# Neutral weak currents: The other shoe

It frequently happens in science that two or more experimental groups are working on the same subject. One of them comes up with a new and startling result. In confident hope of confirmation, the scientific public stands around waiting for the other shoe to fall. Sometimes it falls with a bang; sometimes it never falls at all, and once in a while it is set down very gently. The last alternative is what has now happened in the case of the so-called neutral weak currents.

Two groups, one at the CERN laboratory in Geneva, the other at the National Accelerator Laboratory in Batavia, Ill., have been studying the physics of neutrinos with very high energies, hoping among other things to find out something about the workings of the weak interaction. Last year the CERN group reported that it had found a phenomenon called neutral weak currents, a particular process in the collision of two particles under the influence of the weak interaction that is predicted by newer theories of the interaction but forbidden by older ones. The effect of the discovery, if it were confirmed, would be to overthrow the older theories and pave the way for the acceptance of the new ones. The new ones are more exciting to many theorists because they go beyond the weak force alone and make attempts to unite it theoretically with other classes of force. Everyone waited for the NAL result.

The weak interaction is one of the four classes of force that physicists recognize in nature. It comes into play in the domain of particle physics, where it governs a number of the ways certain particles decay radioactively (and also the beta decay of atomic nuclei). The older theory had said—and it was upheld experimentally until the CERN result—that when two particles collide under the governance of the weak interaction, they must exchange a unit of electric charge. That is, a particle that goes in uncharged comes out charged, while one that goes in charged comes out neutral. The newer theories, which seek to unite the weak interaction with other classes of force (the electromagnetic or the strong interaction or sometimes both), demand the possibility of a weak-interaction collision without charge exchange. This is called a neutral weak current, a term taken from the branch of mathematics used to describe these events.

The CERN group found evidence for a collision in which no exchange of charge occurred, and they published bubble-chamber pictures to prove it. Interested people then turned to NAL and inquired after their results. At first the talk among informed sources was that a confirmation was in the offing, but one was warned not to write anything pending publication or public announcement of the results. The physicists were not through with their analysis. Gradually the talk became more and more equivocal.

Now the NAL group (A. Benvenuti et al) has finally published a report, in the April 8 PHYSICAL REVIEW LETTERS. It sets down the other shoe with a certain tentativeness.

The NAL result concerns collisions of neutrinos with neutrons or protons. One of the things that is supposed to come out of such a collision is a muon. The NAL group has found numbers of such collisions in which muons do not come out. Their conclusion: "A possible, but by no means unique, interpretation of this effect is the existence of a neutral weak current."

They also mention that the numerical data assembled in their experiment tend to fall into the range predicted by one of the new theoretical models, that of Steven Weinberg of Massachusetts Institute of Technology.

But the NAL physicists caution that the nonproduction of muons could have other causes, contamination of the beam of muon neutrinos that they were using with the other type of neutrino, electron neutrinos, or the existence or production of a new particle. For the moment these cannot be ruled out. They have an improved version of the experiment running and promise results soon.

# Quantum electrodynamics: A first kick

Quantum electrodynamics, the theory of electromagnetic phenomena on the subatomic level, has been one of the big success stories in particle physics. A great body of experimental evidence can be cited in its favor. As experiments have gone to higher and higher energy, thus probing shorter and shorter distances, the theory has continued to apply very satisfactorily. Physicists wonder how far quantum electrodynamics will hold out. Will it work in the new energy domain now opening up?

The availability of beams of protons with 200 billion electron-volts energy at the National Accelerator Laboratory made it possible for a group from the State University of New York at Buffalo (P. L. Jain et al) to do an experiment probing the theory at very high energy. The experimental mode they chose is one in which some hints of conflicts have appeared at lower energies: the production of electron-positron pairs by a swiftly moving particle as it interacts with the electric field of an atomic nucleus.

The results of their experiment disagree with theory. The Buffalo group concludes: "We feel that the present . . . observations will be useful to the theorists who wish to look into these discrepancies very seriously." In the past when there has been trouble in this domain modifications of the theory to fit experiment were possible. Whether that will happen in this case is in the laps of the theorists. □

# Margarine and your heart

Hardening of the arteries causes 90 percent of all heart disease. Evidence has indicated that the hardening results from high amounts of cholesterol and saturated fatty acids in the blood. So the medical community has encouraged people to eat foods with less cholesterol and with polyunsaturated fatty acids rather than saturated fatty acids. Down with eggs and butter, up with polyunsaturated vegetable oils and margarine! This has become the credo of millions.

Now margarine is being accused of being a worse villain in hardening of the arteries than butter or eggs. The unorthodox indictment, by Fred A. Kummerow, professor of food chemistry at the University of Illinois, and his team, was made last week at the annual meeting of Federation of Societies for Experimental Biology in Atlantic City.

The problem, Kummerow explains, is that although margarine consists of polyunsaturated acids, many of these acids change from their natural form to an altered form during the hydrogenation process. The altered form of fatty acids appears to be more damaging to arteries than even saturated fatty acids or cholesterol.

Kummerow and his colleagues fed 10 groups of 12 pigs each a basic diet. Five of the groups received a supplement of one of the following: beef tallow, corn oil, butterfat, fat free of altered fatty acids, or hydrogenated soybean oil (margarine base stock containing 50 percent altered fatty acids). One group received a supplement of fat and sugar. One group was supplemented with a mixture of used fat and sugar. Three groups received egg yolk, whole egg powder or crystalline cholesterol