Does Dibaryomania Start Here?

Where two or three are gathered together — that should be all, according to the current theory of particle physics. Two or three quarks, that is. The theory explains the properties and behavior of most kinds of subatomic particles by proposing that they are made up of two or three out of a small number of subparticles called quarks and antiquarks. (The small number was originally three quarks and three antiquarks, but in recent versions of the theory it can go as high as six of each.)

The "most naive" form of the theory, to quote the adjective used by physicist Charles Ward of Argonne National Laboratory, holds that three quarks are the maximum that can be bound together. At that point the force that binds them together "saturates," and no further quarks can be attracted to the group. Unfortunately for the naive form of the theory, a group of Argonne experimentalists has found a particle that appears to be made of six quarks bound together. The object is called a diproton resonance, because it seems to consist of two protons melded together into a single particle. The group that found it was led by Akihiko Yokosawa and included Ivan Auer, Andrew Beretvas, Eugene Colton, Howard Halpern, Daniel Hill, Kenneth Nield, Harold Spinka, George Theodosiu, David Underwood and Yasushi Watanabe. Their report was published recently in PHYSICS LETTERS B.

The discovery came in an experiment involving collisions of polarized protons, that is, experiments in which the spins of the projectile proton and the target proton are known. In proton experiments generally the spins of the protons are not known, and in the past it was expected that the interactions between the spins would have only a small effect on the total interaction of the two protons. This is at least the second recent result that indicates that spin effects can sometimes be very important. (For another, see SN: 9/24/77, p. 196.)

The diproton resonance forms only when the spins of the two protons are parallel and can add together to give the total spin that the resonance seems to require. The resonance does not form when the spins are antiparallel. The resonance lasts only a very fleeting time, even by modern particle physics standards, and then falls apart into two protons.

Probably next on the agenda is finding out whether the resonance can decay into other combinations, for example, a proton, a neutron and a pi meson. Another interesting question is whether other dibaryon resonances, resonances involving two other particles of the proton's class, are possible. Such experiments, however, will not be done at Argonne, because the Zero Gradient Synchrotron, Argonne's major accelerator, is funded only for polarized proton experiments and not for work with other particles.

If the naive version of the quark theory will not contain dibaryon resonances, modified versions may. A major type of modification deals with a puzzling paradox involving the force that holds quarks together. Inside a particle the quarks appear to be very loosely bound, yet it is impossible at present energies to knock a quark out of a particle. One way of resolving the paradox is to regard the particle as a kind of bag in which the quarks are kept. Inside the bag they can rattle around loosely, but for some reason they cannot get out of its confines. This bag theory seems to have room for combinations of more than three quarks, and it could be the modification chosen to explain the new results. □

National Medal of Science: Fifteen winners

The White House

Carter honors scientists and engineers and asks for increases in federally funded R&D.

President Jimmy Carter took the opportunity last week to reemphasize his interest in and his commitment to science. He did so at the presentation of this year's National Medal of Science Awards. Carter's brief remarks before the ceremony suggest that his support for science will be both symbolic and literal.

After mentioning that he "had some engineering background, some scientific background, in business, agriculture, politics," Carter went on to warn that "the quality of scientific equipment has fallen off rapidly in recent years. The number of top-ranked research centers has been falling off in recent years. The percentage of faculty members who are scientists and who are also young has been falling off rapidly in recent years. In 1968, about 45 percent of the faculty members were young men and women. Now that has dropped off to about only 25 percent, which shows that in the future we have a problem on our hands, unless we take strong action to correct these trends."

In response to this situation, Carter said that he would like to make sure that the climate for research and development in our country is enhanced "with my own imprimatur of approval and interest, with a broad-scale exhibition of interest on numerous occasions by the members of Congress and my own administration, with publicity accruing to those who have achieved notably in the scientific and engineering field, and also in direct budget allocations."

Speaking of the budget, Carter said that in many instances the heads of government agencies (cabinet members and others) have relegated scientific research and development to a fairly low position of priority. In order to remedy this, Carter has directed the Office of Management and Budget "to boost these research and development items much higher, and they will be funded accordingly."

On that note, Carter and his Science and Technology Adviser, Frank Press, went on to present the National Medal of Science Awards, the nation's highest honor for research in science and engineering.

In the biological sciences awards went to:

- Roger Guillemin of the Salk Institute for Biological Studies. Guillemin also shared in this year's Nobel Prize for Physiology and Medicine. He was honored for "demonstrating the presence of a new class of hormones made in the brain that regulate the function of the pituitary gland, thereby making possible improved diagnosis and treatment of many endocrine disorders."
- Keith R. Porter of the University of Colorado, "for his many contributions in the use of the electron microscope ... to give us a comprehensive and unified picture of the life of cells."
- Efraim Racker of Cornell University, "for major contributions to the understanding of the subcellular mechanisms