Fundamental Fermion and Boson "Strandwiches"

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Abstract
This paper presents an approach in which Fundamental Fermions and Bosons are constructed from Ten Strands that form adhered, two-layer "Strandwiches". Space and Time Strands are integral parts of these Strandwiches. Almost identical formulae calculate Fermion and Boson Masses. Matter predominance arises naturally, as well as Planck and Strong-Weak Unification Masses. Neutrino Mass is a result of heavier Weakon Generations. The Dark Matter particle is a stable, spin-2 boson. The adhesion layer is identified as a Unified Field in which all four fundamental forces operate by a single mechanism: perturbation of quantum number sectors. The Equivalence Principle and the Tensor Character of Gravity follow without postulate. "Bulk Strandwiches" enable entanglement.

STRANDS. We begin by multiplying the SU(10) Matrix (Table 1) by the Transform Matrix Ω (Table 2) to obtain the Strand Quantum Number Matrix (Table 3).

Table 1 SU(10) Matrix

T_3	T_8	T_{15}	T_{24}	T_{35}	T_{48}	T_{63}	T_{80}	T_{99}
1/2	1/6	1/12	1/20	1/30	1/42	1/56	1/72	1/90
-1/2	1/6	1/12	1/20	1/30	1/42	1/56	1/72	1/90
0	-1/3	1/12	1/20	1/30	1/42	1/56	1/72	1/90
0	0	-1/4	1/20	1/30	1/42	1/56	1/72	1/90
0	0	0	-1/5	1/30	1/42	1/56	1/72	1/90
0	0	0	0	-1/6	1/42	1/56	1/72	1/90
0	0	0	0	0	-1/7	1/56	1/72	1/90
0	0	0	0	0	0	-1/8	1/72	1/90
0	0	0	0	0	0	0	-1/9	1/90
0	0	0	0	0	0	0	0	-1/10

Table 2 Ω Matrix

1/2	-1/2	0	0	0	0	0	0	0
-3/2	-1/2	0	0	0	0	0	0	0
0	0	3/2	5/2	0	0	0	0	0
0	0	-5/2	5/2	-2	2	0	0	0
0	0	0	0	3	2	0	0	0
0	0	0	0	0	-7	3	3	3
0	0	0	0	0	0	-4	-1/2	-1/2
0	0	0	0	0	0	0	-9/2	-1/2
0	0	0	0	0	0	0	0	-5

The Strand Quantum Number Matrix (Table 3) shows the association of the Strands to the Strong (Color) and Electroweak Forces, as well as, to the Mass and Spacetime Spins. The derived Strand Quantum Numbers (Table 4) show the Strand Extent Valence, the Strand Minkowski Metric Signature, the Strand Spin Angular Momentum, and the Strand Baryon minus Lepton Number.

Table 3 — Strand Quantum Number Matrix = SU(10) x Ω Matrices

Ten Fundamental Strands, S	I_3^C	Y^C	I_3^W	Y^W	I_3^M	Y^M	I_{31}^X	I_{32}^X	I_{33}^X
C_1		-1/3		1/3					
C_2	-1/2	1/6		1/3					
C_3	1/2	1/6		1/3					
E			-1/2	-1/2					
N			1/2	-1/2	1/2	-1/2			
L					-1/2	-1/2			
X^0						1	-1/2	-1/2	-1/2
X^1							1/2	0	0
X^2								1/2	0
X^3									1/2

The Ω Matrix (Table 2) transforms the SU(10) Matrix (Table 1) into the Strand Quantum Number Matrix
where
I_3^C and Y^C are the Strand Color Isocharge and Hypercharge
I_3^W and Y^W are the Strand Weak Isocharge and Hyperharge, with Charge $Q = I_3^W + Y^W$
I_3^M and Y^M are the Strand Mass Isospin and Hyperspin
I_{31}^X, I_{32}^X, and I_{33}^X are the Strand Spacetime Isospins, indivisible intervals of Space and Time;
and, the basis of the Lorentz boost derivation. (See Appendix A.)
where I_3^X is I_{31}^X, I_{32}^X, or I_{33}^X

Table 4 — Derived Strand Quantum Numbers

S	V_e	N_M	J, j_3	N_{B-L}	
C_1	1	0	0	2/3	
C_2	1	0	0	2/3	There are three Color Strands, C_1, C_2, C_3, with $V_e = +1$
C_3	1	0	0	2/3	
E	1	0	0	0	
N	1	0	0	0	and three Flavor Strands, E, N, L, also with $V_e = +1$
L	1	0	-1	0	
X^0	6	-1	-1/2	1	and one Time Strand, X^0, with $V_e = +6$
X^1	-4	1	1/2	-1	
X^2	-4	1	1/2	-1	and three Space Strands, X^1, X^2, X^3, with $V_e = -4$
X^3	-4	1	1/2	-1	

$V_e = (-5I_3^W + 3Y^W) + (4I_3^J - 6Y^J) - 8(I_{31}^X + I_{32}^X + I_{33}^X)$ gives the Strand Extent Valence

$N_M = (1 - V_e)/5$ gives the Strand Minkowski Metric Signature of Special Relativity, recovering (−,+,+,+) from Strand V_e values (See Appendix A)

$J, j_3 = (I_3^M + Y^M) + (I_{31}^X + I_{32}^X + I_{33}^X)$ gives the Strand Spin Angular Momentum

$N_{B-L} = 2[(-I_3^W + Y^W) + (I_3^M - Y^M) - (I_{31}^X + I_{32}^X + I_{33}^X)]$ gives the Strand Baryon Number minus the Lepton Number

5-STRAND FERMION STRANDWICHES. Figure 1 shows examples of 5-Strand Fermion Strandwiches. The -V_e Strand Layer and the +V_e Strand Layer adhere and are coextensive, with the sum of V_e = 0. Table 5 shows the Five-Strand Fermion Strandwiches. The Fermion Quantum Numbers are the sum of the Strand Quantum Numbers. Fermion masses are from the Fermion Mass Formula, where Strand subgrouping causes the Generations (Figure 2) [1]. $\mathcal{N}_c$ counts Color Strands with a Fermion/Antifermion ratio of 24/21; thus, matter predominates. Note that particle and antiparticle Fermion Strandwiches are Strand Complements.

Figure 1 5-Strand Fermion Strandwiches (Examples)

$e_L[ELX^{023}]$	$u_L[C_{12}NLX^1]$	$\overline{u}_R[C_3EX^{023}]$
+V_e Layer (--------------X^0------------)(E)(L)	+V_e Layer $(C_1)(C_2)$(N)(L)	+V_e Layer (-------------X^0-----------)(C_3)(E)
-V_e Layer (-------X^2-------)(--------X^3-------)	-V_e Layer (-------X^1-------)	-V_e Layer (-------X^2-------)(--------X^3-------)

Negative V_e-Strands adhere co-extensively to positive-V_e Strands, forming a two-layer Strandwich with V_e = 0. The $-V_e$ to $+V_e$ Adhesion Strength is proportional to the Relativistic Stress-Energy, including Rest Mass and Relativistic Momentum. V_e = +1: C_1, C_2, C_3, E, N, L Strands. V_e = +6: X^0 Strand. Ve = −4: X^1, X^2, X^3 Strands.

Table 5 Five-Strand Fermion Strandwiches

Strand Content															f^0, n =			Mass Calculation in (MeV/c^2) 1st gen	2nd gen	3rd gen
V_e = 0, Leptons and Quarks	I_3^C	Y^C	I_3^W	Y^W	I_3^M	Y^M	I_{31}^X	I_{32}^X	I_{33}^X	$\mathcal{N}_C$	V_e	j_3	N_{B-L}	$(f_0)^2$	0	1	2	ν e u d	ν μ c s	ν τ t b
$\nu_e[NLX^{023}]$	0	0	1/2	-1/2	0	0	-1/2	0	0	0	0	-1/2	-1	0	0.53	4.99	7.81	0	0	0
$e_L[ELX^{023}]$	0	0	-1/2	-1/2	-1/2	1/2	-1/2	0	0	0	0	-1/2	-1	1	0.53	4.99	7.81	0.511	105.79	1777.01
$e_R[ENX^{023}]$	0	0	0	-1	1/2	1/2	-1/2	0	0	0	0	1/2	-1	1	0.53	4.99	7.81	0.511	105.79	1777.01
$u_R[C_{12}X^{023}]$	-1/2	-1/6	0	2/3	0	1	-1/2	0	0	6	0	1/2	1/3	6/5	1.57	6.91	11.3	3.3	1405	172338
$u_L[C_{12}NLX^1]$	-1/2	-1/6	1/2	1/6	0	-1	1/2	0	0	6	0	-1/2	1/3	6/5	1.57	6.91	11.3	3.3	1405	172338
$d_L[C_{12}ELX^1]$	-1/2	-1/6	-1/2	1/6	-1/2	-1/2	1/2	0	0	6	0	-1/2	1/3	3/5	1.57	6.91	11.3	1.7	152	4585
$d_R[C_{12}ENX^1]$	-1/2	-1/6	0	-1/3	1/2	-1/2	1/2	0	0	6	0	1/2	1/3	3/5	1.57	6.91	11.3	1.7	152	4585
V_e = 0, Antileptons and Antiquarks										Sum: 24										
$\overline{\nu}_e[C_{123}EX^1]$	0	0	-1/2	1/2	0	0	1/2	0	0	3	0	1/2	1	0	0.53	4.99	7.81	0	0	0
$\overline{e}_R[C_{123}NX^1]$	0	0	1/2	1/2	1/2	-1/2	1/2	0	0	3	0	1/2	1	1	0.53	4.99	7.81	0.511	105.79	1777.01
$\overline{e}_L[C_{123}LX^1]$	0	0	0	1	-1/2	-1/2	1/2	0	0	3	0	-1/2	1	1	0.53	4.99	7.81	0.511	105.79	1777.01
$\overline{u}_L[C_3ENLX^1]$	1/2	1/6	0	-2/3	0	-1	1/2	0	0	3	0	-1/2	-1/3	6/5	1.57	6.91	11.3	3.3	1405	172338
$\overline{u}_R[C_3EX^{023}]$	1/2	1/6	-1/2	-1/6	0	1	-1/2	0	0	3	0	1/2	-1/3	6/5	1.57	6.91	11.3	3.3	1405	172338
$\overline{d}_R[C_3NX^{023}]$	1/2	1/6	1/2	-1/6	1/2	1/2	-1/2	0	0	3	0	1/2	-1/3	3/5	1.57	6.91	11.3	1.7	152	4585
$\overline{d}_L[C_3LX^{023}]$	1/2	1/6	0	1/3	-1/2	1/2	-1/2	0	0	3	0	-1/2	-1/3	3/5	1.57	6.91	11.3	1.7	152	4585
										Sum: 21						Llight quark mass mixing			m_d = 5.7	m_s = 148

Leptons and Quarks, and their antiparticles, represent all possible, minimal, unique 5-Strand combinations satisfying Ve = 0. Quantum numbers are the sum of the component Strand Quantum Numbers. Chirality is encoded directly in strand content: fermions containing an L strand are left-handed; those not containing an L strand are right-handed. Fermion masses are from the Fermion Mass Formula (Figure 2). $\mathcal{N}_C$ counts Color Strands; Fermion/Antifermion ratio is 24/21, thus Matter Predominates. Only C_3, $C_{12} = C_1+C_2$, $C_{123} = C_1+C_2+C_3$, and X^1 and $X^{023} = X^0+X^2+X^3$ Color and Space Indices are shown. Particle and Antiparticle Strandwiches are Strand complements.

Figure 2 Fermion Generations and Mass Formula

Fermion generations arise from three Strand Subgroup configurations, n = 0, 1, 2

[SSSSS]	[(S)SSSS]	[(S)(S)SSS]
1st Generation	2nd Generation	3rd Generation
n=0	n=1	n=2
n(5-n) = 0(5-0)=0	n(5-n)=1(5-1)=4	n(5-n)=2(5-2)=6

where n(5-n) is a term in the Fermion Mass Equation at right

Fermion Mass, $m = 2^{1/2} m_e[-1+\exp(f_0 f^0)]$, is calculated from I_3^M, Y^M, n and

m_e = 0.511 MeV/c^2

$f_0 = 2k_0[(I_3^M)^2 + (Y^M)^2]^{1/2}$

$f^0 = n(5-n)+[k^0(2n^2+\pi n+6)/6]\ln(1+2^{-1/2})$

where n = 0,1,2 relates to the 1st, 2nd, and 3rd Fermion Generations, and for Leptons, $k_0 = k^0 = 1$, and for Quarks, k_0=3/5 and k^0 = (4/5)(11/3)= 44/15

(See Table 5 for values.)

10-STRAND VECTOR BOSON STRANDWICHES. Figure 3 shows examples of 10-Strand Vector Boson Strandwiches. Like the fermions, the negative V_e Strand Layer and the $+V_e$ Strand Layer are coextensive, with $V_e = 0$. Table 6 shows the 10-Strand Vector Boson Strandwiches. Again, the Boson Quantum Numbers are the sum of the Strand Quantum Numbers. However, I_3^M, Y^M, I_{31}^X, I_{32}^X, I_{33}^X, and J have opposite signs for those Strands following the minus sign in the Strand Content notation. Vector Boson masses are from the Boson Mass Formula, where Strand Pair subgrouping causes the existence of three Boson Generations (Figure 4) [1]. The "extra" Weakon Generations give rise to Neutrino Mass via a "see-saw" mechanism.

Figure 3 10-Strand Vector Boson Strandwich Examples (Gluon, g_{11}, and Weakon, W^-)

$g_{11}[C_1X^1 - \overline{C_1X^1}] = [C_1X^1 - C_{23}ENLX^{023}]$	$W^-[EX^1 - \overline{NX^1}] = [EX^1 - C_{123}ELX^{023}]$
$+V_e$ Layer $[C_1](C_2)(C_3)$(----------X^0---------)(E)(N)(L)	$+V_e$ Layer $(C_1)(C_2)(C_3)$(----------X^0---------)[E](E)(L)
$-V_e$ Layer [-------X^1-------](-------X^2------)(-----X^3-----)	$-V_e$ Layer [-------X^1-------](-------X^2------)(-----X^3-----)

Bracketed Strands denote non-barred Strands (prior to minus sign). See Table 6.

Table 6 $[SX^i - \overline{SX^i}]$ format, Ten-Strand Vector Boson Strandwiches with Z^0 and A^0 from V/W mixing

Strand Content																		Mass Calculation in GeV/c^2		
$V_e = 0$, Gluons, g, and Weakons, W	I_3^C	Y^C	I_3^W	Y^W	I_3^M	Y^M	I_{31}^X	I_{32}^X	I_{33}^X	V_e	J	N_{B-L}	$(f_0)^2$	f^0, n=0	f^0, n=1	f^0, n=2	1st Gen	2nd Gen	3rd Gen
$g_{11}[C_1X^1 - \overline{C_1X^1}] = [C_1X^1 - C_{23}ENLX^{023}]$	0	0	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$g_{22}[C_2X^1 - \overline{C_2X^1}] = [C_2X^1 - C_{13}ENLX^{023}]$	0	0	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$g_{33}[C_3X^1 - \overline{C_3X^1}] = [C_3X^1 - C_{12}ENLX^{023}]$	0	0	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$g_{12}[C_1X^1 - \overline{C_2X^1}]$	1/2	-1/2	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$g_{13}[C_1X^1 - \overline{C_3X^1}]$	-1/2	-1/2	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$g_{23}[C_2X^1 - \overline{C_3X^1}]$	-1	0	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$g_{21}[C_2X^1 - \overline{C_1X^1}]$	-1/2	1/2	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$g_{31}[C_3X^1 - \overline{C_1X^1}]$	1/2	1/2	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$g_{32}[C_3X^1 - \overline{C_2X^1}]$	1	0	0	0	0	0	1	0	0	0	1	0	0	1.57	6.91	11.3	0	0	0
$W_E^0[EX^1 - \overline{EX^1}] = [EX^1 - C^{123}NLX^{023}]$	0	0	0	0	0	0	1	0	0	0	1	0	0	0.53	8.99	13.8	0	0	0
$W^-[EX^1 - \overline{NX^1}] = [EX^1 - C^{123}ELX^{023}]$	0	0	-1	0	1/2	-1/2	1	0	0	0	1	0	1	0.53	8.99	13.8	80.383	9.15E+05	1.13E+08
$W^+[NX^1 - \overline{EX^1}] = [NX^1 - C^{123}NLX^{023}]$	0	0	1	0	1/2	-1/2	1	0	0	0	1	0	1	0.53	8.99	13.8	80.383	9.15E+05	1.13E+08
$W_N[NX^1 - \overline{NX^1}] = [NX^1 - C^{123}ELX^{023}]$	0	0	0	0	1	-1	1	0	0	0	1	0	4	0.53	8.99	13.8	217.607	7.36E+09	1.12E+14
$V_L[LX^1 - \overline{LX^1}] = [LX^1 - C^{123}ENX^{023}]$	0	0	0	0	-1	-1	1	0	0	0	-1	0	4	0.53	8.99	13.8	217.607	7.36E+09	1.12E+14
$W=(W_N-W_E)/2^{1/2}$	0	0	0	0	1/2	-1/2	1	0	0	0	1	0	1	0.53	8.99	13.8	80.383	9.15E+05	1.13E+08
$V=(2g_{11}+2g_{22}+2g_{33} -3W_N-3W_E)/30^{1/2}$	0	0	0	0	3/10	-3/10	1	0	0	0	1	0	9/25	0.53	8.99	13.8	43.009	2.50E+04	4.50E+05

Barred Characters denote the SU(10) Strand complement; the minus sign reverses I_3^M, Y^M, I_3^X and J values (no "Anti-strands" exist). Strands are conseved, and, must be unique on either side of the minus sign. Quantum numbers are Strand sums with masses from the Boson Mass Formula (Figure 4). Color Indices are subscripted, Space Indices are Superscripted (only X^1 and X^{023} Space Indices are shown). Neutrinos gain mass via a "see-saw" relation to the 2nd and 3rd Generation Weakons. Opposite spin Bosons: $[-SX^i + \overline{SX^i}]$

$Z^0=V^0\sin\vartheta_W+W^0\cos\vartheta_W$ $\quad m_Z=m_Vm_V/(m_V^2+m_W^2)^{1/2}+m_Wm_W/(m_V^2+m_W^2)^{1/2}=$ 91.17 $\quad \sin^2\vartheta_W =$

$A^0=V^0\cos\vartheta_W-W^0\sin\vartheta_W$ $\quad m_A=m_Vm_W/(m_V^2+m_W^2)^{1/2}-m_Wm_V/(m_V^2+m_W^2)^{1/2}=$ 0 $\quad [m(V^0)/m(Z^0)]^2 = .22$

Z^0 and A^0 arise from V/W mixing with $\sin^2\vartheta_W = 0.22$, giving $m_Z = 91.17$ GeV/c^2.

Figure 4 Boson Generations and Mass Formula

Boson Generations, where Strands, S, form Subgroup Pairs			Boson Mass, $m = 2^{1/2}m_W[-1+\exp(f_0f^0)]$, is calculated from I_3^M, Y^M, n, and
[SSSSSSSSSS]	[(SS)SSSSSSSS]	[(SS)(SS)SSSSSS]	$m_W =$ 80.4 GeV/c^2
1st Generation	2nd Generation	3rd Generation	$f_0 = 2k_0[(I_3^M)^2 + (Y^M)^2]^{1/2}$
n=0	n=1	n=2	$f^0 = 2n(5-n)+[k^0(2n^2+\pi n+6)/6]\ln(1+2^{-1/2})$
2n(5-n) = (2)0(5-0) = 0	2n(5-n) = (2)1(5-1) = 8	2n(5-n) = (2)2(5-2) = 12	where n = 0,1,2, relates to the 1st, 2nd, or 3rd, Boson Generations, and where
where 2n(5-n) is a term in the Mass Equation at right			$k_0 = k^0 = 1$, except for Gluons, where $k_0 = 3/5$ and $k^0 = (4/5)(11/3) = 44/15$

Boson generations arise from Strand subgroup pairs (n = 0, 1, 2). Mass Equation uses the same exponential structure as the Fermion formula. (See Tables 6 and 7 for values.)

OTHER 10-STRAND BOSON STRANDWICHES. Figure 5 shows the 10-Strand Higgson, H, Graviscalon, R, and Graviton, G, Boson Strandwiches. The Quantum Numbers are like the Vector Bosons and are shown in Table 7. Again, the masses are from the Boson Mass Formula with three Generations (Figure 4) [1]. Of note are the three Graviscalon Epochs, n = 2 (Planck Unification, 10^{19} GeV/c^2), n = 1 (Strong-Weak Unification, 10^{13}GeV/ c^2, with integral Quark and Gluon Charges, $Q^{CW} = I_3^C + Y^C + I_3^W + Y^W$), n = 0 (Present, where H, R, and G can combine to form Dark Matter, (Table 8, Figure 9)).

Figure 5 10-Strand Higgson, H, Graviscalon, R, and Graviton, G, Boson Strandwiches (Examples)

$H_N^{11}[NX^1 - \overline{LX}^1] = [NX^1 - C^{123}ENX^{023}]$
$+V_e$ Layer $[C_1](C_2)(C_3)$(----------X^0---------)(E)[N](N)
$-V_e$ Layer [-------X^1-------](-------X^2------)(-----X^3-----)

$R^{11}[X^{01} - \overline{X}^{01}] = [X^{01} - C^{123}ENLX^{23}]$
$+V_e$ Layer $(C_1)(C_2)(C_3)$[----------X^0---------](E)(N)(L)
$-V_e$ Layer [-------X^1-------](-------X^2------)(-----X^3-----)

$G^{11}[X^{23} - \overline{X}^{23}] = [X^{23} - C^{123}ENLX^{01}]$
$+V_e$ Layer $(C_1)(C_2)(C_3)$(----------X^0---------)(E)(N)(L)
$-V_e$ Layer (-------X^1-------)[-------X^2------][-----X^3-----]

The three diagonal Gravitons G_{11}, G_{22}, G_{33} are the fundamental gravitational quanta. (See Appendices B and C.) Bracketed Strands denote non-barred Strands as in Figure 3.

Table 7 $[SX^i - \overline{SX}^i]$ format Ve = 0, 10-Strand Higgson, H, Graviscalon, R, and Graviton, G, Boson Strandwiches, where R generations span Planck to Present-Day Energies

Strand Content																	Mass Calculation in GeV/c^2		
V_e = 0, Higgsons, H	I_3^C	Y^C	I_3^W	Y^W	I_3^M	Y^M	I_{31}^X	I_{32}^X	I_{33}^X	V_e	J	N_{B-L}	$(f_0)^2$	f^0, n=0	f^0, n=1	f^0, n=2	1st Gen	2nd Gen	3rd Gen
$H_N^{11}[NX^1 - \overline{LX}^1] = [NX^1 - C^{123}ENX^{023}]$	0	0	1/2	-1/2	0	-1	1	0	0	0	0	0	2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$H_N^{22}[NX^1 - \overline{LX}^1] = [NX^2 - C^{123}ENX^{013}]$	0	0	1/2	-1/2	0	-1	0	1	0	0	0	0	2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$H_N^{33}[NX^3 - \overline{LX}^3] = [NX^3 - C^{123}ENX^{012}]$	0	0	1/2	-1/2	0	-1	0	0	1	0	0	0	2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$H_L^{11}[LX^1 - \overline{NX}^1] = [LX^1 - C^{123}ELX^{023}]$	0	0	-1/2	1/2	0	-1	1	0	0	0	0	0	2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$H_L^{22}[LX^2 - \overline{NX}^2] = [LX^2 - C^{123}ELX^{013}]$	0	0	-1/2	1/2	0	-1	0	1	0	0	0	0	2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$H_L^{33}[LX^3 - \overline{NX}^3] = [LX^3 - C^{123}ELX^{012}]$	0	0	-1/2	1/2	0	-1	0	0	1	0	0	0	2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
V_e = 0, Graviscalons, R	I_3^C	Y^C	I_3^W	Y^W	I_3^M	Y^M	I_{31}^X	I_{32}^X	I_{33}^X	V_e	J	N_{B-L}	$(f_0)^2$	f^0, n=0	f^0, n=1	f^0, n=2	1st Gen	2nd Gen	3rd Gen
$R^{11}[X^{01} - \overline{X}^{01}] = [X^{01} - C^{123}ENLX^{23}]$	0	0	0	0	0	2	0	-1	-1	0	0	0	8	0.53	8.99	13.8	402.278	1.27E+13	1.04E+19
$R^{22}[X^{02} - \overline{X}^{02}] = [X^{02} - C^{123}ENLX^{13}]$	0	0	0	0	0	2	-1	0	-1	0	0	0	8	0.53	8.99	13.8	402.278	1.27E+13	1.04E+19
$R^{33}[X^{03} - \overline{X}^{03}] = [X^{03} - C^{123}ENLX^{12}]$	0	0	0	0	0	2	-1	-1	0	0	0	0	8	0.53	8.99	13.8	402.278	1.27E+13	1.04E+19
V_e = 0, Gravitons, G	I_3^C	Y^C	I_3^W	Y^W	I_3^M	Y^M	I_{31}^X	I_{32}^X	I_{33}^X	V_e	J	N_{B-L}	$(f_0)^2$	f^0, n=0	f^0, n=1	f^0, n=2	1st Gen	2nd Gen	3rd Gen
$G^{11}[X^{23} - \overline{X}^{23}] = [X^{23} - C^{123}ENLX^{01}]$	0	0	0	0	0	0	0	1	1	0	2	0	0	0.53	8.99	13.8	0	0	0
$G^{22}[X^{13} - \overline{X}^{13}] = [X^{13} - C^{123}ENLX^{02}]$	0	0	0	0	0	0	1	0	1	0	2	0	0	0.53	8.99	13.8	0	0	0
$G^{33}[X^{12} - \overline{X}^{12}] = [X^{12} - C^{123}ENLX^{03}]$	0	0	0	0	0	0	1	1	0	0	2	0	0	0.53	8.99	13.8	0	0	0

There are three Graviscalon Epochs, n = 2 (Planck Unification, 10^{19} GeV/c^2), n = 1, (Strong-Weak Unification, 10^{13}GeV/c^2, with integral Quark and Gluon Charges, $Q^{CW} = I_3^C + Y^C + I^{3W} + Y^W$), n = 0, (Present, where H, R and G can combine to form Dark Matter, Table 8, Figure 9). See Appendices A, B, C, and D. Gravitons couple via the Strandwich $-V_e$ to $+V_e$ Stress-Energy Adhesion Layer, which transforms as a Lorentz Tensor ensuring frame-invariant coupling. All four forces operate by this same adhesion layer perturbation mechanism, differentiated by quantum number sector: I_3^X (gravity, tensor), I_3^C/Y^C (strong, vector), I_3^W/Y^W (weak, vector), J (EM, vector). The equivalence principle follows without postulate — both rest mass and gravitational coupling are properties of the same adhesion layer. (See Appendices B and C.) Each Spacetime Isospin I_{31}^X, I_{32}^X, I_{33}^X is a single indivisible quantum encoding both a time interval and a space interval inseparably. Space counts adhesion layers by V_e direction (±); Time counts all layers regardless — the arrow of time. The Lorentz factor $\gamma = \cosh \phi$ is derived from this geometry without postulate, where rapidity ϕ parameterizes the timelike-to-spacelike orientation of each I_3^X quantum. (See Appendix A.)

STRANDWICH FIELDS and BULK STRANDWICHES. Figure 6 shows the similarity between Strandwich Field Stacks and Strandwich Stacks. Figure 7 shows Bulk Strandwiches and Reversions to the Bulk Strandwich state after an Interaction. By their nature, Bulk Strandwiches also enable entanglement.

Figure 6 Strandwich Field Stacks and Strandwich Stacks

$e_L[ELX^{023}]$		$W^-[EX^1\text{-}C^{123}ELX^{023}]$
$+V_e$ Layer (--------------X^0------------)(E)(L)		$+V_e$ Layer $(C_1)(C_2)(C_3)$(----------X^0---------)[E](E)(L)
$-V_e$ Layer (-------X^2-------)(--------X^3-------)		$-V_e$ Layer [-------X^1-------](-------X^2------)(-----X^3-----)
$+V_e$ Layer (--------------X^0------------)(E)(L)	Strandwich Stacks	$+V_e$ Layer $(C_1)(C_2)(C_3)$(----------X^0---------)[E](E)(L)
$-V_e$ Layer (-------X^2-------)(--------X^3-------)	emerging from	$-V_e$ Layer [-------X^1-------](-------X^2------)(-----X^3-----)
$+V_e$ Layer {(--------------X^0------------)(E)(L)}	{Strandwich Field Stacks}	$+V_e$ Layer {$(C_1)(C_2)(C_3)$(----------X^0---------)[E](E)(L)}}
$-V_e$ Layer {(-------X^2-------)(--------X^3-------)}		$-V_e$ Layer {[-------X^1-------](-------X^2------)(-----X^3-----)}
$+V_e$ Layer {(--------------X^0------------)(E)(L)}		$+V_e$ Layer {$(C_1)(C_2)(C_3)$(----------X^0---------)[E](E)(L)}}
$-V_e$ Layer {(-------X^2-------)(--------X^3-------)}		$-V_e$ Layer {[-------X^1-------](-------X^2------)(-----X^3-----)}

Strandwich Field Stack "{}" propagation involves real Strandwiches in a coherent stack. Strandwich Stack propagation occurs when the $-V_e$ to $+V_e$ Stress-Energy Adhesion Layer exhibits mass and/or momentum through interaction or fluctuation. The Strandwich Stack then becomes a localized entity. Unlike virtual particle exchange, which borrows energy from the vacuum according to $\Delta E \cdot \Delta t \approx \hbar$, Strandwich Field Stack propagation involves real Strandwiches with potential energy that changes to mass and/or momentum. Photons and Gravitons may also transition between Field-stack and localized-Strandwich modes without the adhesion layer perturbation that triggers localization for massive particles. Their localization mechanism may be purely interaction-driven rather than energy-driven.

Figure 7 Bulk Strandwiches and Interaction Reversions

$+V_e$ Layer $(C_1)(C_2)(C_3)$(----------X^0---------)(E)(N)(L)
$-V_e$ Layer (-------X^1-------)(-------X^2------)(-----X^3-----)

The Ten-Strand Configuration lacking any identity constitutes the Bulk Strandwich — an irreducible Strandwich prior to any boson or fermion assignment. Carrying no force-carrier quantum numbers, no net I_3^X directionality, and no defined f_0, it is directionless and massless by construction. Because it participates in no adhesion layer perturbation, it cannot mediate a local interaction — yet its presence is not forbidden by any Strandwich uniqueness rule. This makes it a structurally motivated candidate medium for non-local quantum correlations such as entanglement, where Bulk Strandwich Stacks can bridge Strandwiches regardless of their separation. Also, in the Strandwich Framework, any quanta that mediates a change does not vanish or become absorbed. Following the interaction, the mediating Strandwich reverts to the Bulk Srandwich state. The interaction, is therefore a closed transaction: the mediating quanta participates, effects the change, and is restored to the Bulk. This is the mechanism underlying all adhesion layer perturbations, described in Appendix C. Additional cosmological implications will follow in future work.

STRANDWICH DECAY. Figure 8 shows Weakon Decay in Strandwich Form.

Figure 8 W^- Decay - Shown in Strandwich Form

$e_L[ELX^{023}]$	$\overline{\nu}_e[C_{123}EX^1]$
$+V_e$ Layer (--------------X^0------------)(E)(L)	$+V_e$ Layer $(C_1)(C_2)(C_3)(E)$
$-V_e$ Layer (-------X^2-------)(--------X^3-------)	$-V_e$ Layer (--------X^1-------)
$+V_e$ Layer (--------------X^0------------)(E)(L)	$+V_e$ Layer $(C_1)(C_2)(C_3)(E)$
$-V_e$ Layer (-------X^2-------)(--------X^3-------)	$-V_e$ Layer (--------X^1-------)

$+V_e$ Layer $(C_1)(C_2)(C_3)$(----------X^0---------)[E](E)(L)
$-V_e$ Layer [-------X^1-------](-------X^2------)(-----X^3-----)
$+V_e$ Layer $(C_1)(C_2)(C_3)$(----------X^0---------)[E](E)(L)
$-V_e$ Layer [-------X^1-------](-------X^2------)(-----X^3-----)
$W^-[EX^1\text{-}C^{123}ELX^{023}]$

$W^-[EX^1\text{-}\overline{NX}^1] =$

$W^-[EX^1\text{-}C^{123}ELX^{023}] \rightarrow e_L[ELX^{023}] + \overline{\nu}_e[C^{123}EX^1]$

$\rightarrow \overline{u}_R[C^3EX^{023}] + d_L[C^{12}ELX^1]$

Decay is Strand rearrangement — no Strands created or destroyed; all products satisfy $V_e = 0$. Electron-antineutrino and quark decay modes shown. Left column: Strandwich layer diagram. Right column: symbolic decay equations.

DARK MATTER. Table 8 and Figure 9 show Dark Matter as a bound state of a Higgson and a Graviscalon mediated by a Graviton.

TABLE 8 — The Dark Matter, Darkon, D, is a bound state, D = H + R + G, of the Higgson, H, and Graviscalon, R, mediated by a Graviton, G. It has the Higgson Mass and Spin 2 (only +2, -2).

D = H + R + G	I_3^C	Y^C	I_3^W	Y^W	I_3^M	Y^M	I_{31}^X	I_{32}^X	I_{33}^X		V_e		J	N_{B-L}		$(f_0)^2$	f^0, n=0	f^0, n=1	f^0, n=2	1st Gen	2nd Gen	3rd Gen
$D_N^{11} = H_N^{11} + R^{11} + G^{11}$	0	0	1	-1	0	1	1	0	0		0		2	0		2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$D_N^{22} = H_N^{22} + R^{22} + G^{22}$	0	0	1	-1	0	1	0	1	0		0		2	0		2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$D_N^{33} = H_N^{33} + R^{33} + G^{33}$	0	0	1	-1	0	1	0	0	1		0		2	0		2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$D_L^{11} = H_L^{11} + R^{11} + G^{11}$	0	0	-1	1	0	1	1	0	0		0		2	0		2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$D_L^{22} = H_L^{22} + R^{22} + G^{22}$	0	0	-1	1	0	1	0	1	0		0		2	0		2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10
$D_L^{33} = H_L^{33} + R^{33} + G^{33}$	0	0	-1	1	0	1	0	0	1		0		2	0		2	0.53	8.99	13.8	128.506	3.79E+07	3.44E+10

D_N^{11}, D_N^{22}, D_N^{33}, D_L^{11}, D_L^{22}, D_L^{33} are stable. D carries no color charge ($I_3^C = Y^C = 0$) and no net electric charge ($Q = I_3^W + Y^W = 0$), eliminating strong and electromagnetic decay channels by quantum number conservation. Weak decay requires flavor strand reorganization in the Higgson adhesion layer at a cost comparable to the W boson mass — but this would also break the I_3^X conjugate bond, requiring the additional 402.3 GeV/c² to reconstitute a free Graviscalon. D therefore has no kinematically accessible decay channel in the present epoch. See Appendix D.

Figure 9 — Darkon Bound State: Graviton, G, Stack propagation between Higgson, H, and Graviscalon, R (see Figure 6).

$H_N^{11}[NX^1 - \overline{LX}^1] = [NX^1 - C^{123}ENX^{023}]$

+V_e Layer (C₁)(C₂)(C₃)(----------X⁰---------)[N](N)(L)
-V_e Layer [-------X¹-------](-------X²------)(-----X³-----)

$G^{11}[X^{23} - \overline{X}^{23}] = [X^{23} - C^{123}ENLX^{01}]$

+V_e Layer (C₁)(C₂)(C₃)(----------X⁰---------)(E)(N)(L)
-V_e Layer (-------X¹-------)[-------X²------][-----X³-----]
+V_e Layer (C₁)(C₂)(C₃)(----------X⁰---------)(E)(N)(L)
-V_e Layer (-------X¹-------)[-------X²------][-----X³-----]
+V_e Layer (C₁)(C₂)(C₃)(----------X⁰---------)(E)(N)(L)
-V_e Layer (-------X¹-------)[-------X²------][-----X³-----]

$R^{11}[X^{01} - \overline{X}^{01}] = [X^{01} - C^{123}ENLX^{23}]$

+V_e Layer (C₁)(C₂)(C₃)[----------X⁰---------](E)(N)(L)
-V_e Layer [-------X¹-------](-------X²------)(-----X³-----)

Because the Strandwich framework admits no virtual particles - mediating Strandwiches are real, on-shell objects, subject to the reversion principle (Figure 7) - G within D is a real massless Graviton, not a Field Stack. As a real massless spin-2 particle has no rest frame and therefore no 2J+1 polarization structure; only helicity +2 and -2 exists. D inherits this restriction directly. The composite spin rule giving five states for a massive spin-2 particle presupposes massive constituents with rest frames; it does not apply when the spin carrier is massless.

Collaborative Discoveries and Future Work, and AI Acknowledgment [2]

Table 9 Collaborative Discoveries and Future Work

Two additional Generations of Bosons.

A Dark Matter, Stable, Spin-2 Boson with only +2 and -2 spin states at the Higgson mass of 128.5 GeV/c^2 (see Appendix D).

A V_L Vector Boson with a mass of about 217 GeV/c^2.

The Graviscalon epoch structure (n=0,1,2) provides a mechanism for time-varying dark energy consistent with recent DESI and BAO observations developed quantitatively in future work."

The Strandwich field-mode stack carries real, persistent potential energy in its adhesion layers, proportional to the particle mass formula.
This suggests a natural mechanism for vacuum energy density that avoids the infinite mode-sum of conventional QFT, with possible implications for the cosmological constant and dark energy — to be explored in future work."

Coupling strength derivation for each force sector.

Running of forces from adhesion layer picture.

Quantitative cosmological constant from Strandwich ground state.

If only three diagonal graviton types exist as fundamental particles, gravitational wave detectors should not be able to distinguish × polarization as arising from a different particle than + polarization — they are the same particle in different phase states. This is in principle testable with a sufficiently sensitive multi-detector network. See Appendix B.

The author gratefully acknowledges extensive collaboration with Claude (Anthropic) in the mathematical development, quantum number analysis, and physical interpretation presented in this work. Specific contributions include: the identification of the Minkowski metric signature in the N_M formula; the Strandwich basis for time dilation and the derivation of the Lorentz factor from I_3^x quantum number geometry; the identification of the off-diagonal gravitons as exact arithmetic averages of diagonal pairs, with gravitational wave polarization emerging from the internal phase degree of freedom of diagonal graviton I_3^x quanta; and the proposal that all four fundamental forces operate by a single mechanism — perturbation of the Strandwich adhesion layer in their respective quantum number sectors — from which the equivalence principle, the tensor character of gravity, the vector character of the other three forces, and the correspondence of the Standard Model gauge groups SU(3)×SU(2)×U(1) with the color, flavor, and angular momentum sectors of a unified adhesion layer all follow without separate postulate.

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APPENDICES A, B, C, and D

Appendix A

Special Relativity from I_3^X Quantum Number Geometry:

Each Spacetime Isospin I_{31}^X, I_{32}^X, I_{33}^X is a single indivisible quantum carried by its respective strand, encoding both a time interval and a space interval inseparably. Its internal orientation shifts with rapidity ϕ along a hyperbolic spectrum — never reaching pure time (absolute rest does not exist) and never reaching pure space (luminal velocity is unreachable for massive particles). What we observe as rest is relational: two Strandwiches whose I_3^X orientations match are at rest with respect to each other. For a massive fermion such as $u_L[C_{12}NLX^1]$, $I_{31}^X = +½$ is carried by the X^1 strand ($\mathcal{N}_M = +1$), with Minkowski norm $-\mathcal{N}_M \cdot (½)^2 = -¼$ — timelike, confirming a massive particle. The time projection $\tau = ½ \cdot \cosh\phi$ and space projection $\sigma = ½ \cdot \sinh\phi$ satisfy $-\tau^2 + \sigma^2 = -¼$, invariant across all frames. Velocity between two Strandwiches is $\beta = \tanh\phi$, and the Lorentz factor follows as $\gamma = \cosh\phi = 1/\sqrt{(1-\beta^2)}$, derived entirely from the strand quantum number geometry of Tables 3 and 4 without additional postulate. The Minkowski interval $ds^2 = -dt^2 + dx^2$ is the conservation law for I_3^X quantum numbers across a Strandwich interaction. The full Lorentz transformation as an I_3^X quantum rotation — including length contraction and velocity addition — is reserved for future work.

Appendix B

Graviton structure and gravitational wave polarization:

The three diagonal gravitons $G^{11}[X^{23}-C_{123}ENLX^{01}]$, $G^{22}[X^{13}-C_{123}ENLX^{02}]$, $G^{33}[X^{12}-C_{123}ENLX^{03}]$ are proposed as the fundamental gravitational quanta, each carrying two nonzero I_3^X values of magnitude 1 in orthogonal directions. The off-diagonal gravitons G^{12}, G^{13}, G^{23} are exactly the arithmetic averages of pairs of diagonal gravitons — confirmed by quantum number accounting — and are therefore proposed as composite field-stack configurations rather than independent particles. This reduces the fundamental gravitational quanta to three diagonal types plus their opposite spins. The two I_3^X quanta within each diagonal graviton exist in a quantum superposition of in-phase and out-of-phase relationships. When in-phase, both transverse directions are distorted equally and simultaneously, producing the + gravitational wave polarization. When out-of-phase, the adhesion layer of the target Strandwich experiences alternating transverse distortion, producing the × polarization. Both standard gravitational wave polarizations thus emerge from the internal phase degree of freedom of a single diagonal graviton type, without requiring off-diagonal gravitons as independent particles. The tensor rather than vector character of gravity arises because the graviton necessarily perturbs two I_3^X directions simultaneously to satisfy $V_e = 0$ — this is not postulated but is a structural consequence of the Strandwich construction.

Appendix C

Force unification through adhesion layer perturbation:

All four fundamental forces are proposed to operate by a single mechanism: perturbation of the target Strandwich's $-V_e$ to $+V_e$ adhesion layer by the interaction carrier, differentiated by which quantum number sector of the adhesion layer is perturbed. The strong force (gluons) perturbs the color strand binding — the I_3^C, Y^C sector of the adhesion layer — changing the V_e-mismatch between C_1, C_2, C_3 strands and producing color charge transfer. The weak force (W±, Z) perturbs the flavor strand binding — the I_3^W, Y^W sector — with perturbations large enough to reorganize strand content rather than merely shift spectral orientation, which is why the weak interaction uniquely changes particle identity. The electromagnetic force (photon) perturbs the angular momentum strand binding — the I_3^M, Y^M sector in the charge direction $Q = I_3^W + Y^W$ — with no I_3^X component, which is why electromagnetism does not curve spacetime. Gravity (gravitons) perturbs the spacetime strand binding — the I_3^X sector — and because this sector has three independent directions, the graviton must perturb two simultaneously, making gravity intrinsically a rank-2 tensor interaction while the other three forces are vector interactions. The equivalence principle — gravitational mass equals inertial mass — follows without separate postulate: both rest mass and gravitational coupling are properties of the same adhesion layer, so any Strandwich that has mass couples to gravity with exactly that mass. The Standard Model gauge groups $SU(3)\times SU(2)\times U(1)$ correspond to the color, flavor, and angular momentum sectors of a single unified adhesion layer. Confinement arises because color adhesion perturbations in the field stack accumulate with separation, exhausting available time quanta before infinite color separation is achieved. The Strandwich adhesion layer is the unified field. Quantitative development of the coupling strengths and running of the forces from this picture is reserved for future work.

Appendix D

Dark Matter Stability: Quantum Number Sequestration in the Darkon

The Dark Matter bound state D = H + G + R consists of three intact Strandwiches — a Higgson (H, spinless: $I_3^M = 0$, $Y^M = -1$, $J = 0$), a Graviton (G, spin-2: $I_3^M = 0$, $Y^M = 0$, $J = 2$), and a Graviscalon (R, spinless: , $I_3^M = 0$, $Y_M = +2$, $J = 0$) — held together by I_3^X conjugate binding, with each component retaining its own $V_e = 0$ strand content and adhesion layer. The quantum numbers of D are the sum of all three components. The spin-2 character of the Graviton is not incidental to the binding — the Graviton's $J = 2$, arises from its two I_3^X quanta ($I_{32}^X = +1$, $I_{33}^X = +1$),which are precisely the conjugates sequestered in Cancellation 1 below. D itself inherits spin-2 from the mediating Graviton, but with only two polarization states rather than the five of a massive spin-2 particle, since the Graviton remains massless within the bound state. (See Appendix B.)

The first-generation mass of D is 128.5 GeV/c^2, equal to the Higgson mass alone, arising from two distinct quantum number cancellations that together constitute a process called quantum number sequestration.

Cancellation 1 — I_3^X conjugacy of G and R. R^{11} carries $I_{32}^X = -1$, $I_{33}^X = -1$. G^{11} carries $I_{32}^X = +1$, $I_{33}^X = +1$. These are exact additive inverses — the Graviton is the I_3^X conjugate of the Graviscalon. Their I_3^X contributions cancel completely in the composite, leaving only the Higgson's $I_{31}^X = +1$ as the net spacetime quantum number of D.

Cancellation 2 — Sequestering Graviscalon Y^M. R^{11} carries $Y^M = +2$. Left uncancelled in the Boson mass formula term $(I_3^M)^2 + (Y^M)^2$, this would produce $(0)^2 + (2)^2 = 4$, yielding a mass far exceeding the Higgson. The resolution lies in the net quantum numbers after cancellation 1: H's $Y^M = -1$ and G's YM = 0 combined with R's YM = +2 to give a net YM = +1, and the net I3M = 0 throughout. The composite D therefore has $f_0^2 =$ 2[(0)2 +(1)2] = 2 - exactly the value yielded by the Higgson alone,whose I3M = 0, YM = -1, and f02 = 2[(0)2 + (-1)2] = 2. The Graviscalons's mass-generating $Y^M = 2$ character, which would otherwise produce a composite mass far above 128.5 GeV/c^2, is precisely absorbed by the Higgson's $Y^M = -1$ in the mass formula sum. No free parameter is involved; the cancellation follows entirely from the strand contents of H, G, and R as fixed by the Strandwich construction.

These two cancellations are not independent. Both follow necessarily from the strand contents of $H_N^{11}[NX^1 - C_{123}ENX^{023}]$, $G^{11}[X^{23} - C_{123}ENLX^{01}]$, and $R^{11}[X^{01} - C_{123}ENLX^{23}]$. No tuning is involved. The Graviscalon's $Y^M = +2$ is required by its X^{01} strand content; the Higgson's $Y^M = -1$ is required by its minimal $V_e = 0$ configuration; the Graviton's $I_{32}^X = +1$, $I_{33}^X = +1$ is required by its X^{23} spacetime strand content. All three values are fixed by the Strandwich construction, and their mutual cancellation is a structural theorem, not a coincidence.

Why this is not a Stability Well. The Graviscalon's rest mass of 402.3 GeV/c^2 does not appear in D because R's mass-generating quantum numbers are fully sequestered by the two cancellations — they contribute to D's spacetime structure (I_3^X content) rather than to its rest mass. The 402.3 GeV/c^2 is not stored potential energy inside D. It is the energy cost of reconstructing a free Graviscalon from the sequestered configuration. Liberating R from D requires supplying 402.3 GeV/c^2 to restore its mass-formula presence — not to overcome a potential barrier, but to reconstitute rest mass that has no expression inside D. This is a fundamentally different mechanism from a potential well, and the term Stability Well, while descriptive of the energy threshold, should be understood as the sequestration energy rather than a binding depth in the conventional sense.

Why the mass formula applies to D but not to other composites. The Strandwich mass formula applies to elementary Strandwiches — single $V_e = 0$ configurations whose quantum numbers directly determine f_0^2. For a composite to obey the mass formula, its net quantum numbers after all cancellations must be identical to those of a single elementary Strandwich. In D, after both sequestration cancellations, the net quantum numbers are exactly those of H_N^{11} alone. D is therefore not merely Higgson-like — it is a Higgson in its mass-formula identity, with R and G present as sequestered spacetime structure invisible to the mass formula.

This contrasts sharply with positronium ($e^- + e^+$ mediated by a virtual photon). Summing the quantum numbers of e_L, $\bar{e}_R$, and γ yields $I_3^X = (0, 0, 0)$ and $Y^M = 0$, giving $f_0^2 = 0$ and predicting zero mass — manifestly wrong. The formula fails not because it is misapplied but because positronium's net quantum numbers do not correspond to any elementary Strandwich. Positronium has no Strandwich identity: it is a composite whose mass comes entirely from constituent rest masses minus a small electromagnetic binding correction. The mass formula was never applicable to it. D is the unique case where a three-body composite reduces, by exact quantum number cancellation, to an elementary Strandwich equivalent — and the mass formula therefore applies legitimately and exactly.

Stability. D carries no color charge ($I_3^C = Y^C = 0$) and no net electric charge ($Q = I_3^W + Y^W = 0$), eliminating strong and electromagnetic decay channels by quantum number conservation. Weak decay requires flavor strand reorganization in the Higgson adhesion layer at a cost comparable to the W boson mass — but this would also break the I_3^X conjugate bond, requiring the additional 402.3 GeV/c^2 to reconstitute a free Graviscalon. D therefore has no kinematically accessible decay channel in the present epoch. It is stable not because a well is too deep, but because its Strandwich identity is elementary and its decay products are not.

The spin-2 character of D with only two polarization states — inherited from the massless mediating Graviton — is a falsifiable experimental signature distinguishing D from massive spin-2 dark matter candidates, which would display five polarization states. (See Appendix B.) Quantitative cross-section predictions from the adhesion layer coupling mechanism are reserved for future work.