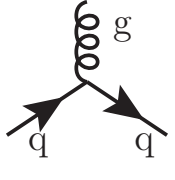
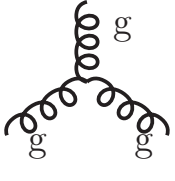
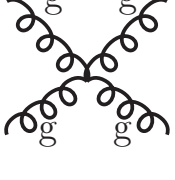
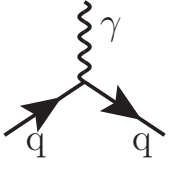
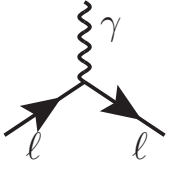
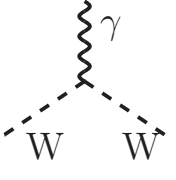
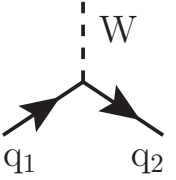
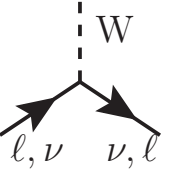
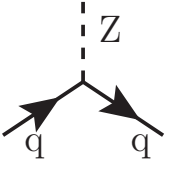
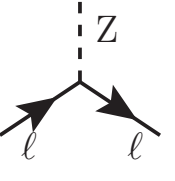
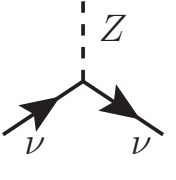
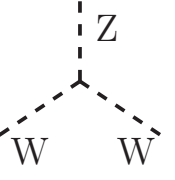
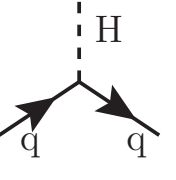
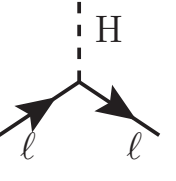
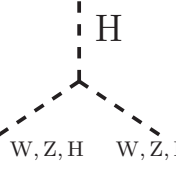


Particule		Q	I	I_3	S $= q_s$	q_c	q_b	q_t	J^P	Masse [MeV/ c^2]	Composition en quarks				
$BOSONS$ $D'ÉCHANGE$ $(B = L = 0)$	g	0	0	0	0	0	0	0	1^-	0	–				
	γ	0	–	–	0	0	0	0	1^-	0	–				
	Z	0	–	–	0	0	0	0	1	91.2×10^3	–				
	$W^\pm$	± 1	–	–	0	0	0	0	1	80.4×10^3	–				
	H	0	–	–	0	0	0	0	0^+	125.2×10^3	–				
$LEPTONS$ $(B = 0, L = 1)$	e^-	–1	–	–	0	0	0	0	1/2	0.511	–				
	ν_e	0	–	–	0	0	0	0	1/2	$< 0.8 \times 10^{-6}$	–				
	μ^-	–1	–	–	0	0	0	0	1/2	105.7	–				
	ν_μ	0	–	–	0	0	0	0	1/2	< 0.19	–				
	τ^-	–1	–	–	0	0	0	0	1/2	1776.9	–				
	ν_τ	0	–	–	0	0	0	0	1/2	< 18.2	–				
$QUARKS$ $(B = \frac{1}{3}, L = 0)$	d	–1/3	1/2	–1/2	0	0	0	0	$1/2^+$	4.7	d				
	u	+2/3	1/2	+1/2	0	0	0	0	$1/2^+$	2.2	u				
	s	–1/3	0	0	–1	0	0	0	$1/2^+$	93.5	s				
	c	+2/3	0	0	0	+1	0	0	$1/2^+$	1.3×10^3	c				
	b	–1/3	0	0	0	0	–1	0	$1/2^+$	4.2×10^3	b				
	t	+2/3	0	0	0	0	0	+1	$1/2^+$	172.6×10^3	t				
$HADRONS$ <i>(liste non exhaustive)</i>	$MÉSONS$ $(B = 0, L = 0)$	$\pi^\pm$	± 1	1	± 1	0	0	0	0	0^-	139.6	$u\bar{d}, d\bar{u}$			
		π^0	0	1	0	0	0	0	0	0	0^-	135.0	$(u\bar{u} - d\bar{d})/\sqrt{2}$		
		η^0	0	0	0	0	0	0	0	0	0^-	547.9	$(u\bar{u} + d\bar{d} - 2s\bar{s})/\sqrt{6}$		
		$\rho^\pm$	± 1	1	± 1	0	0	0	0	0	1^-	775.1	$u\bar{d}, d\bar{u}$		
		ρ^0	0	1	0	0	0	0	0	0	1^-	775.3	$(u\bar{u} - d\bar{d})/\sqrt{2}$		
		ω	0	0	0	0	0	0	0	0	1^-	782.7	$(u\bar{u} + d\bar{d})/\sqrt{2}$		
		ϕ	0	0	0	0	0	0	0	0	1^-	1019.5	$s\bar{s}$		
		$K^\pm$	± 1	1/2	$\pm 1/2$	± 1	0	0	0	0	0^-	493.7	$u\bar{s}, s\bar{u}$		
		K^0	0	1/2	–1/2	+1	0	0	0	0	0^-	497.6	$d\bar{s}$		
		$\bar{K}^0$	0	1/2	+1/2	–1	0	0	0	0	0^-	497.6	$s\bar{d}$		
		$D^\pm$	± 1	1/2	$\pm 1/2$	0	± 1	0	0	0	0^-	1869.7	$c\bar{d}, d\bar{c}$		
		D^0	0	1/2	–1/2	0	+1	0	0	0	0^-	1864.8	$c\bar{u}$		
		$\bar{D}^0$	0	1/2	+1/2	0	–1	0	0	0	0^-	1864.8	$u\bar{c}$		
		$B^\pm$	± 1	1/2	$\pm 1/2$	0	0	± 1	0	0	0^-	5279.4	$u\bar{b}, b\bar{u}$		
		B^0	0	1/2	–1/2	0	0	+1	0	0	0^-	5279.7	$d\bar{b}$		
		$\bar{B}^0$	0	1/2	+1/2	0	0	–1	0	0	0^-	5279.7	$b\bar{d}$		
		J/ ψ	0	0	0	0	0	0	0	0	1^-	3096.9	$c\bar{c}$		
		$\Upsilon(1S)$	0	0	0	0	0	0	0	0	1^-	9460.4	$b\bar{b}$		
	$BARYONS$ $(B = 1, L = 0)$	NUCL.	p	+1	1/2	+1/2	0	0	0	0	$1/2^+$	938.3	uud		
			n	0	1/2	–1/2	0	0	0	0	0	$1/2^+$	939.6	udd	
		$HYPÉRONS$ $(S \neq 0, q_c = q_b = q_t = 0)$	Δ^{++}	+2	3/2	+3/2	0	0	0	0	0	$3/2^+$	~ 1232	uuu	
			Δ^+	+1	3/2	+1/2	0	0	0	0	0	$3/2^+$	~ 1232	uud	
			Δ^0	0	3/2	–1/2	0	0	0	0	0	$3/2^+$	~ 1232	udd	
			Δ^-	–1	3/2	–3/2	0	0	0	0	0	$3/2^+$	~ 1232	ddd	
			Λ	0	0	0	–1	0	0	0	0	$1/2^+$	1115.7	uds	
			Σ^+	+1	1	+1	–1	0	0	0	0	$1/2^+$	1189.4	uus	
			Σ^0	0	1	0	–1	0	0	0	0	$1/2^+$	1192.6	uds	
			Σ^-	–1	1	–1	–1	0	0	0	0	$1/2^+$	1197.4	dds	
			Σ^{*+}	+1	1	+1	–1	0	0	0	0	$3/2^+$	1382.8	uus	
			Σ^{*0}	0	1	0	–1	0	0	0	0	$3/2^+$	1383.7	uds	
			Σ^{*-}	–1	1	–1	–1	0	0	0	0	$3/2^+$	1387.2	dds	
			Ξ^0	0	1/2	+1/2	–2	0	0	0	0	$1/2^+$	1314.9	uss	
			Ξ^-	–1	1/2	–1/2	–2	0	0	0	0	$1/2^+$	1321.7	dss	
			Ξ^{*0}	0	1/2	+1/2	–2	0	0	0	0	$3/2^+$	1531.8	uss	
			Ξ^{*-}	–1	1/2	–1/2	–2	0	0	0	0	$3/2^+$	1535.0	dss	
			Ω^-	–1	0	0	–3	0	0	0	0	$3/2^+$	1672.5	sss	
				Λ_c^+	+1	0	0	0	+1	0	0	0	$1/2^+$	2286.5	udc
				Σ_c^+	+1	1	0	0	+1	0	0	0	$1/2^+$	2452.7	udc
				Λ_b	0	0	0	0	0	–1	0	0	$1/2^+$	5619.6	udb

Formule de Gell-Mann et Nishijima généralisée (quarks et hadrons) : $Q = I_3 + (B + S + q_c + q_b + q_t)/2$

Interaction	forte	électromagnétique	faible	Higgs
Particules sensibles	quarks et gluons q, g	chargées q, ℓ , W	quarks et leptons q, ℓ , ν	massives q, ℓ , W, Z, H
Bosons d'échange	 8 gluons g	 photon γ	 W^+ , W^- , Z^0	 H^0
Vertex	  	  	     	  
Fermions	 $q = \text{quark } (q_1 \neq q_2), l = \text{lepton chargé}, \nu = \text{lepton neutre}$			

Constantes physiques : $c = 3 \times 10^8 \text{ m/s}$, $\hbar c = 197 \text{ MeV fm}$, $\alpha = e^2/(4\pi\epsilon_0\hbar c) = 1/137$

Coefficients de Clebsch-Gordan

Note: A $\sqrt{}$ is to be understood over every coefficient; e.g., for $-8/15$ read $-\sqrt{8/15}$.

Notation:

J J ...
M M ...

m_1	m_2	
m_1	m_2	Coefficients
$\cdot$	$\cdot$	
$\cdot$	$\cdot$	

$1/2 \times 1/2$

1	0
+1/2	0
+1/2	1/2
-1/2	1/2
-1/2	-1/2
-1/2	-1/2

$2 \times 1/2$

5/2	3/2
+5/2	3/2
+2	1/2
+2	-1/2
+1	1/2
+1	-1/2
0	1/2
0	-1/2
-1	1/2
-1	-1/2
-2	1/2
-2	-1/2

$1 \times 1/2$

3/2	1/2
+3/2	1/2
+1	1/2
+1	-1/2
0	1/2
0	-1/2
-1	1/2
-1	-1/2
-2	1/2
-2	-1/2

$3/2 \times 1/2$

2	1
+2	1
+3/2	1/2
+3/2	-1/2
+1/2	1/2
+1/2	-1/2
0	1/2
0	-1/2
-1	1/2
-1	-1/2
-2	1/2
-2	-1/2

2×1

3	2
+3	2
+2	1
+2	0
+1	1
+1	0
0	1
0	0
-1	1
-1	0
-2	1
-2	0

$3/2 \times 1$

5/2	3/2
+5/2	3/2
+3/2	1
+3/2	0
+1/2	1
+1/2	0
-1/2	1
-1/2	0
-3/2	1
-3/2	0
-5/2	3/2
-5/2	3/2

1×1

2	1
+2	1
+1	0
+1	-1
0	1
0	0
-1	1
-1	0
-2	1
-2	0

5/2	3/2	1/2
+5/2	3/2	1/2
+3/2	1	1/2
+3/2	0	1/2
+1/2	1	1/2
+1/2	0	1/2
-1/2	1	1/2
-1/2	0	1/2
-3/2	1	1/2
-3/2	0	1/2
-5/2	3/2	1/2
-5/2	3/2	1/2

1	1/5	1/3	3/5
+1	0	8/15	1/6
0	1	6/15	-1/2
+1	-1	1/5	1/2
0	0	3/5	0
-1	1	1/5	-1/2

3	2	1
+3	2	1
+2	1	1
+2	0	1
+1	1	1
+1	0	1
0	1	1
0	0	1
-1	1	1
-1	0	1
-2	1	1
-2	0	1

5/2	3/2	1/2
+5/2	3/2	1/2
+3/2	1	1/2
+3/2	0	1/2
+1/2	1	1/2
+1/2	0	1/2
-1/2	1	1/2
-1/2	0	1/2
-3/2	1	1/2
-3/2	0	1/2
-5/2	3/2	1/2
-5/2	3/2	1/2

0	-1	1/2	1/2
-1	0	1/2	-1/2
-1	-1	1	1

-1	-1	2/3	1/3
-2	0	1/3	-2/3
-2	-1	1	1

$(j_1 j_2 m_1 m_2 | j_1 j_2 J M)$
 $= (-1)^{J-j_1-j_2} (j_2 j_1 m_2 m_1 | j_2 j_1 J M)$