

CEvNS and Light Z' Mediators: An Alternative Statistical Analysis of CONUS+ CEvNS Data

Friday 5 December 2025 11:10 (20 minutes)

We investigate constraints on a hypothetical light gauge boson, Z' , using recent CEvNS measurements from the CONUS+ reactor experiment. The presence of such a Z' would induce additional neutrino-quark interactions beyond the Standard Model. To explore this possibility, we perform both a χ^2 minimization and a binned Poisson likelihood analysis. Systematic uncertainties arising from the reactor flux, background contributions, and detector efficiency are incorporated as nuisance parameters with Gaussian priors. From this procedure, we derive 90% C.L. exclusion regions in the $(M_{Z'}, g_{Z'})$ parameter space for representative benchmark scenarios. The resulting bounds are especially stringent for light mediators with masses of a few MeV, providing complementary constraints to those obtained from other CEvNS and neutrino experiments.

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Session Classification: Neutrinos