physical sciences

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PARTICLE PHYSICS

W not yet found

Another search for the W particle, or intermediate vector boson, theoretically supposed to be the carrier of the weak subnuclear force (SN: 11/16, p. 500) has failed to find it.

A group of physicists from Yale University and Brookhaven National Laboratory, working at the Brookhaven Alternating Gradient Synchrotron, made the search. They measured the polarization and flux of high-energy mu mesons produced when the proton beam from the AGS collided with a target of uranium. The hope was that W particles would sometimes appear as products of the protons' interactions with the uranium nucleons and then decay into mu mesons. If such things did happen they were not directly detected. The experiment did determine that the cross section (probability) for W production in a proton-nucleon interaction is less than 5×10^{-36} square centimeters, if the W decays to a mu meson 25 percent of the time.

CHEMICAL PHYSICS

Magnetic fields and cholesteric crystals

An experiment to observe the distortion and breakdown of a cholesteric liquid crystal under the influence of a magnetic field is reported by Dr. Robert B. Meyer of Harvard University.

The sample he used is a dilute solution of an ester of cholesterol in p-azoxyanisole, which has a structure like a helical spring with a pitch of 10 to 20 microns (millionths of a meter). The distortion of the helix and its eventual breakdown to a needle-like, nematic structure could be observed with a low-power microscope and a magnetic field of less than 10 kilogauss.

The experiment, says Dr. Meyer, confirms a theory of how such structures should be bent and broken by magnetic fields.

PARTICLE PHYSICS

Still not magnetic monopoles

Another search for magnetic monopoles, north or south magnetic poles existing in isolation from their opposites, has failed to find any.

Historically wherever magnets appear, they appear as dipoles, a north and a south pole physically bound together.

But the theory of magnetism and the theory of electricity are reciprocal to one another. Every electric effect has its magnetic analogue and vice versa, except in the case of monopoles. Electric charges exist easily as positive or negative monopoles, but magnetic monopoles have never been seen.

In spite of the lack of physical evidence, theorists have concluded that magnetic monopoles ought to exist in order to balance out the theory. And so experimenters are looking for them.

A favorite method is to investigate geologically old mineral samples in the hope that monopoles might have been embedded in them after arriving as cosmic rays. A group of physicists from the General Electric Co. and Florida State University reports a negative result after looking for monopoles in manganese nodules from the bottom of the Indian Ocean. They conclude that at no energy up to 20 million billion electron volts are primary cosmic rays dominantly composed of magnetic monopoles.

The team includes Drs. P. B. Price, R. L. Fleischer, I. S. Jacobs and W. M. Schwarz of G.E., and H. G. Goodell of Florida State.

OPTICS

Water changes laser colors

Lasers emit light beams of certain isolated highly pure colors. Each laser has its own particular color and cannot ordinarily be tuned or modulated over a range of frequencies as can some radio broadcasting apparatus. Tunable lasers are the object of several research efforts.

One approach to the conversion of laser light to a wide-frequency band is to look for materials that exhibit what is called parametric optical noise. That is, they accept a light beam at a given frequency and convert some of its energy to light of different colors.

Some solid materials are known that will do this. Now Dr. Donald L. Weinberg of the National Aeronautics and Space Administration's Electronics Research Center at Cambridge, Mass., reports optical parametric noise in water. Furthermore, he says, this is the first time that the noise has come off at a frequency greater than the input frequency.

In his experiments, red beam from a ruby laser was converted to a continuous range of colors in the violet, blue and green ranges, each color emerging at a definite individual angle to the original beam.

ASTROPHYSICS

Quasars as protogalaxies

Dr. James Paul Wesley of the University of Missouri at Rolla suggests that galaxies may originate in collisions between two massive neutron stars and that such collisions when underway should look much like quasars.

As such neutron stars come close to each other, large tidal bulges would be produced on their facing sides with a great release of gravitationally induced pressure. This release of pressure permits neutrons to decay into other forms of matter in the force-free region between the two spheres. Electromagnetic rotation produced in this region would be subject to a strong gravitational field and therefore exhibit a large red shift.

Dr. Wesley says that the stability of such a system, the large red shift, the dimensions of the system, the period of rotation, the width of the emission lines in the spectrum and the rate of energy emission are all compatible with observations of quasars.