# Production of $F^-$ mesons in $\tilde{\nu}N$ interactions

A. É. Asratyan, P. A. Gorichev, S. P. Kruchinin, M. A. Kubantsev, I. V. Makhlyueva, A. V. Fedotov, V. I. Shekelyan, V. V. Ammosov,[1] V. S. Burtovoĭ,[1] V. A. Gapienko,[1] G. S. Gapienko,[1] A. G. Denisov,[1] V. G. Zaets,[1] V. I. Klyukhin,[1] V. I. Koreshev,[1] P. V. Pitukhin,[1] V. I. Sirotenko,[1] and Z. U. Usubov[1]
*Institute of Theoretical and Experimental Physics*

(Submitted 12 October 1987)
Pis'ma Zh. Eksp. Teor. Fiz. **46**, No. 10, 413–415 (25 November 1987)

The production of charmed strange pseudoscalar $F^-$ mesons in $\tilde{\nu}N$ interactions in a 15-foot bubble chamber is studied.

In the present letter we report the results of an experimental study of the production of charmed strange $F^-$ (1970) mesons in $\tilde{\nu}N$ interactions in a 15-foot bubble chamber.[2)]

Since the range of the $F^-$ meson cannot be observed directly under our experimental conditions, we conducted the search on the basis of the invariant mass of the secondary particles in the decay channel $F^- \to \Phi\pi^-, \Phi \to K^+K^-$. The kaon and pion masses were arbitrarily assigned to the charged meson tracks. We chose the candidates in the decay $\Phi \to K^+K^-$ which satisfy the condition $|m(K^+K^-) - m(\Phi)| < 10$ MeV [the mass resolution in the region $\Phi$ (1020) is $\sim 6$ MeV]. To suppress the background, we used the cutoff $\cos\theta > -0.8$ for an angle $\theta$ between the directions of motion of $(K^+K^-)$ and $(K^+K^-)\pi^-$ in the rest frame of $(K^+K^-)\pi^-$. The acceptance of this cutoff with respect to the effect is 90%, whereas the background decreases by approximately a factor of two. To suppress the combinatorial background, we used the cutoff $z > 0.6$ for a fraction of hadron energy carried off by the system $(K^+K^-)\pi^-$.

Figure 1a shows a two-dimensional distribution of the $(K^+K^-)\pi^-$ combinations in the variables $m(KK\pi)$ and $Q^2$, where $Q^2$ is the square of the momentum transfer from the leptons to the hadrons. The errors for the mass can be calculated separately for each combination by carrying over the measuring errors of the momenta and angles of all particles. Seven events were observed in the region $m(KK\pi) \sim m(F)$ (within one-and-one-half standard deviations of the mass). These events form a distinct cluster at low values of $Q^2$ ($\lesssim 2$ GeV$^2$).

To estimate the background, we consider a similar distribution in which the mass is shifted with respect to $\Phi$

$$10 < |m(K^+K^-) - m(\Phi)| < 30 \text{ MeV}$$

(see Fig. 1b). There are two inputs within one-and-one-half standard deviations from the mass of $\Phi$ (1970), so that the background amounts to $1.0 \pm 0.7$ events [with allowance for twice the interval over $m(KK)$ in the background distribution].

We interpret the observed effect as a signal from the decays $F^- \to \Phi\pi^-$. The small value of $Q^2$ suggests that in the $\tilde{\nu}N$ interactions the $F^-$ mesons with $z > 0.6$ are pro-

  

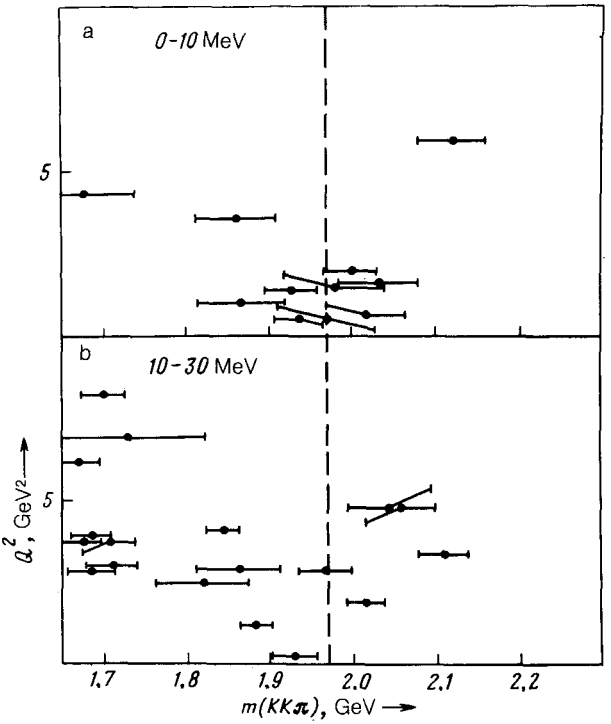


FIG. 1. A two-dimensional distribution of the combinations $(K^+K^-)\pi^-$ over the variables $m(KK\pi)$ and $Q^2$ in the region $\Phi(a)$ and in the doubled interval with a mass shift with respect to $\Phi(b)$.

duced primarily through the vector-dominance mechanism[2] (see also the preceding work of our group[3]). Using $R$ to denote the yield of $F^-$ mesons with $z>0.6$ with respect to all $\tilde{\nu}N$ interactions of the charged current, we find

$$R \times B = (2,7 \pm 1,2) \times 10^{-3} ,$$

where $B$ is the relative probability of the decay $F^- \to \Phi\pi^-$.

The initial experimental estimate of $B$ is[4] 0.04. If this estimate is correct, the $F^-$ meson yield would be $(7 \pm 3)\%$ and hence the production of $F^-$ mesons in $\tilde{\nu}N$ interactions would not be suppressed in comparison with the $D$ mesons.[5]

We wish to thank our colleagues in FNAL and Michigan University for their contribution in the early stages of this experiment.

[1)] Institute of High Energy Physics, Serpukhov.

[2)] The experimental data are described in detail in Ref. 1. The analyzed sample consists of ~6400 events of the charged current in the energy interval 10–200 GeV, with an average energy of 35 GeV.

[1]P. A. Gorichev *et al.*, Yad. Fiz. **39**, 626 (1984) [Sov. J. Nucl. Phys. **39**, 396 (1984)]; A. É. Asratyan *et al.*, Yad. Fiz. **41**, 1193 (1985) [Sov. J. Nucl. Phys. **41**, 763 (1985)].

[2]B. A. Arbuzov *et al.*, Yad. Fiz. **21**, 1322 (1975) [Sov. J. Nucl. Phys. **21**, 682 (1975)]; B. A. Arbuzov *et al.*, Yad. Fiz. **22**, 173 (1975) [Sov. J. Nucl. Phys. **22**, 85 (1975)]; V. Barger *et al.*, Phys. Rev. D **12**, 2628 (1975).
[3]A. E. Asratyan *et al.*, Phys. Lett. **156B**, 441 (1985); V. V. Ammosov *et al.*, Pis'ma Zh. Eksp. Teor. Fiz. **43**, 502 (1986) [JETP Lett. **43**, 649 (1986)].
[4]W. Toki, SLAC-PUB-4153 (December, 1986).
[5]V. V. Ammosov *et al.*, Nucl. Phys. **B177**, 365 (1981); A. E. Asratyan *et al.*, Phys. Lett. **32B**, 246 (1983); V. V. Ammosov *et al.*, Pis'ma Zh. Eksp. Teor. Fiz. **45**, 453 (1987) [JETP Lett. **45**, 579 (1987)].

Translated by S. J. Amoretty