.

In the Aspect experiments, an emitter shoots two photons at a time in opposite directions. The polarizations of the two photons in each pair are correlated—the photons will display identical polarizations if the polarizations are measured along the same direction. On each side of the emitter is a detector that measures the polarizations of the photons.

According to quantum mechanics, neither photon has a well-defined polarization until it is measured at the detector. Before that, the polarization can only be described statistically, in terms of the probability that a measurement will give this value or that one. In layman's terms, measuring the polarization of the photon transforms the photon from one whose polarization is no more than a set of probabilities to one with a polarization of fixed value.

What bothered Einstein about this experiment was that measuring one photon gives more information about the polarization of the other than the other photon could even know about itself. To describe this rather subtle effect in nonphysical terms, Mermin shows how the photons and detectors seemingly violate the Strong Baseball Principle.

In Mermin's depiction of the Aspect experiment, each detector flashes either red or green, depending on the polarization of the detected photon. Further, each detector has two settings, 1 and 2, that determine the angle the polarization readings are made at. The choice of setting at one detector corresponds to the decision of a fan to watch or not watch a game, and the color flashed at the other detector corresponds to the outcome of the game. The Strong Baseball Principle implies that for each individual pair of photons, whatever happens at detector B does not depend on the choice made at detector A.

By aligning the two detectors so that their orientations differ by a certain angle, it is possible to get the following statistics: If both detectors are set at 1, or if one is set at 1 and the other at 2, they will flash the same color 85% of the time; if both are set at 2, they agree only 15% of the time.

Suppose now that one takes many runs of data with both detectors set at 1. The data for the first 25 runs might look like:

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A(1):  RGGGRGRGRRGRRGRGRRRRGRGGR ...
B(1):  RGGRRGGRRRGRRGRGRGRRGGGGR ...
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Note that each detector flashes red and green randomly, each color flashing half the time. Statistically, the data will look the same no matter what the detector setting—the (Weak) Baseball Principle is valid.

The Strong Baseball Principle states that a different choice of setting for detector A would not have affected what happened at detector B, and vice versa, *in each individual run*. Philosophers might argue that this statement is meaningless, but bear with me, Mermin says—we can learn something here.

Imagine that detector A had been set at 2 instead of 1. It is impossible to say what data would have been taken at A, but the Strong Baseball Principle implies the data at B would be unchanged, run by run. Furthermore, even though the hypothetical A(2) data is unknowable, we do have some information about it: It must agree with the B(1) data in 85% of the runs. Similarly, if detector B had been set at 2 instead of 1, we cannot say what colors it would have recorded, but the B(2) data must agree with the A(1) data 85% of the time.

But now we can see that applying the Strong Baseball Principle has got us into trouble. B(2) differs from A(1) by 15%; A(1) differs from B(1) by 15%; and B(1) differs from A(2) by 15%. This implies that A(2) differs from B(2) by at most 45%. However, the detectors were designed so that A and B would differ by 85% if both had really been set to 2. Thus, even though we cannot say what data appeared in the A(2) and B(2) runs (since, after all, they did not happen), we can say there is no possible arrangement of data that could fit. The Strong Baseball Principle cannot possibly be true here—it is testable, but false.

Does this mean that what happens at B does depend on the choice made at A? That watching the Mets on TV does make a difference? Mermin says no. "It merely implies that you cannot apply the Baseball Principle to individual games." But this, says Mermin, is amazing enough: such metaphysical arguments show that living in a classical, deterministic world has not prepared us to think in quantum terms.

■ ROBERT POOL

ADDITIONAL READING

N. D. Mermin, "Can you help your team tonight by watching on TV? More experimental metaphysics from Einstein, Podolsky, and Rosen," in *Philosophical Consequences of Quantum Theory* (Notre Dame University Press, South Bend, 1989); reprinted in N. D. Mermin, *Boojums All the Way Through* (Cambridge University Press, Cambridge, England, 1989).

Cold Fusion: Bait and Switch?

Cold fusion is starting to look like it might become an example of the "bait and switch" technique. Just as almost everyone is bored with the claims of fusion in a jar, the first whispers are out that it may not be fusion at all, but something more mysterious.

At the 8 May meeting of the Electrochemical Society in Los Angeles, a rumor surfaced to explain why Stanley Pons and Martin Fleischmann have been so secretive about the analysis of their palladium electrodes, in which they claim to have produced room-temperature fusion. The two, the rumor said, suspect that the palladium has undergone some unspecified chemical change that causes it to produce a great deal of heat, and they do not want anyone else to discover the nature of the change first.

At the meeting, Pons and Fleischmann said they have arranged for the electrodes to be tested for the presence of helium-4—a hypothesized by-product of the alleged fusion reaction—but they were quite vague about the details. A number of scientists believe that if analysis shows the electrodes have no helium-4, then the claim of cold fusion is dead. Fleischmann himself admitted as much at the meeting.

James Brophy, vice president for research at the University of Utah, where Pons works, said Pons and Fleischmann have given samples of their electrodes to two laboratories. One is Johnson Matthey PLC, the company that supplied the palladium electrodes. Brophy said Johnson Matthey loaned the palladium to Pons and Fleischmann on the condition that they could analyze the metal after it went through the "cold fusion" process. He would not name the other laboratory.

Although Brophy disagreed with the particular variant of the rumor heard at the meeting, he confirmed speculation that something besides cold fusion is being considered as a cause for the heat Pons and Fleischmann report. One reason for the secrecy surrounding the analysis of the electrodes, he said, is that if something besides fusion is going on, the tests could reveal what it is. If that something turns out to be valuable, the discovers of the process want to be the first to know.

Charles Martin at Texas A&M said his group is still convinced of heat production in the palladium, but has never said it was fusion. The Texas A&M group is also having its electrodes analyzed, but would give no details. ■ ROBERT POOL