A Measurement of Triple Gauge Boson Couplings in Fully Leptonic W Decays

Alun Wyn Lloyd

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Particle Physics Group
School of Physics and Astronomy
University of Birmingham

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Abstract

This thesis presents two investigations performed on data collected by the OPAL detector at LEP, the large electron-positron collider at CERN, Geneva.

The main investigation uses data recorded during 1999 with centre-of-mass energies in the range 192–202 GeV to measure the charged triple gauge boson coupling parameters, κ_γ, λ and g_1^Z in fully leptonic W-pair decays. A sample of 157 events is selected, and a set of five angles, which is sensitive to the coupling strength, is reconstructed for each event. An Optimal Observables technique is used to extract the coupling values from this sample by comparing them with simulated events. The triple gauge boson couplings are measured to be

$$\begin{aligned} \kappa_\gamma &= 1.18^{+0.46}_{-0.32}, \\ \lambda &= -0.13^{+0.13}_{-0.12}, \\ g_1^Z &= 0.85^{+0.17}_{-0.16}, \end{aligned}$$

where the errors include both the statistical and systematic uncertainties. This analysis alone demonstrates the presence of couplings between three gauge bosons, and the values predicted by the Standard Model are κ_γ=+1.0, λ=0.0 and g_1^Z=+1.0.

A second investigation uses data recorded during 1991–5 with centre-of-mass energies at and around the mass of the Z boson. An inclusive b hadron reconstruction is developed and then employed in the reconstruction of orbitally excited B meson states, B_J^*. Some of the results describing the properties of these states are presented.