dicotyledons are, in general, more modern than the woody members. Further support for this belief is found in the host relationships of the smut fungi and of the ascomycetous genus *Taphrina*. It appears probable that the separation seen by Hutchinson is chronological rather than genetic.

If we divide the species of *Puccinia* and *Uromyces* in Canada and the United States into three groups—primitive, intermediate, and advanced—on the basis of teliospore morphology and count the numbers that occur on (i) herbaceous dicotyledons, (ii) Glumiflorae (grasses, sedges, and rushes), and (iii) Liliaceae (*sensu lato*), Amaryllidaceae, and Iridaceae, we may hope to get some idea of the relative ages of these various plants. Such a division is shown in Table 1. The exact distribution must depend upon one's species concept and estimate of the latitude of each category, but the disposition is doubtful for only a few species. It is generally recognized today that the monocotyledons split off from the dicotyledons at an early stage when most members of the latter were woody. Thus the monocotyledons are all more modern than the most ancient dicotyledons, but it is not so clear how the more advanced members of each class compare.

Among the monocotyledons, the Glumiflorae represent one evolutionary line, adapted to wind pollination, and the Liliaceae and related families with showy flowers represent another line in which insect pollination has predominated. The figures in Table 1 strongly suggest that the Glumiflorae are, on the average, older than the herbaceous dicotyledons. The data for the Liliaceae, Amaryllidaceae, and Iridaceae are somewhat scanty, but these families appear to be more modern than the Glumiflorae. This finding may come as a surprise to many botanists, as it did to me, for we think of the reduced flowers of the grasses, sedges, and rushes as being highly advanced and thus modern. The explanation may lie in the fact that most Glumiflorae flower in the first or second year from seed, thus having a much shorter generation time than many of the lilies and their allies that do not flower until they are about 5 to 7 yr old. Thus evolution in the Glumiflorae may have proceeded very rapidly.

Table 1. Telial hosts of North American species of *Puccinia* and *Uramyces*.

Type of rust	Herbaceous dicotyledons	Glumiflorae	Liliaceae, Amaryllidaceae, and Iridaceae
Primitive	91	113	9
Intermediate	21	9	5
Advanced	168	3	21

Conclusion. These observations make only a trifling contribution to phanerogamic taxonomy in proportion to the many and serious phylogenetic problems that remain to be solved. Yet I feel that they are useful examples of the profitable results to be expected from more detailed studies of this sort. It must be repeated that the reliability of the method depends on the validity of the classification of the parasites; and thus the responsibility for its use falls fully on the mycologist.

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Revised Symbols for the New Unstable Particles*

R. W. Thompson

Department of Physics, Indiana University, Bloomington

ONE of the most interesting developments in physics in recent years has been the discovery of a surprising number of new heavy, unstable particles. There is no reason to think the list is yet complete; in fact, at the moment, the rate at which new particles are being found (about two per year) appears to be increasing as a result of concentrated effort in a large number of laboratories in many different countries.

The new particles are produced, directly or indirectly, in nuclear collisions of energy of the order of 1 Bev or more. For this reason, the new particles have been detected and studied primarily in cosmic radiation, although during the last year, artificial production has been achieved with the Brookhaven cosmotron. The methods of observation are quite varied; the principal experimental techniques are the nuclear emulsion, the magnetic cloud chamber, the multiple-plate cloud chamber, and the hydrogen diffusion cloud chamber.

All the new particles at present identified are unstable, with lifetimes in the range 10^{-8} to 10^{-10} sec, disintegrating spontaneously into two or more lighter particles with a large release of energy. The charged parent particles are sometimes observed to decay in flight and sometimes to decay at rest at the end of their range. The neutral parent particles are not decelerated by collision loss of energy, hence their decay must be observed in flight.

The masses of the new particles appear to fall into two fairly distinct intervals. The first grouping occurs about halfway between the π-meson mass of 273 m_e and the proton mass of 1836 m_e. The best established example in this group is the τ-meson of 967 m_e that disintegrates into 3 π-mesons. The second grouping occurs at masses from 20 to 40 percent greater than the proton mass. The best established example is probably the neutral particle, usually denoted $V_1{}^0$, of 2182 m_e that disintegrates into an ordinary proton and a negative π-meson. There is reason to believe that the two groups are fundamentally different. Particles in the first group are usually referred to as "heavy mesons," whereas particles in the second group are sometimes referred to as "excited nucleons."

The development of the notation for the new particles has closely paralleled work on the particles themselves. For example, the first evidence for the existence of the new unstable particles was the phenomenon called "forked tracks" observed in the magnetic cloud chamber. The forked tracks were of two types: one in which a track was observed to undergo an abrupt angular deflection in the gas of the chamber without visible recoil; and one in which two tracks of opposite curvature apparently originated at a common point in the gas, again without visible recoil. The evidence indicated that events of the first kind resulted from the spontaneous decay in flight of heavy charged particles into one charged and one or more neutral fragments. Similarly, events of the second kind were shown to result from the spontaneous decay in flight of heavy neutral particles into two charged and possibly one or more neutral fragments. The name "forked tracks" was later changed to "V-tracks." The particles which, on distintegration in flight, produced the V-tracks were known phenomenologically as "V-particles" in the absence of more detailed knowledge of their specific properties.

When more data on the neutral V-particles were accumulated, two types were distinguished according to the mass of the positive decay fragment. In the majority of cases, the positive fragment was found to have a mass near that of the proton; however, in some cases, the measured mass was found to be near that of the π^+-meson. The two types of neutral V-particles were variously designated by the symbols $V_1{}^0$ or V^0, and $V_2{}^0$ or V^0, respectively. Further evidence indicated the complexity of both groups, and additional subscripts, $V_3{}^0$ and $V_4{}^0$, were introduced, but diversity of usage persisted.

The notation for the charged particles provides similar illustrations. For example, charged heavy, unstable particles were observed to decay at the end of their range, ejecting a single charged fragment. In the multiple-plate cloud chamber they were called "S-particles," and in the nuclear emulsion they were called "κ-mesons." The Greek letter κ was later replaced by the Latin letter K as the symbol for the phenomenological class, the Greek letter κ became the specific symbol for the type of K-particle that decays into a μ-meson and two neutral fragments. It was recognized, of course, that the classes $V^\pm$, S, and K might intersect, in fact might even be identical; however, in view of the differences in observational technique and in the absence of more definite information, the phenomenological distinction was preserved.

Thus, the rapid advances in the field have required frequent introduction of new symbols to designate the particles and continual revision of the meanings of symbols already introduced. Different authors have denoted the same particle (or group of particles) with different symbols or have used the same symbol to designate different particles (or groups of particles). As a result, the number of new symbols to be found in the literature exceeds the number of new particles.

Recently, a revised nomenclature for the new particles has been proposed (*1*) as an outgrowth of discussions held during the International Cosmic Ray Congress at Bagnères-de-Bigorre, France, 6–12 July

Table 1. Specific symbols.

Mass category	Specific symbol	Decay scheme	Mass	Remarks
K-mesons	$\tau^\pm$	$\rightarrow 3\pi$	967 m_e	Well established
	κ	$\rightarrow \mu + ?^0 + ?^0$	$\sim$ 1000 m_e	Very probable
	χ	$\rightarrow \pi + ?^0$	$\sim$ 1000 m_e	Probable
	θ^0	$\rightarrow \pi^\pm + (\pi^\mp \text{ or } \mu^\mp)$	966 m_e	Very probable*
Y-particles	Λ^0	$\rightarrow p + \pi^-$	2182 m_e	Very probable*
	Λ^+	$\rightarrow n + \pi^+$	$\sim$ 2200 m_e	Indicated by recent experiments†
		$\rightarrow p + \pi^0$		

* It is suggested by some results that there are particles with this decay scheme but different Q-values. The proposal suggests that these could be designated with different subscripts.

† Λ^+ here refers to the positively charged counterpart of Λ^0.

1953 (*2*). The authors of the new proposal 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.

The proposed new nomenclature provides two types of *generic* symbols to indicate the classification according to mass and according to phenomenon of decay, in addition to the usual *specific* symbols or "Christian names" to designate each individual type of particle.

Mass Categories

There are three mass categories demarcated by the π-meson mass and the nucleon masses. This grouping is suggested empirically as discussed in the first part of this article and has been more or less anticipated in previous usage.

L-meson: Any particle with mass equal to or less than that of the π-meson. This category thus includes the π-meson, μ-meson, and any other lighter meson that may be discovered. The name "light meson" is suggested for particles in this group.

K-meson: Any particle with mass intermediate between that of the π-meson and the proton. Thus the τ-meson is an example of a K-meson. The name "heavy meson" is suggested for this group.

Y-particle: Any particle with mass intermediate between that of the neutron and the deuteron. (The proposal suggests that this definition might be revised if fundamental particles heavier than deuterons are discovered.) The name "hyperon" is suggested for particles in this group.

It should be noted that the mass categories defined here exclude the ordinary nucleons (neutron and proton).

Phenomenological Categories

The new phenomenological categories extend and make more precise the phenomenological distinction already in use (V-particles, S-particles).

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

S-event: Any phenomenon that can be interpreted as the decay at rest of a charged K-meson or Y-particle.

Specific Symbols

The distinction between generic symbols and specific symbols is emphasized by the use of Latin letters for the former and Greek letters for the latter. This usage of the Greek letters is then identical with most previously well-established usage (for example, γ, μ, ν, π). It is not proposed, however, to change the accepted symbols for the proton (p) and the neutron (n). It is proposed to use the capital Greek letters for hyperons in order to distinguish them from mesons and other particles.

The new particles that have been given specific symbols to date are listed in Table 1.

References and Notes

* Assisted by the U.S. Office of Ordnance Research and by a grant of the Frederick Gardner Cottrell fund of the Research Corporation.

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James Rollin Slonaker, a Worker in Vision, Nutrition, and Activity

The death of James Rollin Slonaker in Palo Alto on 3 January 1954, at the age of 87, marked the end of a long career as a teacher and researcher at Stanford University.

Dr. Slonaker's interest in biology, which led him finally to a professorship in physiology, began early in life. He was born in Farmland, Indiana, on 17 June 1866, and as a young boy he studied the nesting habits of birds. He earned his way through school, then taught all grades in a one-room house, making the fires himself and trudging 4 miles each way from home. In 1889 he graduated from the Indiana State Normal School, at which time he became principal of the high school and superintendent of schools in Elroy, Wisconsin. After 2 years he entered the University of Wisconsin, and in 1893 he was awarded the B.S. degree; a fellowship in biology then enabled him to go to Clark University, where he received the Ph.D. degree in 1896.

At Clark University, Dr. Slonaker studied with Clifton H. Hodge, a noted naturalist and authority on the structure of the eye. Dr. Slonaker spent the first 5 years after receiving his doctorate as assistant professor of zoology at Indiana University. One of his most promising students there was George Daniel Shafer, who later joined him as a member of the Stanford physiology faculty where they were always the closest of friends.

The first paper published by Dr. Slonaker was entitled "A comparative study of the point of acute vision in the vertebrate" [*Am. Naturalist* (1 Jan. 1896)]; this paper was typical of a series of 11 papers on the comparative anatomy and physiology of the eye that he published before 1921. About half of these