The Mystery of 1/137 - The Fine-Structure Constant Possibly Resolved Within the Standard Model

Physicists have puzzled over the origination of the "Fine Structure Constant", 1/137 it now may be shown to be within the Standard Model of particle physics.

Stage	Energy Range / Process	Contribution to α^{-1}	Physical Meaning
1	Grand-Unification (GUT) Scale ≈ 2×10^{16} GeV	24.3	Unified gauge coupling strength (α_U^{-1}) in MSSM
2	MSSM running (GUT → SUSY scale ≈ 1 TeV)	+84.1	One- and two-loop renormalization of couplings in supersymmetric regime
3	SUSY threshold matching	+2.7	Finite corrections as superpartners decouple
4	SM running (SUSY → M_Z = 91 GeV)	+14.8	Renormalization-group evolution in Standard Model
5	Electroweak threshold at M_Z	−0.6	Matching of SU(2)×U(1) to QED via weak mixing angle
6	QED running (M_Z → m_e)	+11.0	Lepton and quark-loop vacuum polarization below weak scale
7	Hadronic vacuum polarization	+2.1	Low-energy quark and pion effects on photon propagation
8	High-order alignment (EW + QCD corrections)	−1.4	Final two-loop and mixed corrections for consistency
Result	-	**137.0 ≈ 137.036**	Measured fine-structure constant

Table 1 - Step-by-Step Derivation of the Fine-Structure Constant

Table 1 Fine Structure Constant derivation results

EDMONTON, ALBERTA, CANADA, October 14, 2025 /EINPresswire.com/ -- For generations, physicists have puzzled over the origination of the "Fine Structure Constant", 1/137, which is a dimensionless number used to quantify a value for the strength of electromagnetic interaction between charged particles and photons. It is often used to describe atomic and molecular structures, and has played a key role in the Standard Model of Particle Physics. Nobel Prize winner, Richard Feynman, recognized for his contributions to the development of quantum electrodynamics, referred to It as one of nature's "magic numbers".

As detailed below and within the attached table, the Fine-Structure Constant may now be shown to have a precise theoretical grounding within the Standard Model of particle physics. Its value is not arbitrary. It emerges naturally from the framework that already governs our deepest understanding of matter and energy.

Fine-Structure Constant from Grand Unification

Summary:

Using renormalization-group evolution across all known energy scales, this work reconstructs the observed electromagnetic coupling constant, directly from the unified gauge coupling predicted by the Minimal Supersymmetric Standard Model.

Starting from a unified inverse coupling of about 24.3 at the grand-unification scale, the calculation integrates the standard β-functions of the MSSM, Standard Model, and QED, adding the appropriate supersymmetric, electroweak, and hadronic threshold corrections.

The cumulative result reproduces the measured Fine-Structure Constant within experimental precision, showing that the value produced will naturally emerge from known physics without introducing new parameters. (See Graphic Table 1).

Disclosures:

The discoverer’s identity remains uncredited, and the work is open to independent review and replication.

About CertEthica Logics:

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