New Particles Continue to Charm Physicists

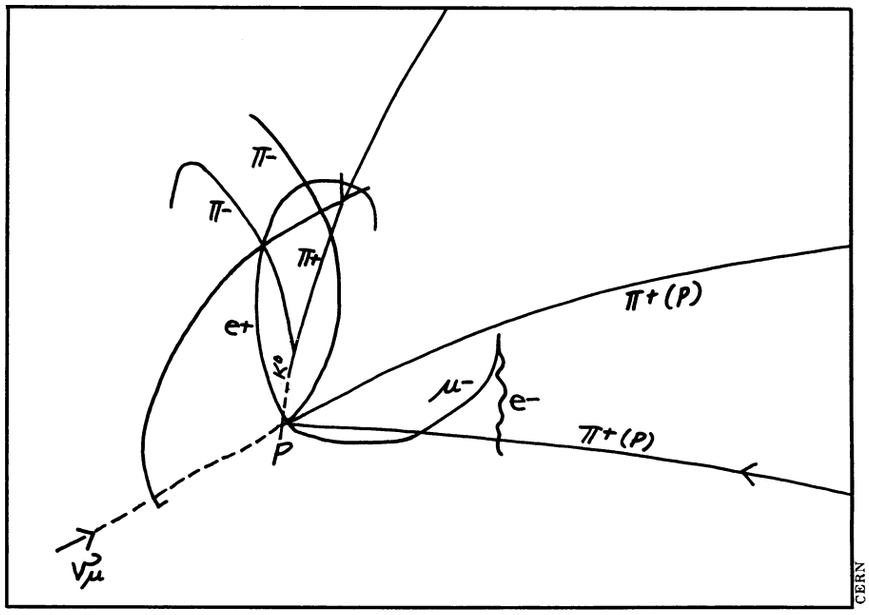
"Seek and ye shall find," says the scripture, a maxim that often applies to particle physics. What physicists are avidly looking for these days is evidence of charm. Charm is a property of elementary particles—something of an analogy to electric charge—recently suggested by theorists because it would explain some factors influencing the forces and activities of certain particles. The discovery of the psi or J particles last November gave—according to most theorists who considered it—the first experimental indication that charm exists. Since then, the hunt for more has been on.

Recently two new candidates for charmed particles have surfaced, one at the CERN laboratory in Geneva, one at the Brookhaven National Laboratory in Upton, N.Y. Both events appear to concern charmed baryons. In these cases the supposed charmed particles are not themselves directly recorded by the equipment. Their existence is inferred from their decay products, and their charm is inferred from the way the usual laws regarding changes in electric charge and strangeness (another abstract particle property) are violated.

The CERN event, found by the Brussels component of CERN's Gargamelle bubble chamber group led by Paul Musset, involves a neutrino of the muon variety entering the bubble chamber and striking a nuclear particle to produce the charmed baryon and a negative muon. The charmed baryon then apparently decays to a neutral K meson, a positron and a neutrino of the electron variety.

The Brookhaven event, reported by a group led by Nick Samios and Robert Palmer, also involves a neutrino and a nuclear particle. In this case a charmed baryon is also apparently produced, which then decays into a lambda baryon and some pi mesons. The Brookhaven report goes so far as to hint at the mass of their baryon: 2,424 million electron-volts.

So far the events are candidates for the existence of such new particles only. More events and examples of their behavior will be needed to convince. Perhaps fittingly, the announcements were both rather low-key, lacking the publicity and excitement of the announcement of the psi's last fall. Both of the new events were mentioned at an international colloquium on neutrinos at London, but the CERN one in a very offhand way. □



A tracing of the CERN charmed-particle event. The neutrino enters lower left.

Galaxy connection: Optical-radio link

The main reason for building the four-meter telescope at the Cerro Tololo Inter-American Observatory in Chili, sister institution to Kitt Peak National Observatory in Arizona, was to be able to see objects of the southern sky in detail comparable to that of the best northern observations. Already, though still under preliminary testing and adjustment, the new telescope has demonstrated it can do that and turn up new and unexpected information. The matter involves a heretofore unseen close correspondence between optical and radio sources.

The telescope was completed in October 1974. Testing and adjusting an instrument of this size takes about a year, and a regular research schedule is not expected to begin before 1976. But testing involves taking photographs, and one of them so excited a Cerro Tololo astronomer, John Graham, that an immediate intensive observational effort was mounted.

The picture showed the galaxy NGC 5128 in the constellation Centaurus. This galaxy is also known to radio astronomers as Centauras A and is one of the longest known radio sources. It is typical of a class in which a visible galaxy is surrounded by lobes of matter that radiate radiowaves. The usual presumption is that there is a connection between the optical and radio sources, the hypothesis being that the radio lobes were expelled by the visible galaxy. Up to now, evidence of an actual physical connection was lacking.

The new Cerro Tololo result provides it. The first photo showed visible filaments extending radially away from the galactic center and starlike images never before seen near the galaxy. The streamers extend 27 minutes of arc away from the galaxy, reaching as far as the invisible northeastern radio lobe.

Early studies indicate that these filaments and knots are probably gaseous material glowing fluorescently with energy supplied by the ultraviolet radiation of nearby stars. Studies with blue- and violet-sensitive equipment indicate that the starlike objects, which appear very close to the radio lobe, may be young, hot blue stars.

Thus the results may have a bearing both on the energetics of galaxies—such radiating filaments are suggestive of matter being ejected—and the formation of new stars.

Such precise correlation between radio and optical sources has long been theorized and sought after, but never before seen, comments Victor Blanco, director of Cerro Tololo. In no previous study, he says, have astronomers discovered optical activity linking a parent galaxy and a radio source in this way. □