Weak Interactions

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Summary

This session on weak interactions covers two topics. The first is a review of the present situation in neutral currents concentrating on the experimental aspects. K. Winter reviewed the neutrino experiments, and there was a special invited talk by C. Prescott on the current state of the analysis of the SLAC experiment studying parity-violating effects in the scattering of polarized electrons.

The last two speakers in the session (M. Murtagh and P. Schreiner) discussed particle production in neutrino interactions with particular reference to charm particle production. Inclusive distributions from charged-current interactions and fragmentation properties of jets are discussed in the session on nucleon structure organized by C. Baltay.

The overall situation in neutral-current phenomenology is that all the neutrino data is consistent with the SU(2) x U(1) model of Weinberg and Salam. The early experiments searching for parity violation in atomic bismuth, the results of which did not agree with the W-S model, still stand, although a recent result from Novosibirsk casts doubt on their validity.

All the neutrino experiments on inclusive NC/CC ratios from both isoscalar and proton targets, as well as the data on exclusive reactions, give a common and unique solution for the left- and right-handed coupling constants for u and d quarks. This conclusion depends on plausible assumptions about some of the form factors relevant to the exclusive data.

For the purely leptonic reaction $\nu_\mu e \to \nu_\mu e$, which is free of such theoretical uncertainties, some new data has just become available, and the results are also in excellent agreement with the W-S model. The $\bar{\nu}_\mu e \to \bar{\nu}_\mu e$ situation is less clear in that several experiments find fewer events than are expected. A definitive new experiment is needed.

The experiment on the scattering of polarized electrons on deuterons from SLAC has shown that the weak electronic current behaves in the same way as the muonic current. This experiment also casts doubt on the results from Oxford and Washington on atomic bismuth.

The next major challenge in neutral currents is to find the predicted intermediate neutral boson Z^o or better yet show that it does not exist.

The extensive data on dilepton production by ν and $\bar{\nu}$ beams can all be explained by charm production by the Cabibbo-allowed quark reactions $\bar{\nu} d \to \mu^- s$, $\nu s \to \mu^- c$, and $\bar{\nu}\bar{s} + \mu^+\bar{c}$, followed by the leptonic decay of the produced charmed object. After correcting for experimental cuts, all experiments agree on the rates, and the fraction of events that contain a strange particle. There is as yet no clean separation into charged and neutral D mesons and Λ_c baryons. The existence of same sign dileptons is still an open experimental question, although many groups see a signal at the two-standard deviation level. The trilepton data can be explained in terms of the conventional mechanisms of electromagnetic and hadronic μ pair production.

Data on particle production in ν and $\bar{\nu}$ interactions is slowly becoming available. The main characteristics of single-pion production can be understood in terms of the old and detailed calculations of Adler. The T = 1/2 amplitude is large. Quark models also represent the data quite well.

Particles of the SU(3) representation such as ρ^o, K^*, and $Y^*(1385)$ have been observed and have production cross sections comparable to those for charm particle production. The latter is clearly seen inclusively in effective mass plots for the D^o meson, and a few events have been observed in which D and Λ_c particles are produced in specific exclusive channels. The rates of exclusive Λ_c production are much lower than some models predict. Many of the D and Λ_c particles seem to result from a cascade decay from a higher excited state.

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