V. A. Khoze. *The heavy lepton $\tau^{\pm}$ in e^+e^- annihilation.* The paper deals with the presently available weighty experimental indications[1-4] that pairs of new heavy charged leptons with mass $M \approx 1.9$ GeV are produced in e^+e^- collisions at energies $3.8 \leq E \leq 7.8$ GeV. The most typical expected (e.g.,[5-7]) and observed[1-4] properties of these new objects are discussed together with their possible theoretical status, and with the problem of their coexistence[8] with the recently observed charmed quarks within the framework of the e^+e^- annihilation.

Perl, Feldman, *et al.* of Stanford University and of the Lawrence Laboratory at Berkeley (the SLAC–LBL group) have observed with the SPEAR setup in 1975 the first indication of production of a heavy lepton, which they dubbed $\tau(\tau\rho\upsilon\tau o\upsilon)$ i.e., the third charged lepton.

According to standard theoretical estimates (e.g.,[5-7]), the τ lepton is expected to have the following properties:

a) Relative probability $B_l \approx 0.2$ of decay via a pure leptonic channel.

b) Relative probability $B(1) \approx 0.85$ of decays with production of only one charged particle.

c) Strong suppression of decays in a state with strange particles in the final state.

d) Lifetime $T \sim 2 \times 10^{-13}$ sec.

The production of a pair of τ leptons in e^+e^- annihilation should take place mainly in states with two charged particles.[7]

For e^+e^- collisions, a large volume of data has by now been accumulated on the production of anomalous (i.e., not explainable by any of the known phonon mechanisms) pairs $e^{\pm}\mu^{\mp}$, $\mu^{\pm}\chi^{\mp}$, $e^{\pm}\chi^{\mp}(\chi^{\pm})$ is a charged particle). Besides the SLAC–LBL group,[1,3] anomalous events have been distinctly observed by the DASP and PLUTO groups[4] with the DORIS installation (Hamburg, W. Germany).

All the observed properties of the anomalous events, particularly the spectra of the secondary leptons, the angular distributions, and the production cross sections are in good agreement with the assumption that they stem from the decays of a heavy lepton with $M \simeq 1.9$ GeV, which enters in the left-hand charged current together with a massless (new?) neutrino. The experimental values of $B(1)$ and B_l are also in good agreement with the theoretical expectations.

The contemporary data seem to exclude completely the possibility of τ^- having the lepton number of μ^+, μ^-, or e^+.

Additional indications in favor of the hypothesis of $\tau^+\tau^-$ pair production in e^+e^- innihilation follow from an analysis of the aggregate of the inclusive characteristics of this reaction.[8]

There are at present no known facts to contradict this hypothesis, nor is there any simple explanation of the entire aggregate of the data.

Among the principal questions in experiments on e^+e^- annihilation is that of the measurements that must still be performed to confirm finally the heavy-lepton hypothesis and to establish reliably the properties of this particle. This problem is dealt with a large number of papers (e.g.,[9,10]).

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