

SEARCH FOR HEAVY NEUTRINOS IN KAON DECAY

T. Yamazaki, T. Ishikawa, Y. Akiba, M. Iwasaki, K.H. Tanaka, S. Ohtake, H. Tamura, M. Nakajima, T. Yamanaka, Department of Physics and Meson Science Laboratory, Faculty of Science, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113, Japan
 I. Arai, Institute of Physics, University of Tsukuba, Sakura-mura, Ibaraki 305, Japan
 T. Suzuki, F. Naito, Department of Applied Physics, Tokyo Institute of Technology, Okavama, Meguro-ku, Tokyo 155, Japan
 and R.S. Hayano, National Laboratory for High Energy Physics, Uho-machi, Ibaraki 305, Japan

The lepton momentum spectrum in a two-body decay of a pseudoscalar meson is expected to show satellite lines of weakly coupled neutrinos at different momenta, as proposed by Shrock /1/. This method covers quite a wide range of neutrino masses with a very high sensitivity to small mixing ratios. The neutrino ν_i here can be either the τ neutrino or any other unknown particle.

In 1981 we made a dedicated experiment (E89) at KEK to search for heavy neutrinos in the decay of K^+ /2/ and in 1983 we carried out an improved experiment. We achieved higher momentum resolution, more effective background suppression and better particle identification. Here we present new results from this experiment (E104).

We obtained a new constraint of $|U_{ei}|^2$ versus $m(\nu_i)$, as shown in Fig.1. Because of the better resolution the lower end of the neutrino mass was reduced to 40 MeV. In Fig.1 are also shown other upper limits. One is from $\pi^+ \rightarrow \mu^+ \nu_i$ done /3/ at SIN. Another comes from the $^{13}\text{He}(\mu^-, \nu_1)$ reaction /4/.

For the first time we obtained e^+ spectrum with rejection of the three body decay mode. Hitherto only the $e^+ \nu$ peak region of 247 MeV/c was known /5/. From the analysis of the spectrum we obtained a new constraint on $|U_{ei}|^2$ in a wide mass range between 140 and 350 MeV, as shown in Fig.2. The $\pi^+ \rightarrow e^+ \nu$ experiment /6/ at TRIUMF covers a complementary mass region. A recent experiment to search for neutrino decays at CERN /7/ gave a new constraint on $|U_{ei}|^2$, but the present experiment has yielded a one-order of magnitude better constraint. It should be noted that the deduction of $|U_{ei}|^2$ from the CERN experiment requires a model for heavy neutrino decay, while in the present experiment it is given purely kinematically.

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