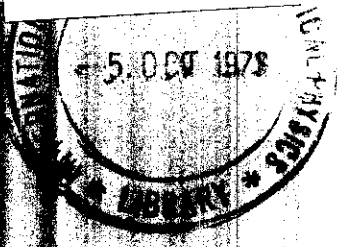


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# INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

TOPICAL SEMINAR  
ON  
WEAK INTERACTIONS

26 - 29 June 1973

(SUMMARIES)



INTERNATIONAL  
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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

T O P I C A L   S E M I N A R  
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July 1973

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EXPERIMENTS ON HIGH-ENERGY NEUTRINO BEAMS

A SUMMARY OF RECENT RESULTS AT CERN

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Recent work on high-energy neutrino beams at CERN, using the giant heavy liquid bubble chamber (Gargamelle), is reported.

1. Single hyperon production by antineutrinos <sup>1)</sup> has been detected and the cross-section  $\sigma_\Lambda$  for the process



averaged over the antineutrino spectrum, has been found to be

$$\langle \sigma_\Lambda \rangle = 1.3 \pm 0.9 \times 10^{-40} \text{ cm}^2/\text{prot.}$$

2. Neutral currents - The theoretical work by Salam and Ward (1959) <sup>2)</sup>, Salam (1962) <sup>3)</sup> and Weinberg (1967) <sup>4)</sup> (often referred to as the SWW model) has stimulated a search for experimental evidence of the existence of neutral currents, and the predictions by the above authors have been used to analyse the results.

One possible candidate for the reaction  $\bar{\nu}_\mu + e^- \rightarrow \bar{\nu}_\mu + e^-$  has been observed so far in 360,000 pictures of an exposure to the  $\bar{\nu}$  beam; on the other hand, no candidate for the reaction  $\nu_\mu + e^- \rightarrow \nu_\mu + e^-$  has been reported after the scrutiny of 375,000 pictures of the exposure to the  $\nu$  beam <sup>5)</sup>.

This corresponds (with 90% confidence) to the following limits of the cross-section:

$$\sigma(\nu_\mu + e^- \rightarrow \nu_\mu + e^-) \leq 0.26 \times E_\nu(\text{GeV}) \times 10^{-41} \text{ cm}^2/\text{el}$$

$$\sigma(\bar{\nu}_\mu + e^- \rightarrow \bar{\nu}_\mu + e^-) \leq 0.88 \times E_\nu(\text{GeV}) \times 10^{-41} \text{ cm}^2/\text{el} ,$$

where  $E_\nu$  is the primary neutrino energy in the laboratory system; and, with the same confidence as above,

$$0.1 \leq \sin^2 \theta_W \leq 0.6 ,$$

$$\sin \theta_W = e/g.$$

3. Total cross-sections for  $\nu/\bar{\nu}$ -nucleon interactions

Fitting the experimental results with an equation of the type

$$\sigma = \alpha E_\nu(\text{GeV}) \times 10^{-38} \text{ cm}^2,$$

one has

$$\text{for neutrinos} \quad \alpha = 0.7 \pm 0.74$$

$$\text{for antineutrinos} \quad \bar{\alpha} = 0.27 \pm 0.05$$

and also

$$\bar{\alpha}/\alpha = 0.38 \pm 0.02.$$

In the Bjorken scaling limit, a number of relations have been proposed which can be tested experimentally. Work on these lines is still in progress.

REFERENCES

- 1) T. Eichten et al. (to be published in Phys. Letters).
- 2) A. Salam and J.C. Ward, Nuovo Cimento 11, 568 (1959); Phys. Letters. 13, 168 (1964).
- 3) A. Salam, Phys. Rev. 127, 331 (1962).
- 4) S. Weinberg, Phys. Rev. Letters 19, 1264 (1967).
- 5) H. Faissner et al. (to be published).