Why Only These Particles?

How the 13D geometry fixes the allowed particle alphabet — and forbids large regions of new-particle search space

a falsifiable particle ontology: it states plainly what should never appear

A mostly non-technical note for anyone who loves quantum physics — written to be checked by specialists

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Before we start

This note asks why nature seems to allow only certain particles. The answer the thirteen-dimensional construction proposes is not that every observed particle is a separate geometric object. It is more disciplined: the geometry selects a short elementary alphabet — quarks, leptons, the gauge bosons, and the Higgs — and the observed particle zoo is built from that alphabet by the strong force, antiparticle conjugation, resonances, and nuclear binding. The same structure also forbids large classes of hypothetical particles. We check this with the simplest allowed particle, the electron, then with the simplest forbidden examples.

Two honest words first. This is a category-level *ontology* audit, not a spectroscopy paper: it asks whether each particle has an allowed place in the grammar, not what its mass is (computing masses is a separate, harder problem, deferred). And the elementary alphabet it leans on is inherited from the main manuscript's certificates, not re-proved here — so the claims are conditional on those certificates. In the spirit of the whole project, the forbidden list is offered as a falsifiable search space, not a guaranteed discovery: it states plainly what should never appear, so that any detector seeing one can break it. You can read every word skipping every equation.

1. The master rule: alphabet plus grammar

The whole picture is two layers, and keeping them separate is the key to the paper. An *elementary* particle is a direct field in the recovered low-energy theory — an electron, a quark, a photon. An *observed* particle is anything the Particle Data Group lists: those elementary fields, but also their antiparticles, the mesons and baryons built from quarks, resonances, and atomic nuclei. The claim is that the geometry fixes the first layer — the alphabet — and ordinary physics assembles the second.

The geometry's particle filter has five gates. A candidate elementary field is allowed only if it (1) fits the recovered gauge group $SU(3)_c \times SU(2)_L \times U(1)_Y$; (2) sits in one of the recovered matter/gauge/Higgs representations; (3) has a charge given by $Q = T_3 + Y$ with an allowed hypercharge; (4) survives the chiral projection, with no surviving mirror duplicate, inside the three-family count; and (5) — for a composite — is a color-singlet combination under the QCD grammar.

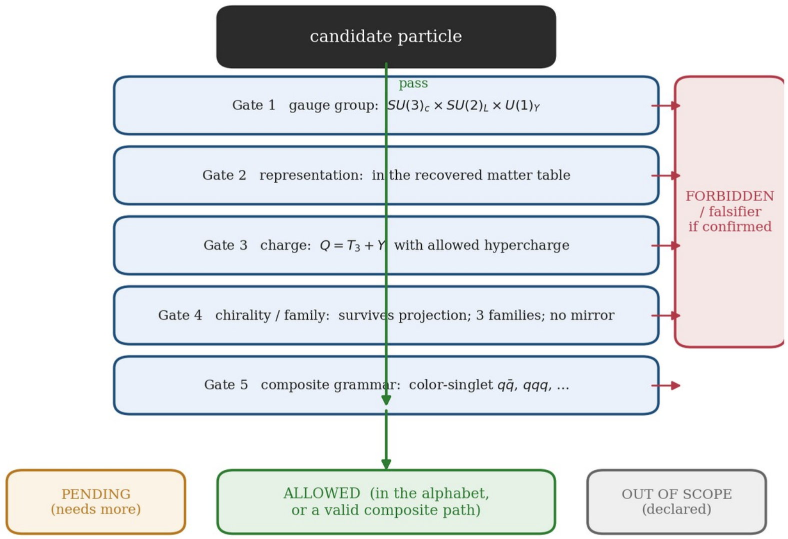

Figure 1. *The geometry as a particle filter. A candidate field must pass all five gates to be allowed; failing any one makes it forbidden — and, if confirmed, a falsifier. Composites enter through the color-singlet grammar gate; some candidates are pending or declared out of scope.*

Anything that passes is in the alphabet or has a valid composite path; anything that fails is forbidden — and, if it were ever confirmed, a falsifier. The rest of this note runs particles through this filter.

2. Route one: how the Standard Model allows the electron

Take the simplest elementary particle, the electron. In the Standard Model it appears in two chiral pieces: a left-handed part that sits inside a weak doublet with its neutrino, and a right-handed part that is a weak singlet. Their quantum numbers are fixed:

Field	SU(3)_c	SU(2)_L	Y	T_3	$Q = T_3+Y$
ν_eL	1	2	−1/2	+1/2	**0**
e_L	1	2	−1/2	−1/2	**−1**
e_R	1	1	−1	0	**−1**

The electron is allowed because it is colorless, has the correct weak representation, has an electric charge that follows from $Q = T_3 + Y$, and fits the chiral lepton family. Nothing about it is arbitrary: a hypothetical electron-like particle must answer for its color representation, its weak representation, its hypercharge, its handedness, and whether it spoils anomaly cancellation. The electron passes every question.

3. Route two: the same electron from the geometry

Now the same electron from the geometry — and here honesty about the grade matters. The check is not that the geometry conjures the electron from nothing; it is that the geometry's recovered representation table contains exactly this lepton doublet and charged singlet, with the charge operator $Q = T_3 + Y$ built in rather than assigned by hand. For the left-handed electron, $T_3 = -½$ and $Y = -½$ give $Q = -1$; for the right-handed electron, $T_3 = 0$ and $Y = -1$ give the same $Q = -1$. The color factor is trivial (the electron carries no color from the color shape K_6), the weak role comes from the S^2 weak structure, and the handedness comes from the chiral projection.

This is what the series elsewhere called a 'same with or without the geometry' check: the electron's charge is standard arithmetic either way. The geometric content is the claim — inherited from the main manuscript's certificates, at certificate grade — that the recovered matter table is exactly the Standard Model's, so that the electron, and only particles like it, appears. The electron is not inserted; it survives the geometry's representation, charge, chirality, and family filters.

4. Downstream: the proton and pion as composites

Most observed particles are not elementary at all, and the alphabet-plus-grammar picture is what makes that fine. Take the proton: it is not a geometric field but a bound state of three quarks, uud. Its charge adds up from the quark charges, $⅔ + ⅔ − ⅓ = +1$, and its baryon number from $⅓ + ⅓ + ⅓ = 1$. Its ontology path is short: the geometry allows the u and d quarks; the strong force allows color-singlet three-quark baryons; uud is a valid color singlet; so the proton is allowed — as a composite, not as a separate field. The pion is the same story one step simpler: $\pi^+ = u\,\bar{d}$, a color-singlet quark–antiquark meson with charge $⅔ + ⅓ = +1$.

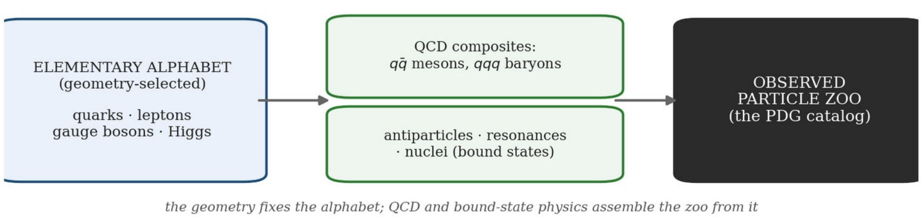

Figure 2. *Two layers. The geometry fixes the short elementary alphabet; the strong force, antiparticle conjugation, resonances, and nuclear binding assemble it into the full observed catalog. A short alphabet accounts for a long zoo.*

This two-layer structure is what lets a short alphabet account for a long catalog: the geometry fixes the few elementary fields, and the strong force, antiparticles, resonances, and nuclei generate the hundreds of observed states from them.

5. The forbidden space: what the geometry rules out

The more interesting content is what the geometry rules out — and this is where it sticks its neck out. Consider a mirror electron: a duplicate of the electron with the opposite weak handedness (a right-handed weak doublet). One can write its gauge labels and assign it a charge with no trouble — so it passes the first gates. But it fails the chirality gate: the geometry's chiral projection keeps left-handed weak doublets and rejects their mirror partners, and the no-mirror ledger forbids exactly this.

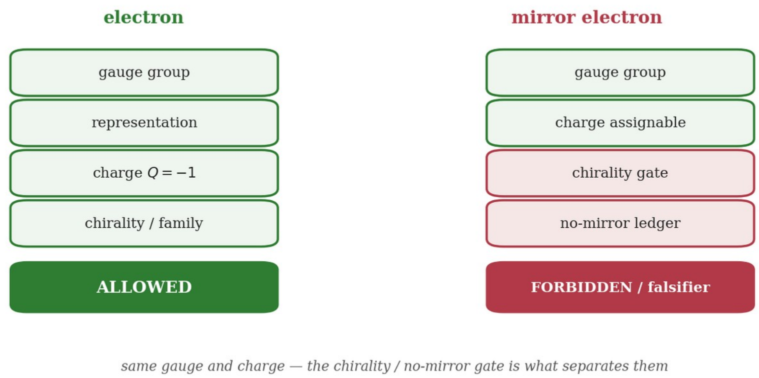

Figure 3. *Allowed versus forbidden, decided at one gate. The electron and a hypothetical mirror electron share gauge labels and a sensible charge; the chirality / no-mirror gate is what admits one and rejects the other. A confirmed mirror electron would falsify that gate.*

That is the cleanest forbidden example, because it is easy to say in one breath: nature has an electron, the geometry allows the electron, and the geometry does not allow a mirror electron with the wrong handedness. A confirmed mirror electron would falsify the no-mirror / chirality part of the geometry. The same logic prunes a whole map of search space:

Candidate	Status	Reason
electron	**allowed**	geometry-derived lepton field
proton (uud)	**allowed composite**	color-singlet qqq baryon
pion ($u\bar{d}$)	**allowed composite**	color-singlet $q\,\bar{q}$ meson
positron	**allowed antiparticle**	conjugate of the electron
mirror electron	**forbidden / falsifier**	violates the no-mirror chirality projection
fourth chiral generation	**forbidden / falsifier**	violates the three-family topological index
extra unbroken U(1) boson	**forbidden / falsifier**	no spare unbroken gauge factor
elementary colorless ½-charge fermion	**forbidden / falsifier**	no allowed representation in the table
free isolated quark	**forbidden (asymptotic)**	confinement / color-singlet rule

Candidate	Status	Reason
hadron at an unexpected mass	**not an ontology falsifier**	a QCD spectroscopy problem, deferred

A fourth chiral generation is forbidden because the family count is not a dial but a topological integer — the geometry's index gives exactly three, and either it gives three or it is the wrong geometry. An extra unbroken photon-like U(1) boson is forbidden because the recovered gauge group has no spare unbroken factor. A free, isolated quark is forbidden as an observed asymptotic state by confinement. And an elementary, colorless, fractionally-charged fermion outside the representation table has no allowed slot at all. Each of these is a falsifier: confirm one, and the corresponding claim breaks. Reassuringly, every one is also consistent with what experiments have already found — no fourth generation at LEP or the LHC, no mirror fermions, no extra unbroken gauge boson, no free quarks — so these are structural predictions in agreement with current data, not lonely bets.

6. The falsifier statement, and the honest scope

Stated precisely, a confirmed particle falsifies the ontology claim if it is established experimentally, not in a declared out-of-scope sector, and has no allowed path: not an elementary field in the recovered table, not an antiparticle, not a color-singlet composite, not a resonance or excitation of one, and not a nuclear or effective bound state. The sharpest such falsifiers are a confirmed fourth chiral generation, a confirmed mirror weak doublet, a confirmed extra unbroken gauge boson, a confirmed elementary colorless fractional-charge fermion outside the table, or a confirmed free asymptotic colored particle.

And here is the scope line that keeps the claim honest. This is an ontology audit, not a spectroscopy paper. It does not compute hadron masses, prove resonance poles, or rule out a beyond-Standard-Model dark sector that the corpus explicitly leaves out of scope; it does not make tentative experimental anomalies disappear, and it does not replace collider searches. Crucially, a hadron found at an unexpected mass is **not** a falsifier of this claim — that is a question for QCD spectroscopy, which this note explicitly defers; the ontology claim is only about whether a particle has an allowed place in the grammar, not about where its mass falls. The gates themselves are inherited certificate claims, conditional on the main manuscript, not theorems — so the honest reading is a conditional, falsifiable particle grammar, not a proof that no other particle can exist.

7. The seam: one alphabet, one grammar

Pulled together: the geometry fixes a short elementary alphabet through five filters — gauge group, representation, charge, chirality and family count, and (for composites) the color-singlet grammar — and ordinary physics assembles the observed zoo from it. Appendix A writes the filter out, runs the electron and proton through it, and states what rests on the inherited certificates. The electron passes as an elementary field; the proton and pion pass as composites; the mirror electron, the fourth generation, the extra gauge boson, the free quark, and the colorless fractional fermion are forbidden, each a falsifier. What the corpus establishes — at certificate grade, conditional, inherited from the main manuscript — is the recovered representation table, the charge operator, the chirality projection, and the three-family index; what this note does is read off, from those, which particles are allowed and which are forbidden. The value is a falsifiable search space: it tells a detector exactly what it should never see, and stakes the geometry on that being true.

Appendix A — The particle filter, worked

This appendix writes out the five-gate filter, runs the electron and the proton through it, states the structural claims behind the gates, and records what rests on the inherited certificates. The arithmetic is standard particle physics; the geometric content is the claim that the recovered representation table is exactly the Standard Model's.

A.1 The five-gate filter

A candidate elementary field is allowed exactly when it satisfies all five conditions — gauge group, representation, charge, chirality/family, and (for composites) color-singlet grammar:

$$\text{allowed elementary} \iff \big[\text{rep of } SU(3)_c \times SU(2)_L \times U(1)_Y\big] \wedge \big[Q = T_3 + Y\big] \wedge \big[\text{survives chiral projection}\big] \wedge \big[\text{3 families, anomaly-free, no exotics}\big]$$

A.2 The electron, gate by gate

The electron enters as a left-handed weak doublet and a right-handed weak singlet, with charges read off from the charge operator:

$$L_e = \begin{pmatrix} \nu_e \\ e \end{pmatrix}_L, \qquad e_R, \qquad\qquad Q = T_3 + Y$$

$$e_L: \quad T_3 = -\tfrac{1}{2}, \quad Y = -\tfrac{1}{2} \;\Rightarrow\; Q = -1; \qquad\qquad e_R: \quad T_3 = 0, \quad Y = -1 \;\Rightarrow\; Q = -1$$

It is colorless (a color singlet), sits in an allowed weak representation, carries an allowed hypercharge, and survives the chiral projection inside the lepton family — so it passes every gate.

A.3 Composites: the proton and pion

Most observed particles are color-singlet composites of the allowed quarks; their charges and baryon numbers add up from the constituents:

$$p = uud: \quad Q = \tfrac{2}{3} + \tfrac{2}{3} - \tfrac{1}{3} = +1, \qquad\qquad B = \tfrac{1}{3} + \tfrac{1}{3} + \tfrac{1}{3} = 1$$

$$\pi^+ = u\bar{d}: \quad Q = \tfrac{2}{3} + \tfrac{1}{3} = +1$$

A.4 The structural claims behind the gates

Two of the gates rest on structural results the geometry claims. The family count is a topological integer — the geometry gives exactly three chiral families, consistent with the LEP measurement of the number of light neutrino species:

$$\text{index} = -3 \;\Rightarrow\; \text{exactly 3 chiral families (a topological integer, not tunable);} \qquad \text{LEP: } N_\nu = 2.984 \pm 0.008$$

And the matter content is anomaly-free, which a hostile reviewer can check on one line for a single generation:

$$3 \cdot \tfrac{1}{6} + \left(-\tfrac{1}{2}\right) = 0 \qquad \text{(the } SU(2)^2\!-\!U(1) \text{ and gravitational} - U(1) \text{ anomaly vanishes)}$$

A.5 A forbidden field: the mirror electron

A mirror electron can be given gauge labels and a charge, but it is rejected by the chiral projection and the no-mirror ledger — the cleanest single-gate failure:

$$L_{e,R}^{\text{mirror}} = \begin{pmatrix} \nu' \\ e' \end{pmatrix}_R \xrightarrow{\text{chiral projection}} \text{rejected (no-mirror ledger)}$$

A.6 The allowed and forbidden particle space

Collected formally, the allowed space is the union of the elementary fields, their antiparticles, the color-singlet composites, resonances, nuclear/effective states, and the declared out-of-scope sectors; the forbidden space is every confirmed state outside it:

$$S_{\text{allowed}} = S_{\text{elem}} \cup S_{\text{anti}} \cup S_{\text{QCD}} \cup S_{\text{res}} \cup S_{\text{nucl}} \cup S_{\text{OOS}}, \qquad S_{\text{forbidden}} = \{\text{confirmed states}\} \setminus S_{\text{allowed}}$$

A.7 What rests where

— **What the corpus establishes (inherited, certificate grade).** The recovered Standard-Model representation table, the charge operator $Q = T_3 + Y$, the chiral projection with no mirrors, the three-family topological index, anomaly cancellation, and proton safety — carried at certificate grade in the main manuscript and its particle-spectrum companion, conditional on the frozen certificates, and inherited here rather than re-proved.

— **What this note does.** Reads off, from those, which particles are allowed (the electron as a field; the proton and pion as composites) and which are forbidden (the mirror electron, the fourth generation, the extra gauge boson, the free quark, the colorless fractional fermion) — a category-level ontology audit.

— **What is explicitly deferred.** Hadron masses, resonance poles, and nuclear binding energies — a hadron at an unexpected mass is a QCD spectroscopy problem, not an ontology falsifier. Beyond-Standard-Model dark sectors are out of scope, as in the corpus.

> **Closed result.** Given the corpus's recovered representation table, charge operator $Q = T_3 + Y$, chiral projection, and three-family index (certificate grade, inherited), the electron is allowed as an elementary field and the proton and pion as color-singlet composites, while a mirror electron, a fourth chiral generation, an extra unbroken gauge boson, a free asymptotic quark, and an elementary colorless fractional-charge fermion are forbidden — each a *falsifier* if confirmed. This is a category-level ontology audit and a falsifiable search

space, conditional on the inherited certificates — not a spectroscopy of masses, and not a proof that no other particle can exist.

Notes and sources

[1] The recovered Standard-Model representation table, the charge operator $Q = T_3 + Y$, the chiral projection with no mirrors, the three-family topological index, anomaly cancellation, and proton safety are carried in the source corpus at certificate grade (Paper I 'GUT', Gates 2–5 and 10; and the dedicated particle-spectrum companion, 'Observed Particle Spectrum Closure'), conditional on the frozen certificates and inherited here, not re-proved: physics.magflowmeters.com

[2] This is a category-level ontology audit, not spectroscopy: hadron masses, resonance poles, and nuclear binding energies are explicitly deferred, and a mass mismatch is not an ontology falsifier.

[3] The forbidden examples are checked against existing experimental exclusions (LEP's N_ν = 2.984 ± 0.008, LHC and Tevatron searches, Super-Kamiokande proton-decay limits, and flavor/cosmology bounds); each is consistent with current data and is offered as a falsifiable search-space boundary, not a guaranteed discovery.

[4] The electron quantum numbers, $Q = T_3 + Y$, the proton and pion compositions, the anomaly cancellation $3\cdot(1/6) + (-1/2) = 0$, and the color-singlet rule are standard; see any particle-physics text.

[5] Companion notes: the five force and quantum-gravity consistency notes, the synthesis (*One Geometry, Four Forces*), and the quantum-computing noise check (*Bit-Flip Code*), same series.