

EN_16: The Geometry of Quarks

Résumé

Il reformule le tableau des quarks et des baryons en termes géométriques de plans de vibration dans 3S+T. Il définit trois plans fondamentaux : XT, YT et ZT. Un quark est une onde stationnaire dans un plan avec une orientation temporelle ($t \rightarrow \text{espace}$ donne une charge $+2/3$ pour XT, $-1/3$ pour YT/ZT ; l'orientation inverse donne des antiquarks). Les saveurs (up, down, strange, charm, top, bottom) sont les harmoniques ($k = 1, 2, 3$) de ces modes fondamentaux. Le confinement n'est pas une force, mais l'impossibilité de séparer une onde de sa direction temporelle inverse. Les collisions sont des dédoublements temporels en $t = t_0$ qui révèlent le dipole quark-antiquark inhérent. La formule de Gell-Mann-Nishijima est la trace des orientations temporelles.

From the Vibration Plane to the Baryon Table

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Dependency: This document is derived from **EN_14 (The 22 Internal Modes of the Nucleon)** and **EN_15 (What Are Quarks)** , and lays the foundation for **EN_GENESIS (Geometric Cosmology of the Neutron)**.

10.5281/zenodo.17172925

1. Introduction: Geometry as the Language of Matter

The Standard Model describes quarks through tables of quantum numbers.

3S+T geometry describes quarks through vibration planes.

This document adds no new hypotheses.

It only translates: from the nomenclature of the 20th century to the geometry of the 21st century.

Concept	Standard Model	3S+T Geometry
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Quark	Irreducible point particle	**Standing wave in an XT, YT or ZT plane**
Antiquark	Opposite charge antiparticle	**Same wave, opposite time direction**
Flavor	Quantum number with no origin	**Vibration plane + harmonic**
Charge	Postulated fractional value	**Temporal orientation of the wave**
Mass	Free parameter	**Wave frequency**
Confinement	Force increasing with distance	**Impossibility of unidirectional wave**
Family	3, unexplained	**Fundamental mode + 2 harmonics**
Collision	Probabilistic pair creation	**Temporal splitting at $t = t_0$**

2. The Three Fundamental Planes

3S+T geometry has **three orthogonal vibration planes**.

Each plane is a **propagation channel** between a spatial dimension and time.

Plane	Coordinates	Direction	Quark	Charge
-----	-----	-----	-----	-----
XT Plane	(x, t)	$t \rightarrow x$	u	$+\frac{2}{3}$
		$x \rightarrow t$	$\bar{u}$	$-\frac{2}{3}$
YT Plane	(y, t)	$t \rightarrow y$	d	$-\frac{1}{3}$
		$y \rightarrow t$	$\bar{d}$	$+\frac{1}{3}$
ZT Plane	(z, t)	$t \rightarrow z$	d	$-\frac{1}{3}$

		$z \rightarrow t$	$\bar{d}$	$+\frac{1}{3}$
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There are no more planes. There cannot be. Visible matter is the combination of waves in these three planes.

3. Harmonics: The Origin of the Three Families

Each plane admits **higher-order vibrational modes**.

Harmonic	Frequency	Family	Quarks
-----	-----	-----	-----
Fundamental mode (k=1)	ν_0	1st family	u, d
First harmonic (k=2)	$2\nu_0$	2nd family	c, s
Second harmonic (k=3)	$3\nu_0$	3rd family	t, b

Mass is not a parameter. It is the frequency of the wave.

That is why charm is more massive than up. That is why strange decays to down. That is why top does not form hadrons: its frequency is so high that it decays before it can couple.

4. The Periodic Table of Baryons

The Standard Model presents the **octet** and **decuplet** as empirical classifications.

3S+T geometry presents them as permitted combinations of waves.

4.1 The Octet (spin 1/2)

Source: Wikipedia			Geometric Interpretation (3S+T)	
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![Baryon octet] (https://upload.wikimedia.org/wikipedia/commons/4/45/Octeto_bari%C3%B4nico.png)			**Combinations of fundamental waves and first harmonics**	
Baryon	Composition	Geometry	Mass	Origin of Mass
-----	-----	-----	-----	-----
p	uud	**XT + XT + YT**	938 MeV	**Fundamental mode**

n	udd	$**XT + YT + ZT**$	940 MeV	$**YT/ZT \text{ asymmetry}** (\delta)$
Λ	uds	$**XT + YT + (YT)**$	1116 MeV	$**One \text{ harmonic } (k=2)**$
Σ^+	uus	$**XT + XT + (YT)**$	1189 MeV	$**One \text{ harmonic}**$
Σ^0	uds	$**XT + YT + (YT)**$	1192 MeV	$**One \text{ harmonic (excited state)}**$
Σ^-	dds	$**YT + ZT + (YT)**$	1197 MeV	$**One \text{ harmonic}**$
Ξ^0	uss	$**XT + (YT)* + (ZT)**$	1315 MeV	$**Two \text{ harmonics}**$
Ξ^-	dss	$**YT + (YT)* + (ZT)**$	1321 MeV	$**Two \text{ harmonics}**$

4.2 The Decuplet (spin 3/2)

Source: Wikipedia	Geometric Interpretation (3S+T)
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![Baryon decuplet] (https://upload.wikimedia.org/wikipedia/commons/4/4d/Decuplete_bari%C3%B4nico.png)	$**The \text{ same geometric systems, in rotationally excited states}**$

Baryon	Composition	Geometry	Mass	Relation to Octet
-----	-----	-----	-----	-----
Δ^{++}	uuu	$**3 \times XT**$	1232 MeV	$**Rotational \text{ excitation}**$
Δ^+	uud	$**XT + XT + YT**$	1232 MeV	$**Proton \text{ excitation}**$
Δ^0	udd	$**XT + YT + ZT**$	1232 MeV	$**Neutron \text{ excitation}**$
Δ^-	ddd	$**2 \times YT + ZT**$	1232 MeV	$**No \text{ XT plane}**$
Σ^{*+}	uus	$**XT + XT + (YT)**$	1385 MeV	$**Excitation \text{ of } \Sigma^+**$
Σ^{*0}	uds	$**XT + YT + (YT)**$	1385 MeV	$**Excitation \text{ of } \Sigma^0**$
Σ^{*-}	dds	$**YT + ZT + (YT)**$	1385 MeV	$**Excitation \text{ of } \Sigma^-**$
Ξ^{*0}	uss	$**XT + (YT)* + (ZT)**$	1530 MeV	$**Excitation \text{ of } \Xi^0**$
Ξ^{*-}	dss	$**YT + (YT)* + (ZT)**$	1530 MeV	$**Excitation \text{ of } \Xi^-**$
Ω^-	sss	$**(YT)* + (ZT)* + (YT/ZT)**$	1672 MeV	$**Three \text{ harmonics, ground state}**$

Key observation:

The decuplet is **not** 10 new particles.

They are the same 2 geometric configurations (proton/neutron) and their harmonic and rotational excitations.

5. The Gell-Mann-Nishijima Formula: The Trace of Geometry

The Standard Model postulates:

$$Q = I_3 + \frac{1}{2}(B + S + C + B' + T)$$

Or, equivalently:

$$Q = \frac{2}{3}[(n_u - n_{\bar{u}}) + (n_c - n_{\bar{c}}) + (n_t - n_{\bar{t}})] - \frac{1}{3}[(n_d - n_{\bar{d}}) + (n_s - n_{\bar{s}}) + (n_b - n_{\bar{b}})]$$

This formula is not an empirical rule. It is the sum of the temporal orientations of waves in the three planes.

Plane	Orientation	Contribution to Q
-----	-----	-----
XT	$t \rightarrow x$ (quark)	$+\frac{2}{3}$
XT	$x \rightarrow t$ (antiquark)	$-\frac{2}{3}$
YT/ZT	$t \rightarrow y, z$ (quark)	$-\frac{1}{3}$
YT/ZT	$y, z \rightarrow t$ (antiquark)	$+\frac{1}{3}$

Charge is not a quantum number. It is the trace of the wave^{^{\prime}}s temporal orientation in the plane.

6. Confinement: Geometry, Not Force

Why are there no free quarks?

Because a **quark** is a wave vibrating in the direction $t \rightarrow \text{space}$. An

antiquark is the same wave, vibrating in the direction $\text{space} \rightarrow t$.

A real wave cannot propagate only toward the past or only toward the future. Every real wave has both directions.

Therefore, when you break confinement, you do not obtain a free quark. You obtain a quark-antiquark dipole.

That dipole is a **meson**.

Meson	Composition	Geometry
-----	-----	-----
π^+	$u\bar{d}$	$XT (t \rightarrow x) + YT (y \rightarrow t)$
π^-	$d\bar{u}$	$YT (t \rightarrow y) + XT (x \rightarrow t)$
π^0	$u\bar{u}$ or $d\bar{d}$	Wave and counter-wave in the same plane

Confinement is not a force that increases with distance. It is the geometric impossibility of separating a wave from its temporal inverse direction.

7. Collisions: Temporal Splitting, Not Creation

In a high-energy collision, at an instant $t = t_0$, the confined loop breaks.

The confined wave, which until that moment vibrated in a single temporal direction, splits:

- The component that came from $t < t_0$ toward t_0 emerges as a **quark** traveling into the future.
- The component that continues from t_0 toward $t > t_0$ emerges as an **antiquark** traveling into the future.

There is no matter creation. There is no pair annihilation. There is only the revelation of the temporal structure of a wave that was always dual.

That is why particle jets always contain quark-antiquark pairs. That is why collision energy transforms into mass: the

frequency of the wave is conserved, but its confinement is broken.

8. Summary: The Geometry of Quarks

Structure	Standard Model	3S+T Geometry
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Up quark	<i>u</i> , charge +2/3	Wave in XT, direction $t \rightarrow x$
Down quark	<i>d</i> , charge -1/3	Wave in YT or ZT, direction $t \rightarrow y, z$
Antiquark	Opposite charge	Same wave, opposite direction
Strange quark	<i>s</i> , strangeness -1	First harmonic ($k = 2$) in YT or ZT
Charm quark	<i>c</i> , charm +1	First harmonic ($k = 2$) in XT
Proton	<i>uud</i>	XT + XT + YT
Neutron	<i>udd</i>	XT + YT + ZT
Meson	<i>q$\bar{q}$</i>	Wave and counter-wave dipole
Confinement	Strong force	Impossibility of unidirectional wave
Collision	Pair creation	Temporal splitting at $t = t_0$
Mass	Free parameter	Wave frequency
Charge	Quantum number	Temporal orientation

9. Conclusion: The Periodic Table of Matter

The baryon table is not a catalog of elementary particles.
It is the periodic table of wave combinations in three planes.

- **3 planes** (XT, YT, ZT)
- **2 temporal directions** ($t \rightarrow \text{space}$, $\text{space} \rightarrow t$)
- **3 harmonics** ($k = 1, 2, 3$)
- **2 stable minimum energy configurations** (proton, neutron)

Everything else is rotational and harmonic excitations of these two configurations.

There are not 100 fundamental particles. There are 3 planes, 2 directions, 3 harmonics, and 2 stable configurations.

Nature is geometric. We only needed the right plane to see it.

10. References

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Fuente: EN_16_la_geometria_de_los_quark.md