physical sciences

Gathered at the American Physical Society meeting in Washington, D.C., last week

COSMIC RAYS

Maybe element 108

Dr. Peter Fowler of the University of Bristol in England believes that he may have found a nucleus of element 108 among the cosmic rays. So far the highest atomic number whose discovery has been definitely claimed is 105 (SN: 5/2, p. 430).

Dr. Fowler and others have been flying balloons from Palestine, Tex., to record heavy cosmic-ray nuclei in detectors made of photographic emulsion and of layered plastic. Dr. Fowler will not make a definite claim for element 108 because of uncertainties in the calculation of the charge from the ionization of the detectors.

The formulas by which the charge is calculated depend on theoretical considerations and do not command 100 percent confidence. They cannot be tested with known nuclei at known speeds since there are no accelerators that can get heavy nuclei to speeds near that of light.

To be a nucleus of 108, the nucleus Dr. Fowler measured should have been traveling with at least 95 percent of the speed of light. A lighter particle traveling slower would do the same damage because it would have more time to do the ionization. The balloons are flown from Palestine because magnetic conditions there should prevent slower particles from getting through, but there is no 100 percent certainty.

Dr. Fowler estimates the probability that the nucleus is element 108 at 65 percent.

QUASARS

Optical fluctuations of 3C 273

The quasar 3C 273 has been traced on astronomical photographs going back more than 80 years. During that time its optical power output has varied, and it has been suggested that this variation was regular with a period somewhere between 9 and 13 years.

Drs. N. James Terrell Jr. and Kenneth H. Olsen of Los Alamos Scientific Laboratory have studied the records to see whether there is statistical evidence to support the suggested periodicity.

No support for periodicity was found, they report. If there is any periodic fluctuation, it is obscured by random fluctuations. If the observed changes in the light from 3C 273 are due to random outbursts of light coming one on top of the other, conclude Drs. Terrell and Olsen, there are between 10 and 20 such outbursts a year, each lasting between three and four years.

GENERAL RELATIVITY

Magnetic fields of neutron stars

According to the theory of general relativity, space should be very strongly curved in the neighborhood of very dense bodies with strong gravitational fields.

A neutron star is a body of this kind, and since nowadays many astronomers believe that pulsars are neutron stars, Dr. Jeffrey M. Cohen of the Institute for Advanced Study in Princeton, N.J., warns them that in their theorizing they will have to take into account the effects of this gravitational field and space curvature.

An important case is the magnetic field of the neutron star. The configuration and strength of the magnetic field are of primary importance in all theories of how pulsars produce radio waves or cosmic rays. Dr. Cohen points out that the field of a neutron star varies with distance from the center of the star in a radically different way in curved space from the way it does in flat space.

The physical consequence of this difference, he says, is that one can make models in which the field strength at the surface in curved space is two, three, five or eight times as large as the flat-space result.

PARTICLES

Time reversal still holds

Physicists believe in a general symmetry and reciprocity of behavior between matter and antimatter. One of the principles that expresses this belief says that there is no way to tell the difference between a particle going forward in time and its antiparticle going backward in time.

A practical result of this is a prediction of reversibility and symmetry of behavior in the interactions of elementary particles. To test the principle, therefore, a group including Drs. Stephen Rock, Michel G. Borghini, Owen Chamberlain, Raymond Z. Fuzesy, Charles Morehouse, Thomas M. Powell, Gilbert Shapiro and Howard L. Weisberg of the Lawrence Radiation Laboratory at Berkeley, Calif., and Drs. Roger L. Cottrell, John Litt, L. W. Mo and Richard E. Taylor of the Stanford Linear Accelerator Center in Palo Alto, Calif., searched for an asymmetry in the pattern of electrons that were scattered from a proton target.

They found no evidence of a failure of the time-reversal principle. They repeated the experiment with positrons instead of electrons, and found no failure.

X-RAY ASTRONOMY

More on NP 0532

X-rays from the Crab nebula in the energy range between 1 and 10 kilo-electron volts (keV) were observed during a rocket flight of April 26, 1969. The observers, Drs. S. Rappaport, Hale Bradt, W. Mayer and E. Boughan of Massachusetts Institute of Technology, report that of 310,000 photons recorded during the flight 25,000 were pulsed at the frequency of the pulsar in the Crab, NP 0532.

Studies of these X-rays lead them to the following conclusions:

There are no gross variations in the intensity of the pulses over the three-minute period of the observation.

The coincidence in time between optical and X-ray pulses is precise to three-tenths of a millisecond.