about the reliability of hybrid computer circuits using these devices, and by R. Naylor (Ferranti), who compared the thermal impedance of flip chip and beam lead assemblies, and showed little difference in thermal properties between the two methods. In the ensuing discussion it was generally accepted that more use would be made of flip chip and beam lead devices, although Dr J. Evans (Standard Telephone Laboratories) expressed some reservations about the cost.

Large scale integration (LSI) has been the subject of controversy for some time, and LSI devices using unit cell and modular systems were described. A metal oxide semiconductor transistor (MOST) memory using discretionary wiring was discussed by A. F. Beer (Mullard Research Laboratories), in which calculations were presented showing a discretionary wired array, with a basic sixteen-bit word unit, giving a lower cost per bit than fixed wired arrays.

The combination of MOST devices and bipolar transistors in a common integrated circuit would allow circuit designers a much more flexible approach by exploiting the better characteristics of each device, and this was the aim of work discussed by D. J. Burt (General Electric Company). The standard triple diffused bipolar transistor integrated circuit fabrication sequence was followed closely, using the shallow *p*-type base diffusion for the MOST source and drain regions. To ensure an adequately low threshold voltage, the thick oxide over the gate regions was removed by an extra photo resist stage, and regrown during the drive in for the bipolar transistor emitters.

NUCLEAR PHYSICS

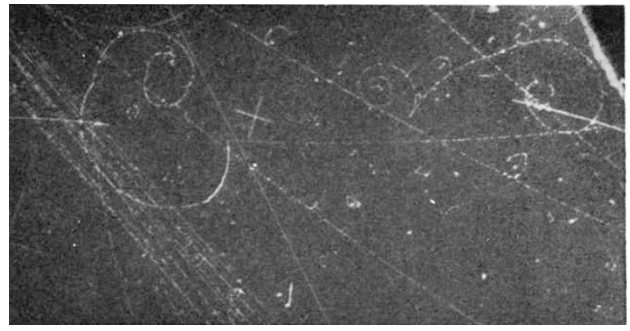
The CP Puzzle Again

from a Correspondent

In 1964 Christenson, Cronin, Fitch and Turlay reported the observation of a two-pion decay mode of the long-lived neutral K-meson K_L^0—a mode forbidden by the law of CP invariance. Subsequent experiments have confirmed the original observations, adding gradually and painfully to knowledge of this unprecedented effect. The most notable feature of the phenomenon is its insignificance. Compared with the violation of parity invariance discovered in 1957 of one part in two, CP is only violated by one part in 500. Consequently the experimental difficulties are daunting and progress has been slow.

There are many possible explanations for the observations, ranging from long range cosmological effects to a breakdown of the laws of quantum mechanics. This array of possibilities has been steadily whittled down by ingenious and delicate experiments. Today we are left essentially with two broad alternatives: the effect is either due to some superweak or milliweak interaction which is CP non-invariant, or quantum mechanics is wrong in some unknown way. The latter possibility seems to be the only means of maintaining CP invariance while still remaining consistent with the experiments.

A recent spate of communications in *Physical Review Letters* has shown how little this experimental evidence is understood. In a letter entitled "Additional Experimental Proof of CP Non-conservation? Who Needs It?" (*Phys. Rev. Lett.*, **22**, 213; 1969), H. J. Lipkin has discussed the possibility of yet another explanation which still maintains CP invariance. His claim was that the so-called particle mixture theories (P. K. Kabir and R. R. Lewis, *Phys. Rev. Lett.*, **15**, 306, 711, 908; 1965) have not been excluded by experiments. These theories postulate the existence of an additional particle with the same properties as K_L^0, except for a slightly different mass and the opposite CP properties.



Bubble chamber photograph of the decay of a K^0 meson into two charged π mesons.

Lipkin's comments have been provoked by an earlier letter from D. I. Lalović (*Phys. Rev. Lett.*, **21**, 1662; 1968) discussing possible tests for the breakdown of quantum mechanics. Lipkin's forceful criticism of the latter point of view has been effectively answered by Kabir in a short article in *Physical Review Letters* (**22**, 1018; 1969). Kabir summarizes the fairly decisive evidence against the particle mixture theories, emphasizing the importance of interference experiments. He then goes on to explain that difficult but not impractical interference experiments will make it possible to test the quantum mechanical laws used in the analysis of the K° complex.

This account perhaps illustrates two typical symptoms of particle physics today. Kabir's analysis is not new: all his arguments appeared almost a year ago in his book *The CP Puzzle* (Academic Press, 1968), and should be known to all interested workers. Even more important is how easy it is to ignore the evidence which so many patient experimentalists have been accumulating during the past five years. Their sometimes unrewarding efforts deserve admiration and attention.

NUCLEAR PHYSICS

Quarks in Absentia

Two more experiments can now be added to the list of unsuccessful attempts to find the first real crumb of direct experimental evidence for the existence of quarks. For those who hope to find a quark—with its characteristic fractional charge—within the lifetime of the impending 200 or 300 GeV accelerators, the emphatically negative results of the latest two experiments will be particularly disappointing.

At Serpukhov, Y. Antipov *et al.* (*Phys. Lett*, **29**B, 245; 1969) used the highest energy proton accelerator at present available, which is capable of accelerating protons up to an energy of about 70 GeV. This means that quarks and antiquarks with masses up to about 4·8 GeV/c (five proton masses) could in theory be produced in collisions between protons and stationary