Experiment #103

FERMILAB-CONF-78-142-E

XIX International conference on High Energy Physics

Tokyo, 1978

(Session B, New Particles)

A SEARCH FOR NEW PARTICLES WITH LIFETIME 10^{-12} - 10^{-14} SEC IN INTERACTIONS OF PROTONS WITH NUCLEONS AND NUCLEI IN EMULSION AT 400 GEV/C

M.M.Chernyavsky, A.A.Komar, G.I.Orlova, N.A.Salmanova,
M.I.Tretyakova

P.N.Lebedev Physical Institute of the Academy of Sciences
of the USSR, Moscow

Abstract (This is only the abstract.)

A stack of nuclear emulsions was irradiated by 400 Gev/c protons at FNAL (Batavia, USA).

In this work a search for the short-lived particles has been carried out by a new method that allowed to detect secondary events (including the narrow ones) on short distances from the parent star. By measuring angles, momenta and ionizations of the secondary particles we could identify electrons and distinguish them from hadrons.

In search for the decays of charged of particles on $n_s \geq 3$ charged relativistic particles or of neutral ones on two or four charged particles the environments of the 1120 stars has been looked through up to 1 mm from the center of parent star inside of cone $\theta \leq 4°$.

By this method 21 secondary events of the type $0+0+n_s$ have been selected. After excluding background due to the nuclear and electro-magnetic interactions 9 events remained (from which 4 of the type 0+0+2n, 2 of the type 0+0+3p and 4 of the type 0+0+4n). We consider them as decays of the new short-lived particles. All these 9 events are characterised by jet like structure ($\theta_L \leq 10^{-2}$ rad). At least in one of these events there is an electron, that is the particle suffered a semileptonic decay.

Estimation of the masses of the decaying particles in most cases agree with the mass of the charmed barions. Mean life time estimated on the basis of 9 events is about $2,0.10^{-14}$sec.

The rate of the production of the new short-lived particles is the following: neutral particles 6.10^{-3} per star and charged ones - 2.10^{-3} per star in pA-interactions at 400 Gev/c. The total cross section for production of these particles is $\sim 100 \mu$ bn. Detection of the charmed particles produced in association with the found ones needs further investigation.