A Simultaneous Measurement of the QCD Colour Factors and the Strong Coupling

The OPAL Collaboration

Abstract

Using data from e^+e^- annihilation into hadrons, taken with the OPAL detector at LEP at the Z pole between 1991 and 1995, we performed a simultaneous measurement of the colour factors of the underlying gauge group of the strong interaction, C_F and C_A, and the strong coupling, α_s. The measurement was carrie d out by fitting next-to-leading order perturbative predictions to measured angular correlations of 4-jet events together with multi-jet related variables. Our results,

$$C_A = 3.02 \pm 0.25(\text{stat.}) \pm 0.49(\text{syst.})\ , \quad C_F = 1.34 \pm 0.13(\text{stat.}) \pm 0.22(\text{syst.})\ ,$$

$$\alpha_s(M_Z) = 0.120 \pm 0.011(\text{stat.}) \pm 0.020(\text{syst.})\ ,$$

provide a test of perturbative QCD in which the only assumptions are non-abelian gauge symmetry and standard hadronization models. The measurements are in agreement with SU(3) expectations for C_F and C_A and the world average of $\alpha_s(M_Z)$.

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