PHYSICS

Foresee New Particles

Einstein's general theory of relativity is still providing a guide for fruitful research directed at improving our understanding of the physical world.

➤ MYSTERIOUS particles very unlike those so far found in nature will be discovered if two mathematical models of equations based on the late Prof. Albert Einstein's general theory of relativity prove correct.

Drs. Peter G. Bergmann and Ranier Sachs of Syracuse University reported their analyses of particle models that may be constructed in general relativity to the American Physical Society meeting in New York.

One mathematical model is based on the characteristics that may appear outside the particle on a surface surrounding the particle's location. From this, Drs. Bergmann and Sachs found that not only the expected types of particles could exist but also some mysterious ones not yet detected.

The mysterious particles also were found in a second set of mathematical equations, which analyze particles in terms of the curvature of space-time in the surrounding region.

Drs. E. Newman of the University of Pittsburgh and J. Goldberg of the Aeronautical Research Laboratory, Dayton, reported their completion of a mathematical program so difficult no one had previously carried it out in the 40-year lifetime of general relativity. They related the usual observational data of the astronomer to the individual quantities that can be constructed within the general theory of relativity.

For the first time a complete set of quantities that are independent of the observer and that together characterize uniquely a physical situation in general relativity has been found by Dr. Arthur B. Komar of Syracuse University. Prior to his discovery of the complete set, not even single quantities were known.

Dr. Goldberg also reported on the physical significance of the idea of energy in general relativity. Two Russian scientists, Profs. Landau and Lifshitz, have introduced a new quantity for energy and stress that differs markedly from those used previously. Dr. Goldberg analyzed the relationships between the new and the customary quantities for energy and stress. He found a strong resemblance, but also significant differences not yet completely understood.

These results represent "real progress in disentangling the effects of the state of the observer and his means of description from the objective situation itself," Dr. Bergmann said.

General relativity holds that nature may be described equally correctly with any frame of reference, however curved. The problem is to determine to what extent the selected frame denotes the actual characteristics of the situation itself.

➤ THE TRACK of a man-made "cascade" particle has been photographed for the first time, Dr. Wilson Powell, University of California physicist, has reported.

All of the known "strange" particles, tiny fragments of sub-atomic matter with fleeting lives, have now been produced and observed in giant atom smashers. Their tracks were also caught in photographic emulsions sent high into the earth's atmosphere to record cosmic rays, mysterious radiation bombarding earth from outer space.

Two "cascade" particles have so far been trapped and photographed in the 30-inch propane bubble chamber placed in the beam of the six-billion-electron volt bevatron, Dr. Powell told the Physical Society.

Cascade particles are the heaviest of the "strange" particles, having a mass 2,539 times the electron and a negative electrical charge. They live for less than a millionth of a second. They were given the name cascade because they decay, or disintegrate, into another heavy particle before finally breaking up again into pi mesons and protons. The psi meson, as the cascade particle is also known, is the only one yet discovered that produces another heavy particle as its first decay product.

The cascade particle studies with the bevatron at University of California Radiation Laboratory were financed by the Atomic Energy Commission.

A previous notable observation with the bubble chamber was the photographing of anti-protons, bits of negative matter. When the protons of ordinary matter come sufficiently close to anti-protons, both particles are annihilated, releasing tremendous amounts of energy.

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ASTRONOMY

Survey Shows 86 Stars Have Magnetic Fields

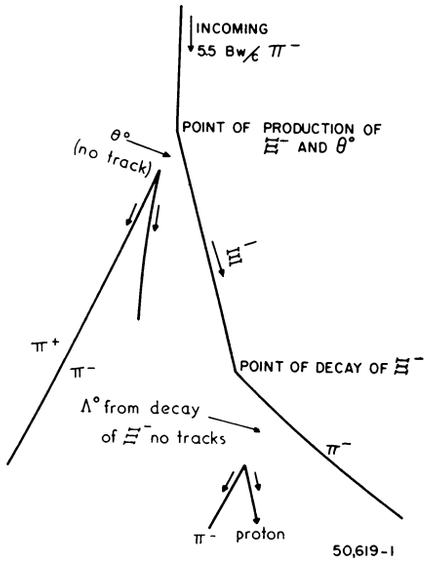
➤ ELEVEN YEARS of scanning the skies have resulted in discovery of 86 stars definitely known to have magnetic fields.

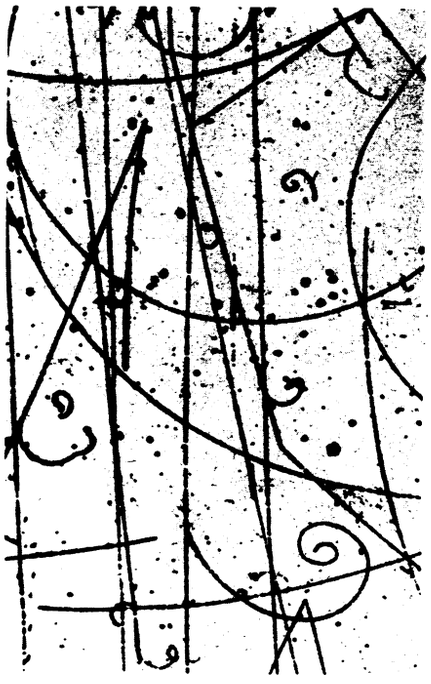
Another 65 stars, self-shining bodies like the sun, are suspected of having magnetic fields by Dr. Horace W. Babcock of Mt. Wilson and Palomar Observatories, Pasadena, Calif. He found the magnetic stars from his studies of their light as photographed with special instruments attached to the 200- and 100-inch telescopes.

All stellar magnetic fields so far observed are variable, Dr. Babcock reports in the *Astrophysical Journal* (Nov. 1957). Most, he has found, vary irregularly, proving that large-scale "hydromagnetic fluctuations occur at the surfaces of these stars."

Of the A-type stars observed, five are regular magnetic variables having very large and nearly uniform magnetic amplitude and almost symmetrical reversal of polarity; 22 are irregular magnetic variables showing reversal of polarity; and 15 are irregular magnetic variables always showing the same polarity.

Science News Letter, February 15, 1958





CASCADE PARTICLE — The first photograph of a man-made cascade particle is shown along with a diagram (at the top) indicating where the various particles are located. The symbols used include: Ξ^- for the psi or cascade particle; π^-, pi minus; π^+, pi plus; θ°, theta neutral; and Λ°, lambda neutral. In identifying the particles in the photograph, first locate the two inverted "V's" at the bottom and near the top left of the diagram.