News and views

Fundamental Particles

Symbols Proposed at Bagnères Congress

[The following proposal for a new set of symbols for fundamental particles was agreed upon as a result of discussions held during the International Cosmic-Ray Congress at Bagnères de Bigorre in the French Pyrenees, July 6–12, 1953. The Congress was organized by the University of Toulouse with the support of Unesco and of the Commission for Cosmic Rays of IUPAP. Co-Authors of the present note are E. Amaldi, C. D. Anderson, P. M. S. Blackett, W. B. Fretter, L. Leprince-Ringuet, B. Peters, C. F. Powell, G. D. Rochester, B. Rossi, and R. W. Thompson.]

Symbols for Fundamental Particles

In recent years we have witnessed startling developments in the field of fundamental particles. One of the consequences has been the appearance in the scientific literature of a new jargon and of a large number of new symbols. Some symbols (such as π, μ, τ) designate specific kinds of particles. Others (such as ρ, σ) have been used to describe merely a phenomenological behavior. Various authors have called the same particle by different names or have attached different meaning to the same symbol. Sometimes the meaning of a symbol has changed through the years. To give an example, the Greek letter κ was used initially to describe a heavy meson which stops in the emulsion and subsequently decays, giving rise to a single ionizing particle. Later the Latin letter K replaced the Greek letter κ as a code for the above phenomenological description, while the letter κ acquired a more definite physical meaning: that of a heavy meson which decays into one charged and two neutral particles. Sometimes, however, the letter K is also used to designate any charged particle heavier than a π-meson and lighter than a proton, whose mode of decay is unknown. As another example, the neutral particle of mass about 1000 m_e, which decays into two π-mesons, has been variously named v^0, $V_2{}^0$, $V_4{}^0$, whereas some authors have used the letter $V_2{}^0$ to designate any V^0-particle different from the so-called $V_1{}^0$.

It seems to us that, in order to avoid confusion, the time has come to agree upon a coordination of the symbols used to indicate fundamental particles or groups of fundamental particles. Our specific suggestions are listed in the table to follow.

We propose first to subdivide fundamental particles into three groups according to their mass and to denote each group by a Latin letter. We tentatively suggest the name *hyperon* for a particle of mass intermediate between that of the neutron and the deuteron.

We then suggest the use of Greek letters to indicate specific particles (as opposed to groups of particles). We note that this procedure has been widely followed in the past (recall the symbols γ, μ, ν, π, τ). We do not propose, however, to change the accepted symbols for the proton (p) or the neutron (n).

We finally suggest to retain and make more precise the phenomenological classification already in use, based on the empirical features of the decay process (V-particles, S-particles).

CLASSIFICATION OF PARTICLES

A. *Groups of Particles*

Light mesons (L-mesons):

π-mesons, μ-mesons, any other lighter meson which may be discovered.

Heavy mesons (K-mesons):

all particles heavier than π-mesons and lighter than protons.

Hyperons (Y-particles):

all particles with mass intermediate between that of the neutron and the deuteron (this definition might be revised if fundamental particles heavier than deuterons are discovered).

B. *"Christian Names"*

Use capital Greek letters for hyperons and small Greek letters for mesons.

(1) *Hyperons*

Λ^0: particle previously known as $V_1{}^0$ and characterized by the decay scheme $\Lambda^0 \rightarrow p + \pi^-$. If it turns out (as suggested by some results) that there are particles with this decay scheme and different Q-values, they could be designated by different subscripts.

Λ^+: the positive counterpart of Λ^0 with the possible decay schemes:

$$\Lambda^+ \rightarrow n + \pi^+$$
$$\Lambda^+ \rightarrow p + \pi^0$$

The existence of these particles is indicated by recent experiments.

(2) *Heavy Mesons*

$\tau \rightarrow 3\pi$ (considered certain).

$\kappa \rightarrow \mu + 2$ *neutral particles* (considered very probable; however, the nature of the neutral products is still unknown).

$\chi \rightarrow \pi + 1$ *neutral particle* (considered as probable; nature of neutral particle unknown).

θ^0: particle previously known as v^0, $V_2{}^0$, $V_4{}^0$, characterized by the decay scheme $\theta^0 \rightarrow \pi^{\pm} + (\pi^{\pm}$ or $\mu^{\mp})$. If it turns out (as suggested by some results) that there are particles with this decay scheme and several Q-values, they could be designated by different subscripts.

Midget with the giant brain

The Problem

To design and build a computer for airborne automatic control systems—with severe restrictions imposed on size, weight and operation under extreme environmental conditions; in short, a computer that would be small, simple, reliable, rugged—and easy to build and maintain.

AT HUGHES RESEARCH and Development Laboratories this problem was examined exhaustively, and it was concluded that a digital computer offered the best means for satisfying the requirements because of its ability to solve complex problems accurately and quickly.

Because the requirements of this application could not be met by existing digital computers, owing to their large size, the following developments were undertaken:

1. Simplification of the logical structure of the computer through the use of a mathematical theory of computer design based on Boolean algebra—but with retention of the operational versatility of a general-purpose computer.

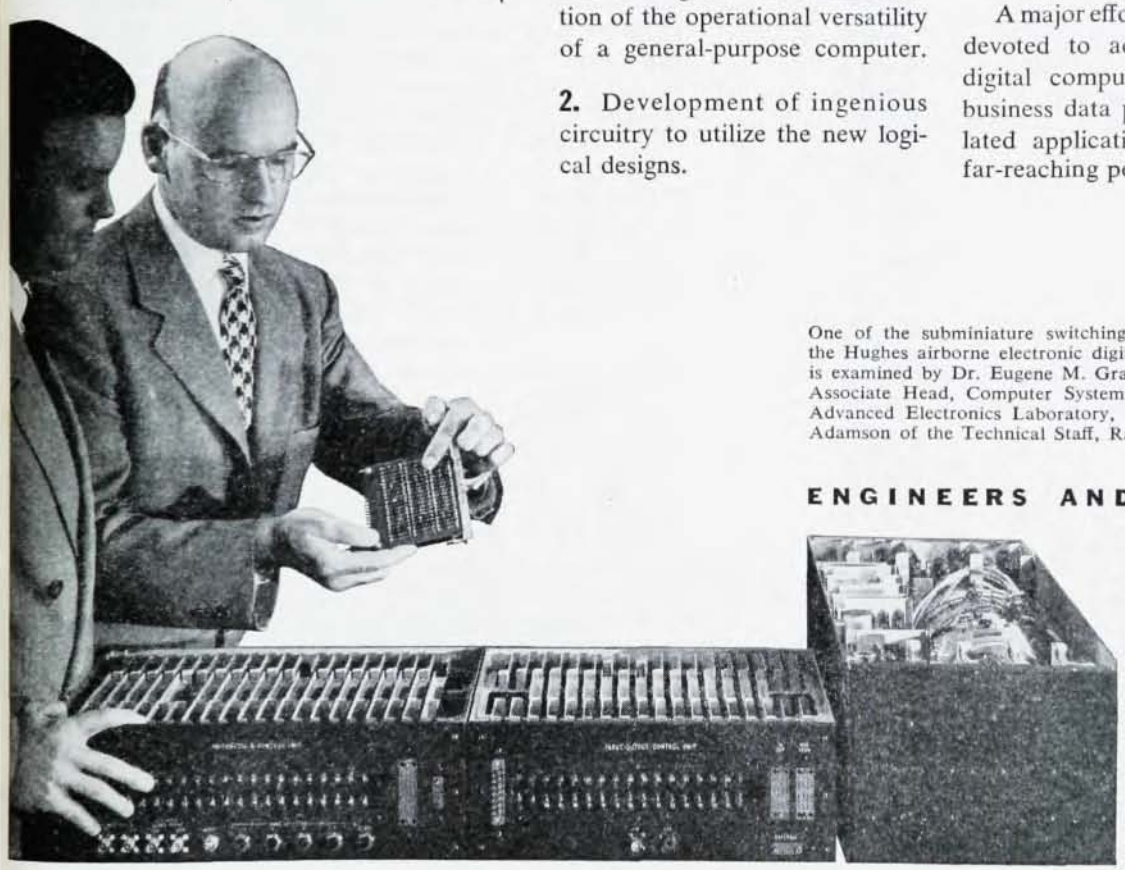
2. Development of ingenious circuitry to utilize the new logical designs.

3. Achievement of minimum size by the use of subminiature techniques, including germanium diodes, subminiature tubes, and etched circuits.

4. Employment of unitized construction: plug-in units of flip-flop circuits and diode networks.

Need for subminiaturization, then, was a governing factor. Consequently, entire new techniques for making things not only vastly smaller, but at the same time easier to build and service, were developed by Hughes. This is a continuing process and there is indication of even more significant advancement in miniaturization for the future.

A major effort at Hughes is also devoted to adapting electronic digital computer techniques to business data processing and related applications—destined for far-reaching peacetime uses.



One of the subminiature switching circuits from the Hughes airborne electronic digital computer is examined by Dr. Eugene M. Grabbe (right), Associate Head, Computer Systems Department, Advanced Electronics Laboratory, and Phil A. Adamson of the Technical Staff, Radar Laboratory.

ENGINEERS AND PHYSICISTS

Activities at Hughes in the computer field are creating some new positions in the Laboratories. Experience in the design and application of electronic digital computers is desirable, but not essential. Engineers and physicists with backgrounds of component development or system engineering are invited to apply.

Assurance is required that the relocation of the applicant will not cause the disruption of an urgent military project.

ADDRESS: *Scientific and Engineering Staff*

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

C. *Phenomenological Categories*

V-event:

phenomenon which can be interpreted as the decay in flight of *K*-meson or *Y*-particle. Subdivisions: V^0-event; decay of a neutral particle; $V^{\pm}$-event, decay of a charged particle.

S-event:

phenomenon which can be interpreted as the decay at rest of a charged *K*-particle or *Y*-particle.

Jeffries Committee Upholds NBS

AD–X2 Declared to be Without Merit

The eleven-man independent committee of scientists to evaluate procedures used in testing the battery additive AD–X2, appointed earlier this year by the National Academy of Sciences at the request of the Secretary of Commerce, has reported unequivocally that the tests conducted by the National Bureau of Standards were "excellent" and that "the relevant data now available to the committee on the effects of AD–X2 are adequate to support the position of the Bureau of Standards that the material is without merit". The committee, which was headed by Zay Jeffries, retired vice-president of General Electric Company, recommended that no further tests of the additive be conducted in view of the "very considerable reliability" of the conclusion that AD–X2 has no beneficial action on battery performance or longevity. The committee's report was released on November 13th together with a statement by Secretary of Commerce Sinclair Weeks, who is quoted as saying that the committee's evaluation "is an assurance to the public and a source of satisfaction to me and to the Bureau". Mr. Weeks added that he would do all in his power "to aid the Bureau in maintaining this high level of scientific service to the nation". AD–X2 manufacturer Jesse M. Ritchie is quoted as having declared the report to be a "whitewash", written "for the most part" by the Bureau itself, and "an insult to the intelligence of Secretary Weeks, my customers, and the American public". The committee's 34-page report, it might be noted, was amplified by two volumes of appendices giving data from the various tests of the product, including the several exhaustive tests performed by NBS.

123 NSF Awards Announced

In Physical and Biological Sciences

The first group of awards for the support of basic scientific research and related matters for the fiscal year 1954 by the National Science Foundation consists of 123 grants totalling $1 332 000. Over 525 such awards involving nearly $5 million have now been made since the start of the program in 1950. In addition to the direct support of research these grants also cover meetings and conferences, scientific information exchange, and travel by American scientists to international scientific meetings. Awards for research in physics and biophysics in the latest series were made as follows: University of California (C. Kittel), "Interaction of Fundamental Particles with Solid State Systems"; Case Institute of Technology (L. L. Foldy and M. J. Klein), "Theoretical Research in Nuclear and Solid State Physics"; University of Connecticut (C. A. Reynolds), "Hydrodynamics of Liquid Helium II"; Duke University (L. W. Nordheim and E. Greuling), "Theory of Nuclear Shell Study"; University of Illinois (D. W. Kerst), "Photoproduction of Pi-Mesons"; Kent State University (A. A. Silvidi), "Continuous Cloud Chambers"; Marquette University (A. G. Barkow), "Elementary Particle Reactions in Photographic Emulsions"; Michigan State College (E. A. Hiedemann), "Light Diffraction and Ultrasonic Waves"; University of Nebraska (D. C. Moore), "Half-Life of Positrons in Condensed Matter"; New York University (A. Beiser), "Sensitivity Time in Nuclear Emulsions"; University of Oklahoma (J. R. Nielsen), "Vibrational Spectra of Compounds in Different States of Aggregation"; University of Puerto Rico (A. Cobas), "Zenith Angle Variation of Cosmic Rays"; Purdue Research Foundation (F. J. Belinfante), "Elementary Particles and Field Theory"; Rice Institute (C. F. Squire), "Studies in Solid State Physics"; Southwestern University at Memphis (D. E. Matthews), "Critical Energy for Secondary Electron Research"; U. S. Embassy, London, England (R. W. G. Wyckoff, science attaché), "Electron Microscopic Study of the Structure of Biological Tissues"; University of Pittsburgh (M. A. Lauffer), "Biophysical Studies on Plant Viruses"; and Yale University (E. C. Pollard and F. Hutchinson), "X-Ray Studies of Viruses".

The following awards are among those granted in other sciences: University of Chicago (W. A. Hiltner), "Interstellar Polarization"; University of Chicago (G. P. Kuiper), "Physical and Statistical Study of the Asteroids"; Harvard University (H. Shapley), "The Stellar Corona Surrounding our Discoidal Galactic System"; Northwestern University (K. A. Strand), "Photographic Observation of Double Stars"; Yale University (D. Brouwer), "Systems of Fundamental Catalogues from Observations of Selected Minor Planets"; University of Chicago (H. C. Urey), "Isotopic Abundances Relating to Geochemical Research"; Georgia Institute of Technology (W. T. Ziegler), "Studies of Compounds for Superconductivity"; and Pennsylvania State College (A. H. Waynick), "Detecting Solar and Upper Atmosphere Phenomena by Long-Wave Radio Methods".

Among the conferences that received NSF support are: The American Academy of Arts and Sciences, "Conference on the Validation of Scientific Theories"; Carnegie Institution of Washington, "Conference on Radio Astronomy"; University of Chicago, "Conference on Nuclear Processes in Geological Settings". One physicist, L. W. Alvarez of the University of California at Berkeley, received a grant to enable his attendance at the Symposia on Nuclear Physics, Geophysics, and Astrophysics to be held next January in Canberra by the Australian-New Zealand Association for the Advancement of Science.