PHYSICS

Nucleus Action Probed

Scientists continue to probe the nucleus of the atom and have proposed a new theory which predicts the discovery of new particles within.

➤ A NEW THEORY explains some of the behavior of particles in the mysterious nucleus of the atom.

The theory, called SU-6, is another step in understanding the structure of matter. All reactions, including those of living matter, are linked to the nucleus.

Discovery of the new theory, reported to the American Physical Society meeting in New York, follows less than a year after the confirmation of the SU-3 theory, or eightfold way. This succeeded in turning what physicists refer to as the "nuclear jungle" into a "zoo." But it did not give much insight into the behavior of the inhabitants.

The SU-6 theory demonstrates an underlying unity among the known families of nuclear particles and predicts the existence of new particles. Some of the predictions have already proved true, others are still being tested.

Besides the underlying unity and the predictions, SU-6 also offers considerable insight into how nuclear particles interact with each other both inside the nucleus and in the atom smashers and other experimental equipment in which they are studied.

Drs. Abraham Pais, Feza Guersey and Luigi Radicati proposed the first steps toward the new theory when they were at Brookhaven National Laboratory, Upton, N.Y. Dr. Pais is at the Rockefeller Institute, New York, Dr. Guersey was on leave from the Middle East Technical University, Ankara, Turkey, and Dr. Radicati was on leave from the Scuola Normale Euperiore, Pisa, Italy.

Important relationships between the masses of these particles were discovered by Dr. M. A. Baqi Beg of the Rockefeller Institute and Dr. Virenda Singh of the Tata Institute for Fundamental Research, Bombay. Dr. B. Sakita of the University of Wisconsin, Madison, has also suggested the possibility of an SU-6 theory.

Early in 1964 order was brought to the nuclear "jungle" by the SU-3 theory under which the 100 or so known nuclear particles are grouped into families, or multiplets, of eight and ten members.

Each eight-fold way multiplet consists of several sub-groups of particles having the same mass, hypercharge and isotopic spin. A rule explaining how the masses of the sub-groups differ binds them together into a multiplet.

The SU-6 theory shows how the masses of the multiplets themselves are related to each other. It groups the multiplets into supermultiplets, and unifies them. It also extends the classification scheme by taking into account the spin of the particles as well as their other properties.

All members of a supermultiplet have the same parity, or handedness, in the sense that a screw has handedness. The supermultiplets have members of 35, 56, 20 and 70.

Using spin as one of the characteristics by which the particles are grouped gave the SU-6 theory its first theoretical success.

SU-6 predicts that if triplet particles exist, they must have one-half unit of spin.

Dr. Pais believes that the SU-6 theory may bring physicists a step closer to the solution of the basic question—are the nuclear particles really different forms of each other or are they composed of several basic particles.

Most physicists now believe that the answer to this question will come only when atom smashers having much higher energies than now available are operating.

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Corning Glass Works

GLASS-CERAMIC—These future sections of a depth-probing underwater vehicle were built for Ordance Research Laboratory of Pennsylvania State University, University Park, Pa., by Corning Glass Works. An engineer examines the submersible's nose afterbody and hull sections.

PHYSICS

Plea for Atom Smasher

➤ A SUPER ATOM smasher that would yield clues to the nature of matter by hurling nuclear particles at energies up to a thousand billion electron volts must be built.

So 30 of the world's top physicists agree in a remarkably unanimous and eloquent plea for continued support of high-energy physics. Each of the 30 has his own reasons for urging support in this field, which seems so remote from everyday experience.

However, high-energy physics, which deals with the world of the extremely tiny and fleetingly brief lifetimes of nuclear particles is not so remote as it might seem. Dr. J. Robert Oppenheimer, director of the Institute for Advanced Study, Princeton, N.J., acknowledges the link in a foreword to the report on "Nature of Matter."

"The last centuries of science have been marked by an unabating struggle to describe and comprehend the nature of matter, its regularities, its laws and the language that makes it intelligible..

"The successes in this struggle, from the Sixteenth Century until our own day, have inspired the whole scientific enterprise and lighted the world of technology, and the whole of man's life," Dr. Oppenheimer said.

The largest accelerator now operating is the machine at Brookhaven National Laboratory giving energies up to 33 billion electron volts, or Bev. An atom smasher of twice that energy is close to completion near Moscow by the Russians.

The 30 scientists, however, urge building a machine that would speed nuclear particles with energies from 200 to 1,000 Bev. It is feasible to do so, Dr. Luke C. L. Yuan of Brookhaven National Laboratory, Upton, N.Y., has concluded on the basis of studies made both in this country and abroad during the past four years.

Such a huge machine could be built using the same principles of the 33-Bev accelerator, but incorporating a number of new ideas.

Dr. Oppenheimber points out that the physicists all agree that "we do not yet understand the nature of matter, the laws that govern it, the language in which it should be described." The scientists also agree in having grave doubts that within the energy range now available "there are or will be enough clues to make possible" a theory of the nature of matter.

Merely because new accelerators and telescopes happen to be expensive is no reason not to build them, Dr. S. Weinberg of the University of California argues. Not to do so would mean denying the importance of discovering the laws of nature.

Dr. Weinberg believes that nature has "absolute laws of great simplicity, from which all the sciences flow in an ordered hierarchy. Thus, working backward, the nervous system has evolved as it has because of certain facts of chemistry and classical physics, which themselves follow from the ordinary quantum mechanics of nuclei electrons and photon, which itself follows from —what?"

"The Nature of Matter", a 150-page publication, is available from the Department of Commerce, Springfield, Va. ($1.75).

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