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Statistical Constraints on E_6 Gauge Extensions via Sanson–Flamsteed CEνNS Analysis from CONUS+ data

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The first reactor-antineutrino observation of coherent elastic neutrino–nucleus scattering (CEνNS) by the CONUS+ experiment provides a unique opportunity to test well-motivated gauge extensions of the Standard Model. Using the CONUS+ recoil spectrum, we investigate light vector mediators arising in E_6-inspired scenarios, including benchmark models such as Z_χ, Z_ψ, and Z_{B-L}, within the unified Sanson–Flamsteed parametrization. Exclusion regions at 90% confidence level are obtained for the mediator mass and coupling strength.

We find that the CONUS+ measurement remains in excellent agreement with the Standard Model prediction, confirming the robustness of CEνNS as a precision observable while significantly restricting the available parameter space of new neutral gauge interactions. These results demonstrate the growing impact of reactor-based CEνNS experiments in probing physics beyond the Standard Model and their complementarity with accelerator and collider searches.

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