

Addendum 344: Flavor-Sector Refutations

Tri-bimaximal θ_{13} , δ_{CP} , and the strong-CP claim of Paper 01

TOE Corpus

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Skill: gap-closure v1.1 — **Outcome:** REFUTATION (three predictions recorded refuted) —
Addresses: Paper 01 flavor-sector predictions — **Verifier:** `verify_P344.py` — all PASS

Abstract

Paper 01 advanced three flavor-sector predictions that current data do not support: the tri-bimaximal value $\theta_{13} = 0$ for the reactor mixing angle, a leptonic CP phase $\delta_{\text{CP}} \approx 240^\circ$, and a topological resolution of the strong-CP problem ($\theta_{\text{QCD}} = 0$, “no axion needed”). The paper’s abstract was reframed to mark these as not having survived current data and to flag them for the Paper 40 registry. This addendum makes that citation true. The reactor angle is measured at $\theta_{13} \approx 8.5^\circ$ ($\sin^2 \theta_{13} \approx 0.022$, NuFIT-6.0), nonzero at more than 5σ since Daya Bay (2012), so $\theta_{13} = 0$ is excluded. The current global fit gives $\delta_{\text{CP}} \approx 177^\circ (+19/-20)^\circ$ for normal ordering, consistent with CP conservation within 1σ , placing 240° roughly 3σ above the central value; the paper’s claim of agreement rested on the superseded $197^\circ \pm 25^\circ$ fit. The strong-CP argument constrains the wrong object: setting the instanton winding number $n = 0$ fixes the gauge sector, not the Lagrangian θ -coupling, which is the physical strong-CP parameter and an independent input; strong CP remains an open problem. Three remarks — P001.4, P001.5, P001.6 — are added to Paper 01 adjacent to the claims they qualify, and the three are recorded *refuted* in the registry. A corpus that records its own refutations is functioning as designed.

1 Tri-bimaximal $\theta_{13} = 0$ (P001_4)

Proposition 1.1 (The reactor angle is nonzero). *The tri-bimaximal pattern fixes the reactor angle at $\theta_{13} = 0$. The measured value is $\sin^2 \theta_{13} = 0.02224$, equivalently $\theta_{13} \approx 8.5^\circ$ (NuFIT-6.0, 2024, normal ordering). With the global-fit uncertainty $\sigma(\sin^2 \theta_{13}) \approx 6.5 \times 10^{-4}$, the value sits more than 30σ from zero; the nonzero result was first established by Daya Bay (2012) at more than 5σ .*

Remark 1.2 (Verdict). *A vanishing reactor angle is excluded. The paper’s reading — that the measured 8.5° is “small, consistent with symmetry breaking” — treats as a perturbation what is in fact a leading-order angle: it is larger than the experimental resolution by two orders of magnitude. The prediction $\theta_{13} = 0$ is **refuted**. Registry: P001_4 $\rightarrow$ refuted.*

2 $\delta_{\text{CP}} \approx 240^\circ$ (P001_5)

Proposition 2.1 (The CP phase prediction fails on current data). *Paper 01 predicts $\delta_{\text{CP}} \approx 240^\circ$ and claims agreement with an experimental value $197^\circ \pm 25^\circ$, within 2σ . The current global fit (NuFIT-6.0, 2024, normal ordering) gives*

$$\delta_{\text{CP}} \approx 177^\circ \begin{smallmatrix} +19^\circ \\ -20^\circ \end{smallmatrix},$$

consistent with CP conservation (180°) within 1σ . The prediction 240° now lies $(240 - 177)/19 \approx 3.3\sigma$ above the central value.

Remark 2.2 (Verdict). *The claimed agreement leaned on a fit that has since moved. Against the current central value the prediction is excluded at $\sim 3\sigma$, and the data no longer favor the near-maximal CP violation the geometric argument required; CP conservation is within one standard deviation. The prediction $\delta_{\text{CP}} \approx 240^\circ$ is **refuted on current data**. Registry: P001_5 $\rightarrow$ refuted.*

3 Topological strong-CP, $\theta_{\text{QCD}} = 0$ (P001_6)

Proposition 3.1 (The argument constrains the wrong object). *Paper 01 argues that boundary conditions on B^4 force the minimal-energy instanton winding number to $n = 0$, and concludes $\theta_{\text{QCD}} = 0$ exactly, eliminating the need for an axion. The physical strong-CP parameter is the coefficient $\bar{\theta}$ of the topological term in the Lagrangian,*

$$\mathcal{L}_\theta = \frac{\bar{\theta} g_s^2}{32\pi^2} G_{\mu\nu} \tilde{G}^{\mu\nu},$$

together with the phase of the quark-mass determinant. The winding number n and the coupling $\bar{\theta}$ are independent inputs: the action enters as $\bar{\theta}n$, so a configuration with $n = 0$ contributes to the path integral at every value of $\bar{\theta}$. Fixing the winding of one configuration does not fix the coupling.

Remark 3.2 (Verdict). *Selecting the trivial topological sector says nothing about the value of $\bar{\theta}$, which remains a free parameter of the theory. The neutron electric dipole moment bound $|\bar{\theta}| < 10^{-10}$ is therefore not explained; it is the very fine-tuning the strong-CP problem names. The claim that the geometry solves strong CP, and that “no axion is needed,” does not follow; strong CP remains an open problem of the Standard Model. The topological strong-CP argument is **refuted** as a solution. Registry: P001_6 $\rightarrow$ refuted.*

Registry. P001_4, P001_5, P001_6 $\rightarrow$ *refuted*, closed by A344. The refuted count rises from 4 (P016_3, P020_1, P017_2, P017_3.c) to 7. Three TBS remarks were added to Paper 01 adjacent to the claims they qualify; the next generator run records them. The reframed abstract of Paper 01 — “corrected here and flagged for the registry (Paper 40)” — is now a true citation: the three predictions are recorded in the registry as refuted, with this addendum on disk as the closing document.

Verifier. `verify_P344.py`: recomputes θ_{13} from $\sin^2 \theta_{13}$ and its $> 5\sigma$ nonzero significance against the tri-bimaximal 0; the δ_{CP} distance of 240° from the NuFIT-6.0 central 177° ($\sim 3.3\sigma$) and its CP-conserving consistency; the structural independence of the winding number n from the coupling $\bar{\theta}$; and the registry regeneration showing the three refuted with the count at 7. All PASS.