Il modello standard della fisica delle particelle

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Sapienza
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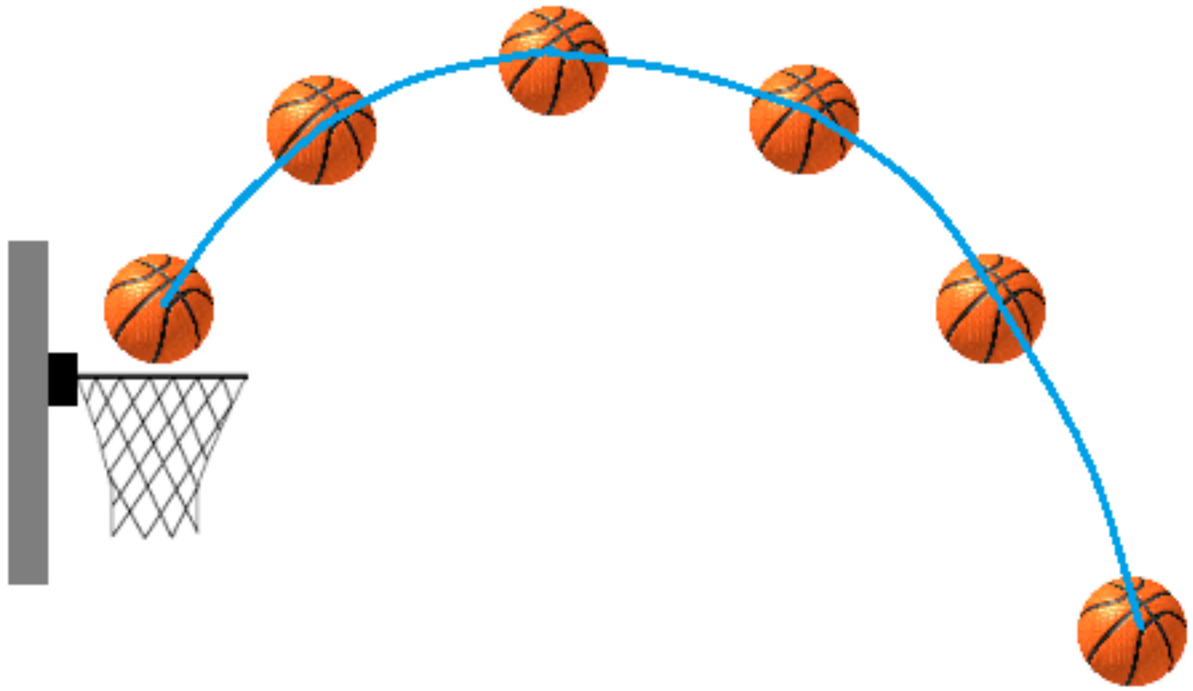
Cosa studiamo

Cosa studiamo

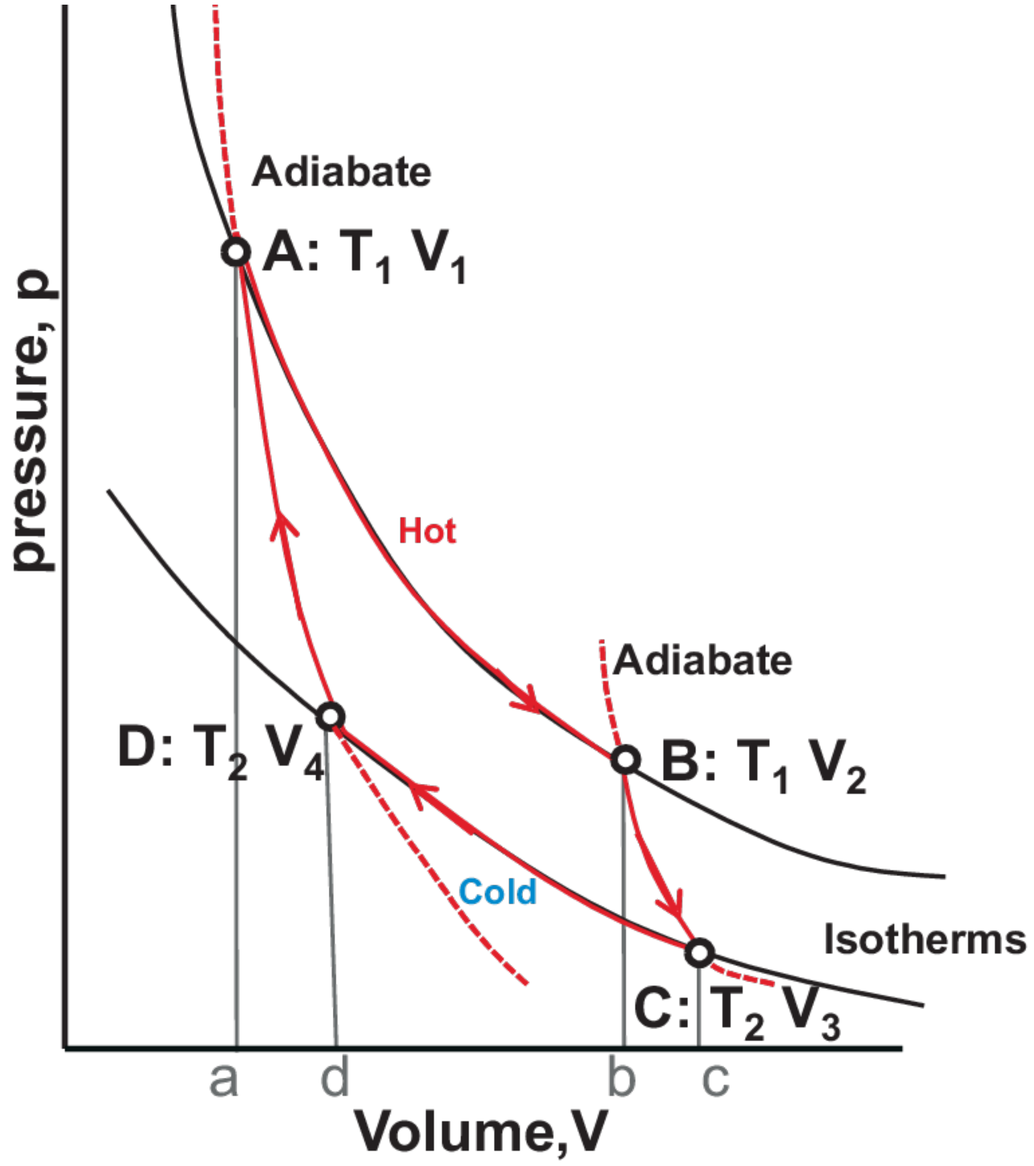
$$\vec{x}\,(t>0) = f\,(\vec{x}(0),\,\vec{v}(0))$$
$$\vec{v}\,(t>0) = g\,(\vec{x}(0),\,\vec{v}(0))$$

$$S_f = \mathcal{O}(\vec{F},\,m)S_i$$



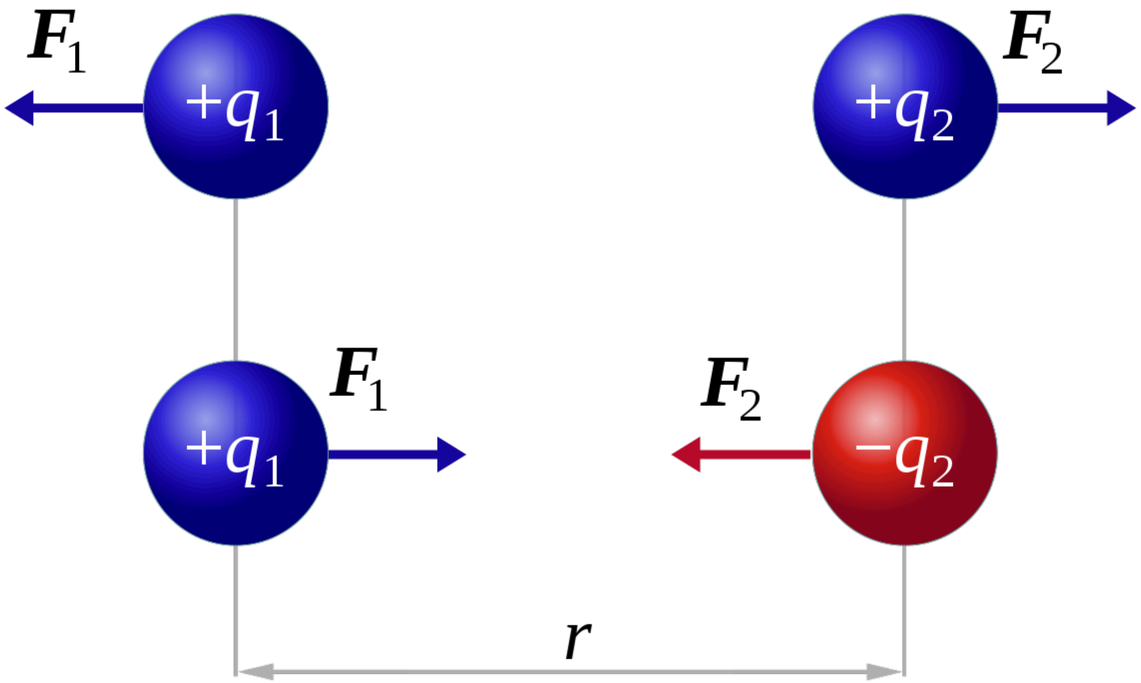
$$p_f = f\left(p_i, V_i, n\right)$$
$$V_f = g\left(p_i, V_i, n\right)$$

$$S_f = \mathcal{O}(T_1, T_2) S_i$$

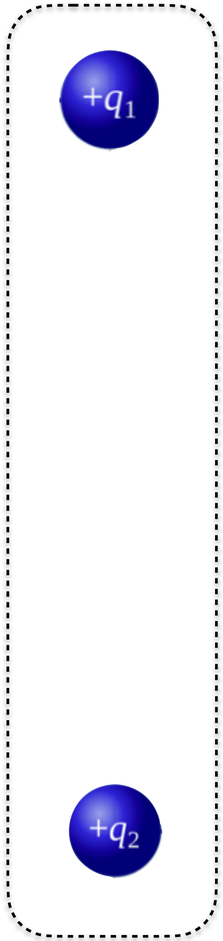


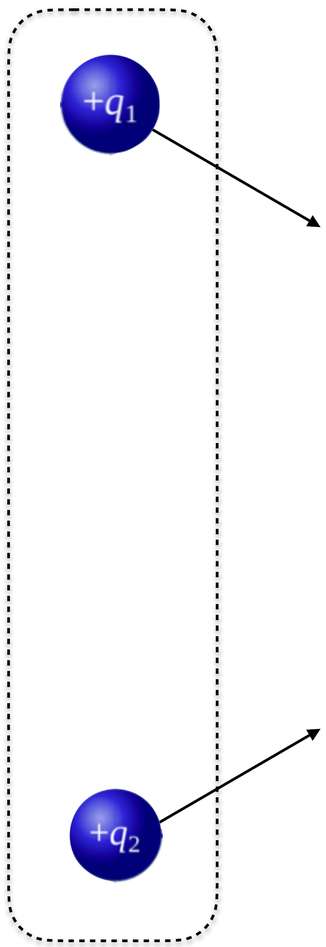
$$r\,(t>0) = f\,(r(0),\, v(0))$$
$$v\,(t>0) = g\,(r(0),\, v(0))$$

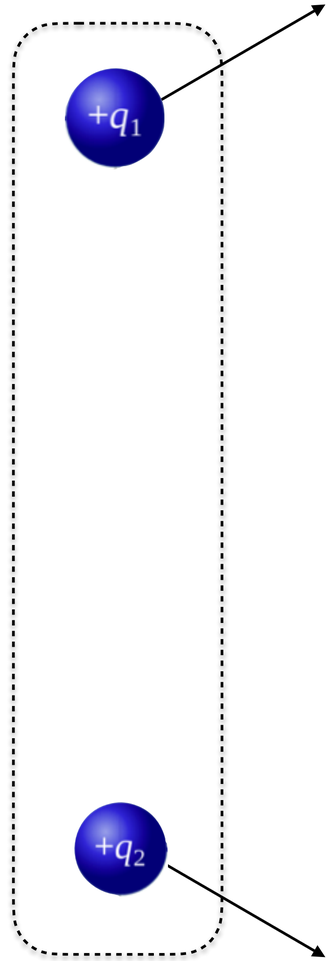
$$S_f = \mathcal{O}(Q_1,\, Q_2\,,\, m) S_i$$

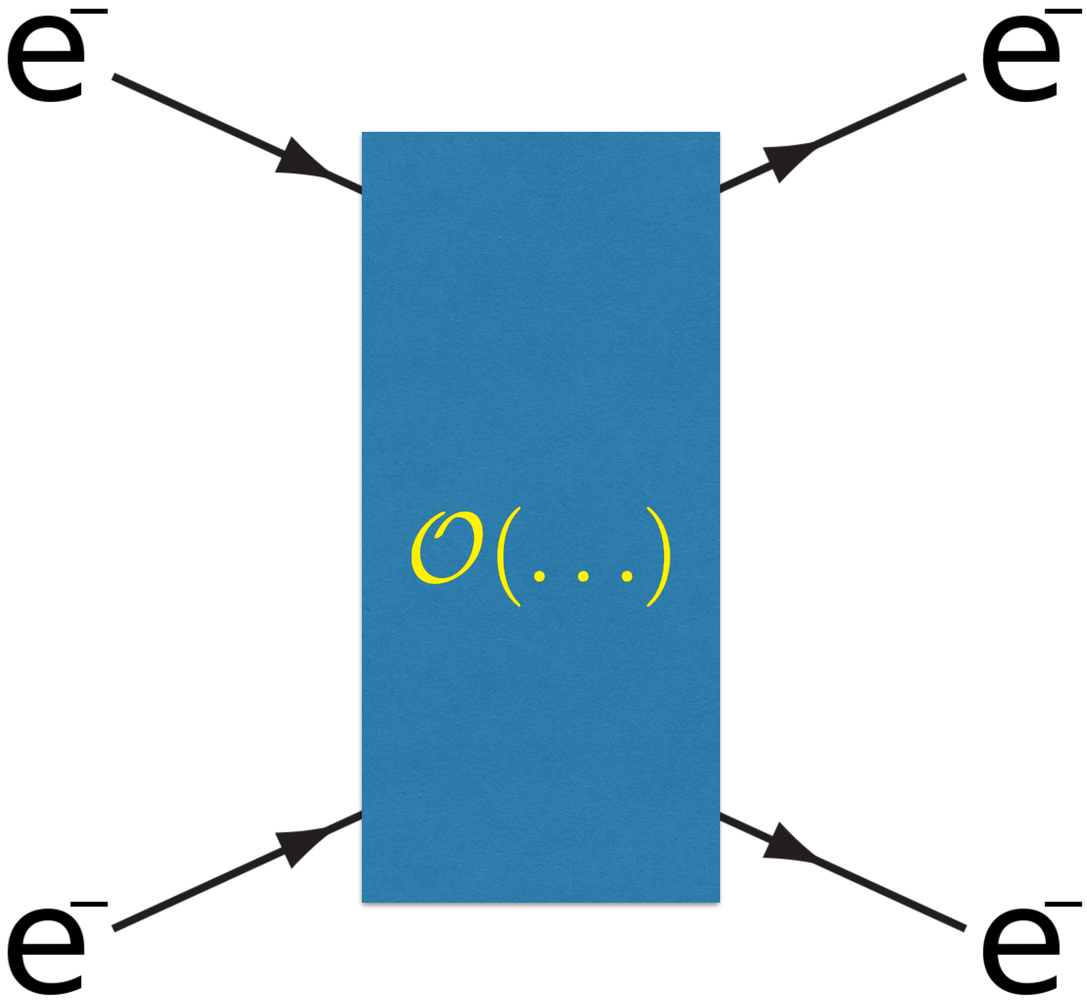


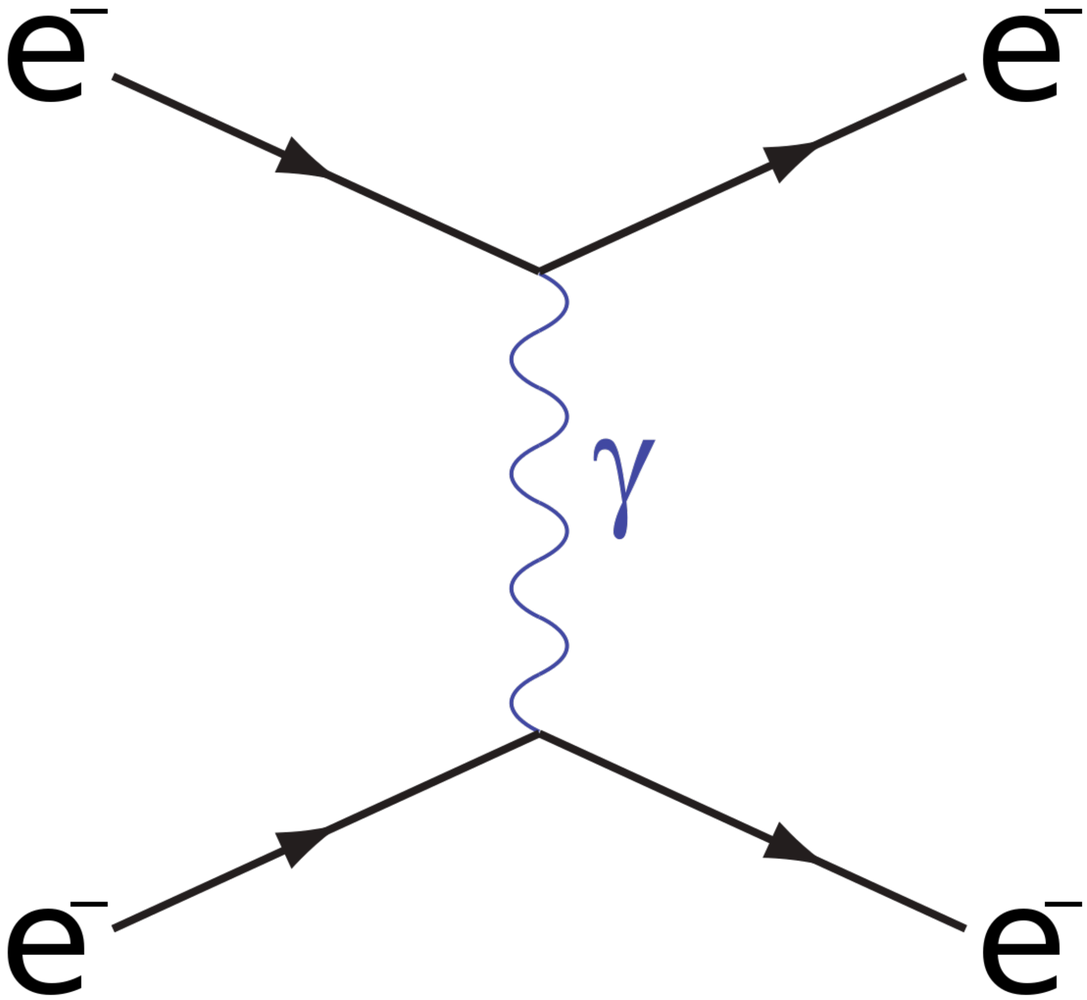
$$\left|\boldsymbol{F}_1\right| = \left|\boldsymbol{F}_2\right| = k_e \frac{|q_1 \times q_2|}{r^2}$$

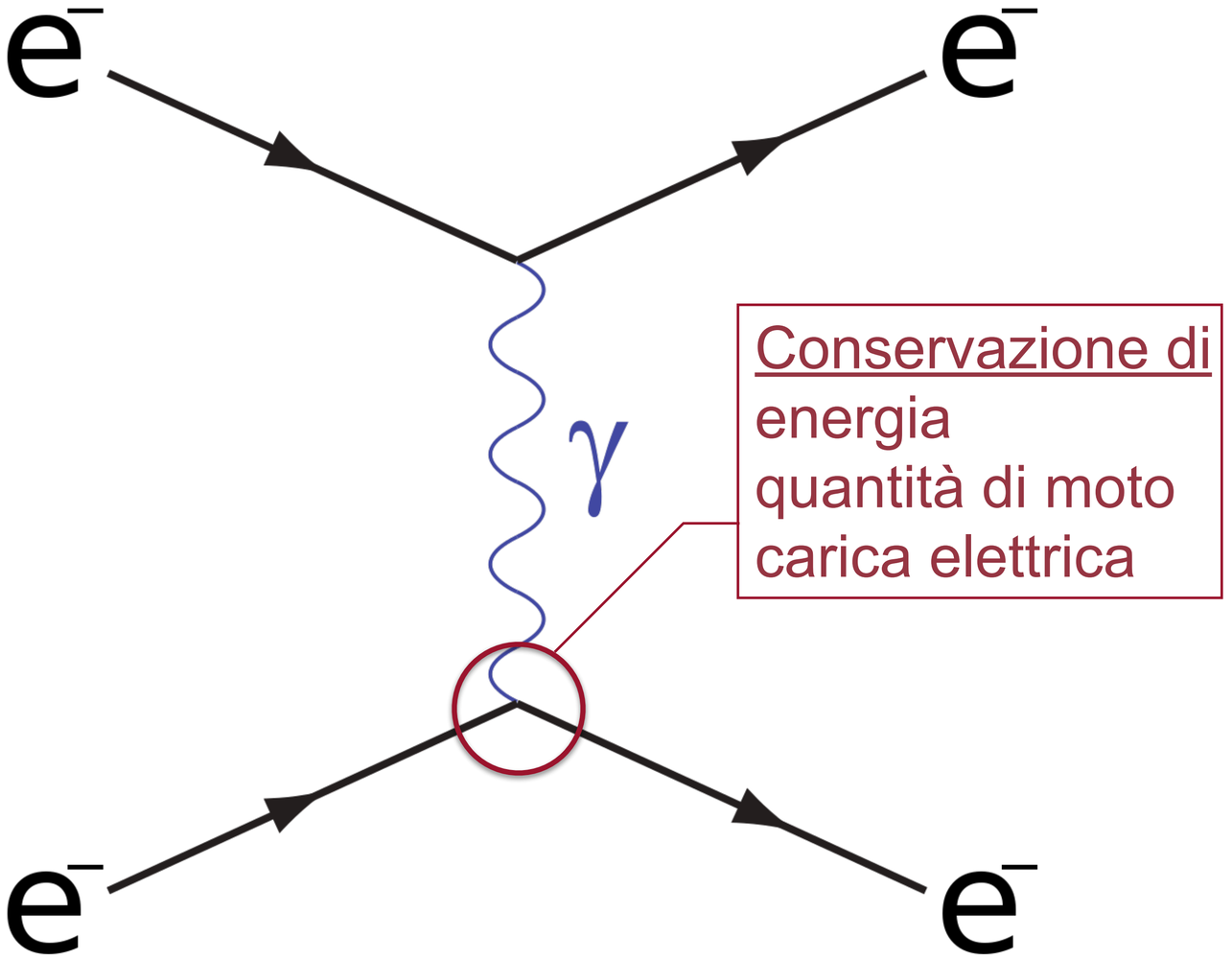

$+q_1$
$+q_2$


$+q_1$
$+q_2$

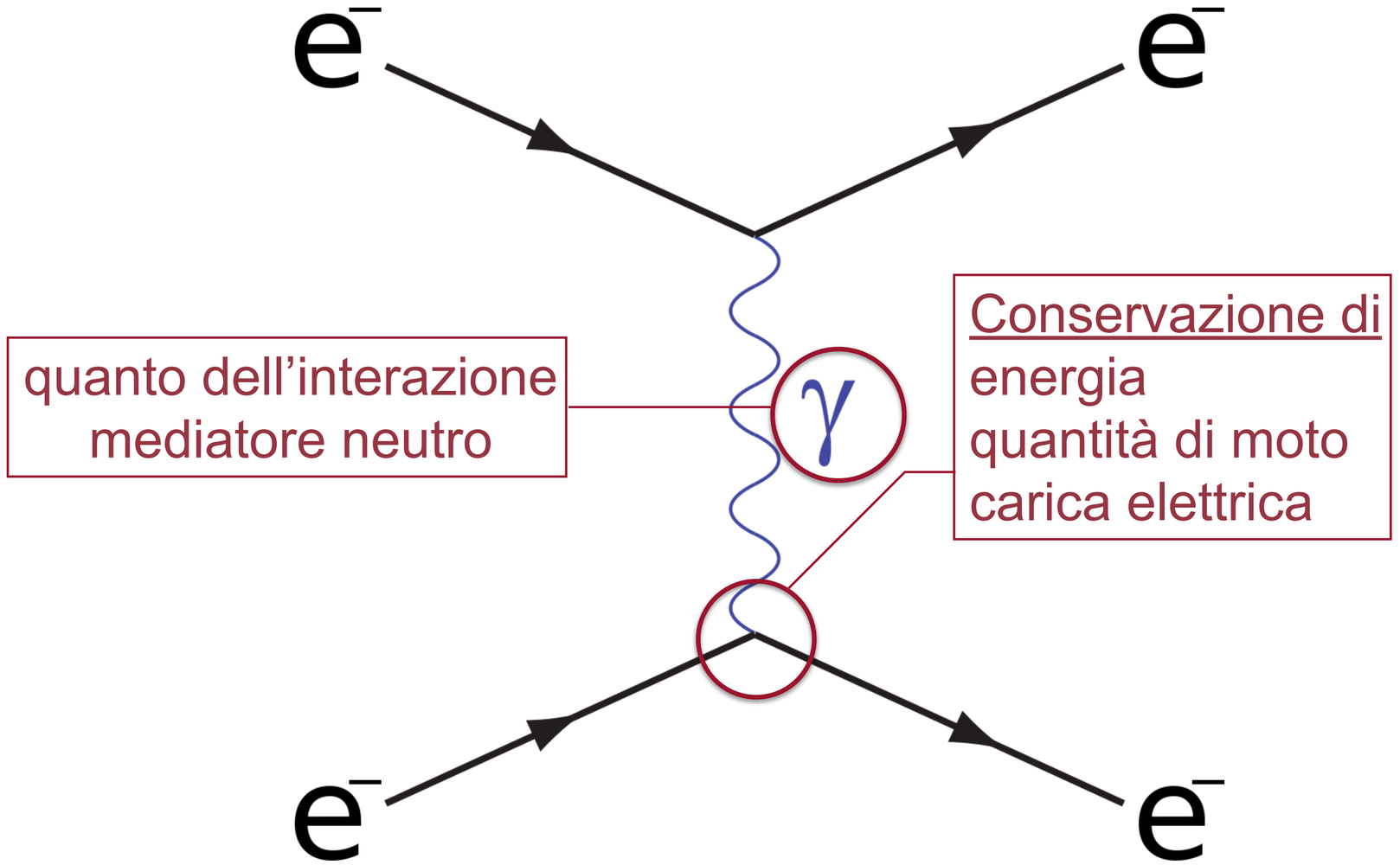

$+q_1$
$+q_2$

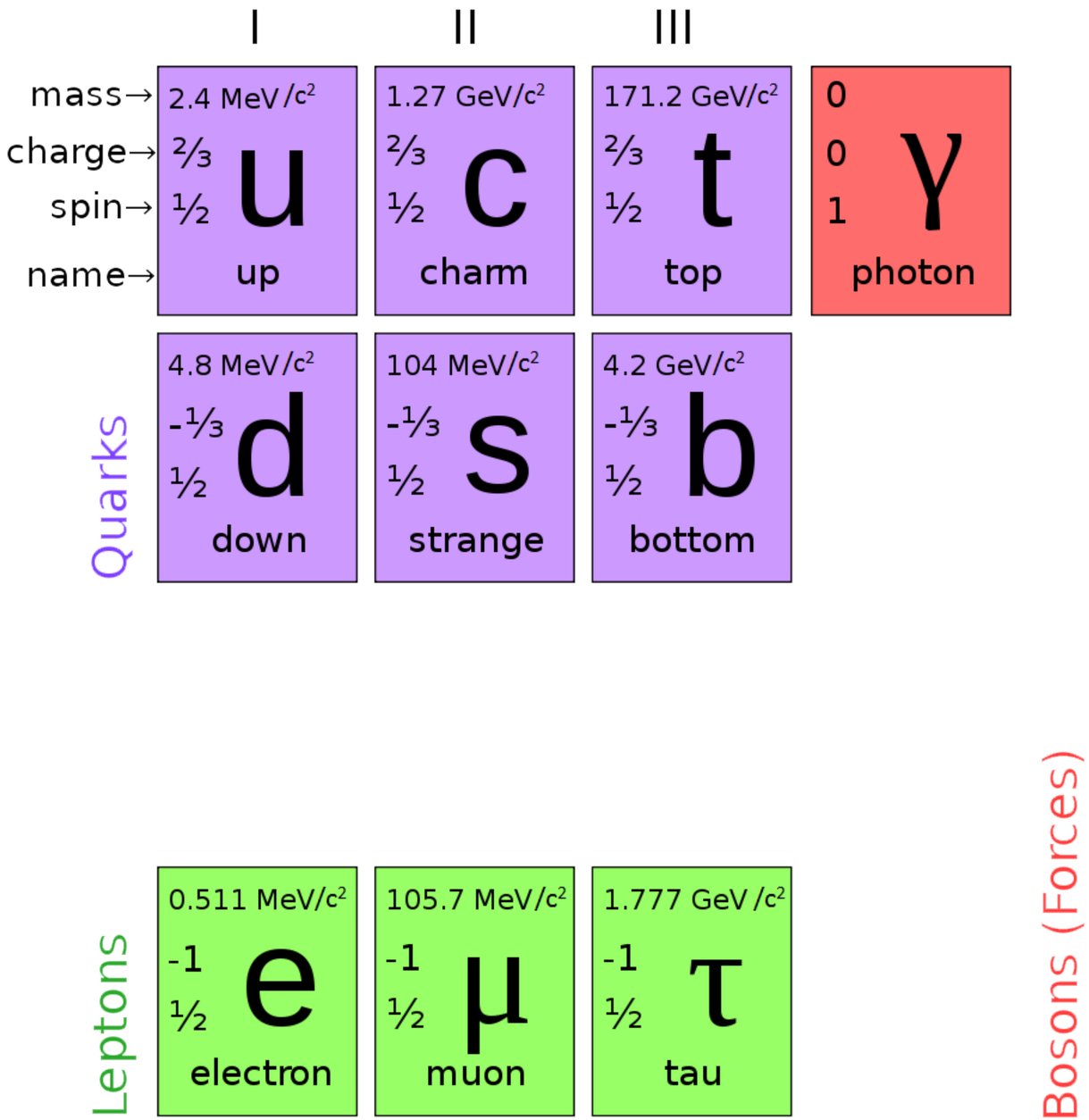

e⁻
e⁻
𝒪(...)
e⁻
e⁻

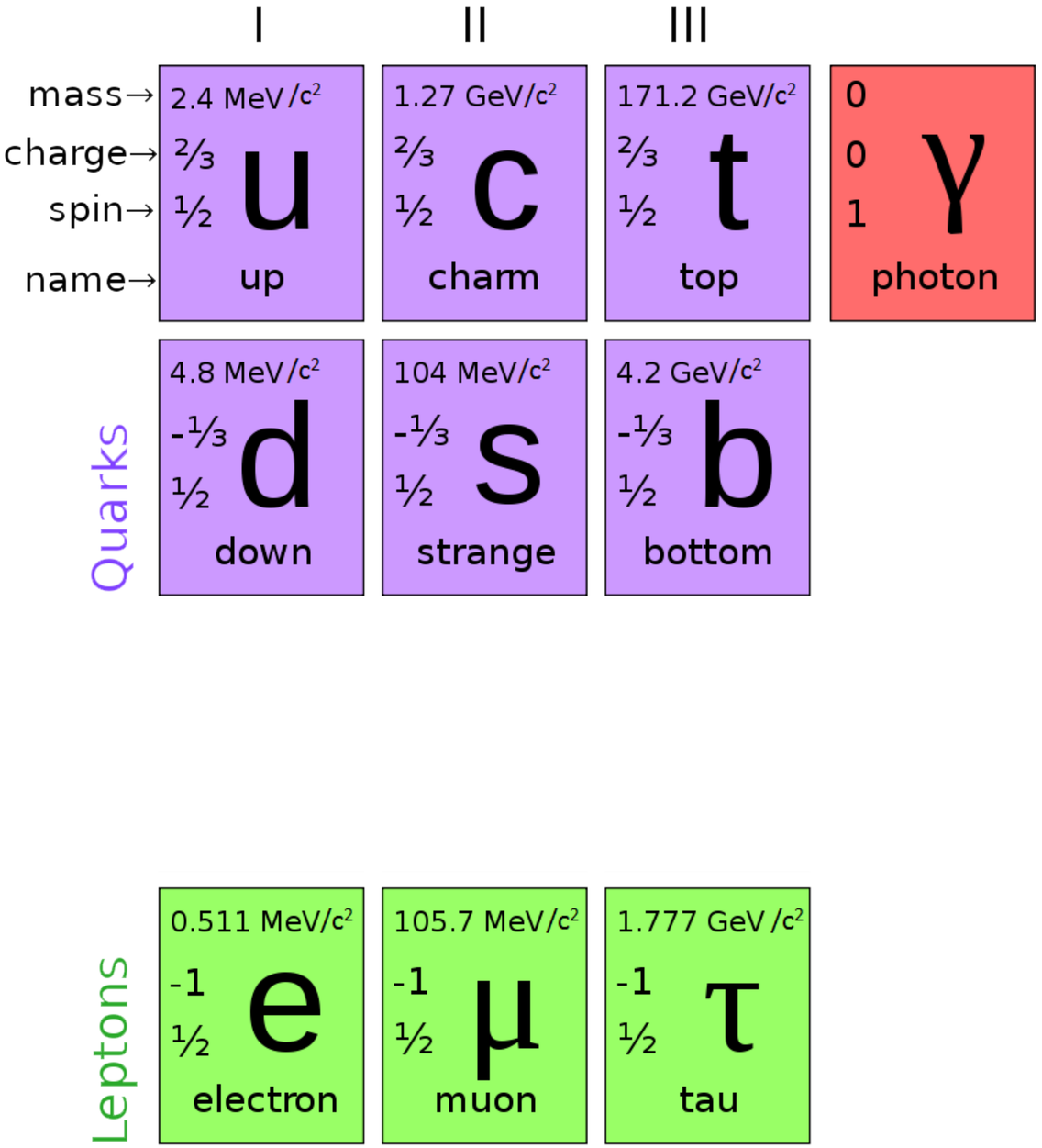

e⁻
e⁻
γ
e⁻
e⁻



Conservazione di
energia
quantità di moto
carica elettrica


e⁻
e⁻
γ
e⁻
e⁻
quanto dell'interazione
mediatore neutro
Conservazione di
energia
quantità di moto
carica elettrica


I
II
III
mass→
charge→
spin→
name→
2.4 MeV/c²
⅔
½
u
up
1.27 GeV/c²
⅔
½
c
charm
171.2 GeV/c²
⅔
½
t
top
0
0
1
γ
photon
Quarks
4.8 MeV/c²
-⅓
½
d
down
104 MeV/c²
-⅓
½
s
strange
4.2 GeV/c²
-⅓
½
b
bottom
Leptons
0.511 MeV/c²
-1
½
e
electron
105.7 MeV/c²
-1
½
μ
muon
1.777 GeV/c²
-1
½
τ
tau
Bosons (Forces)


I
II
III
mass→
charge→
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2.4 MeV/c²
⅔
½
u
up
1.27 GeV/c²
⅔
½
c
charm
171.2 GeV/c²
⅔
½
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0
1
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Quarks
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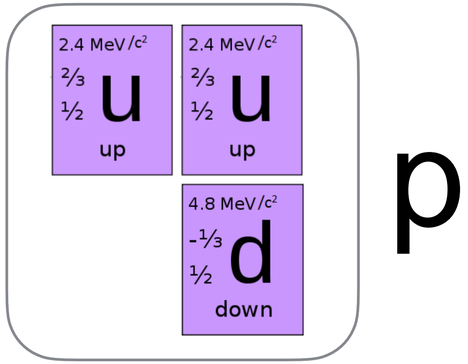
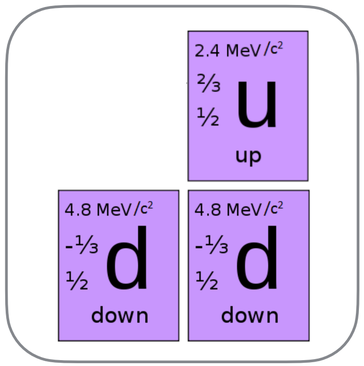
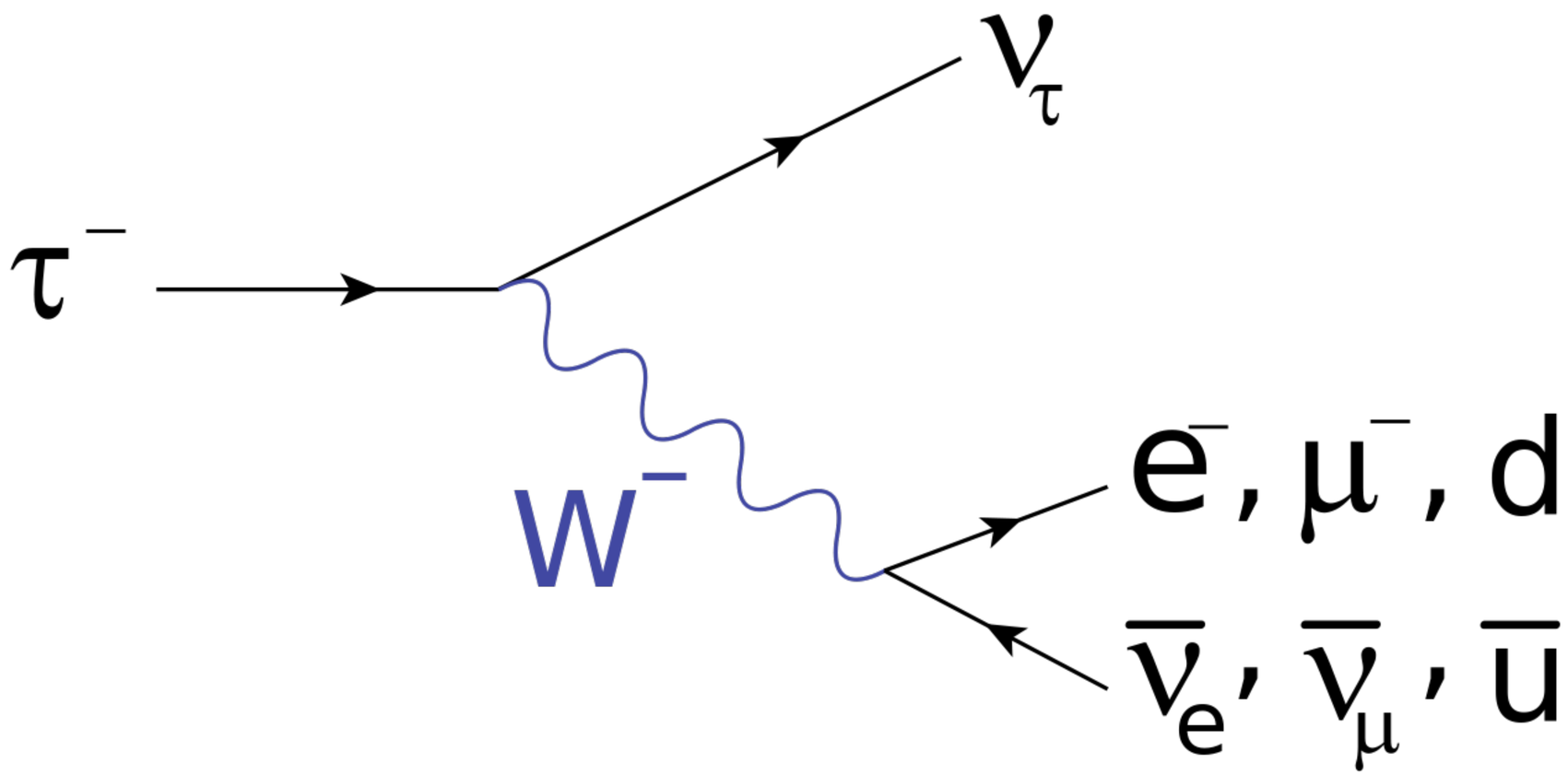
½
μ
muon
1.777 GeV/c²
-1
½
τ
tau
Bosons (Forces)


2.4 MeV/c²
⅔
½
u
up
2.4 MeV/c²
⅔
½
u
up
4.8 MeV/c²
-⅓
½
d
down

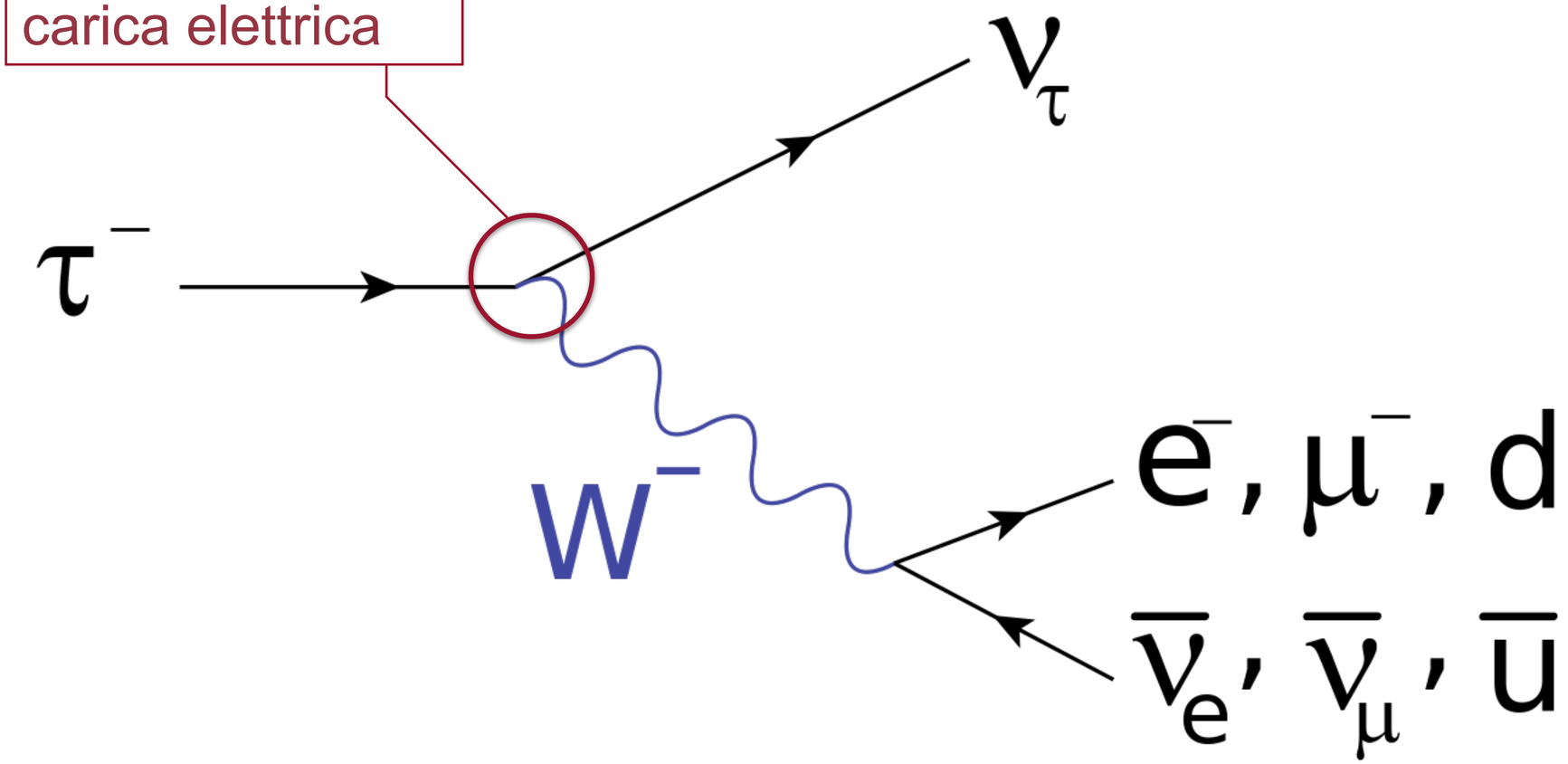
p


2.4 MeV/c²
⅔
½
u
up
4.8 MeV/c²
-⅓
½
d
down
4.8 MeV/c²
-⅓
½
d
down

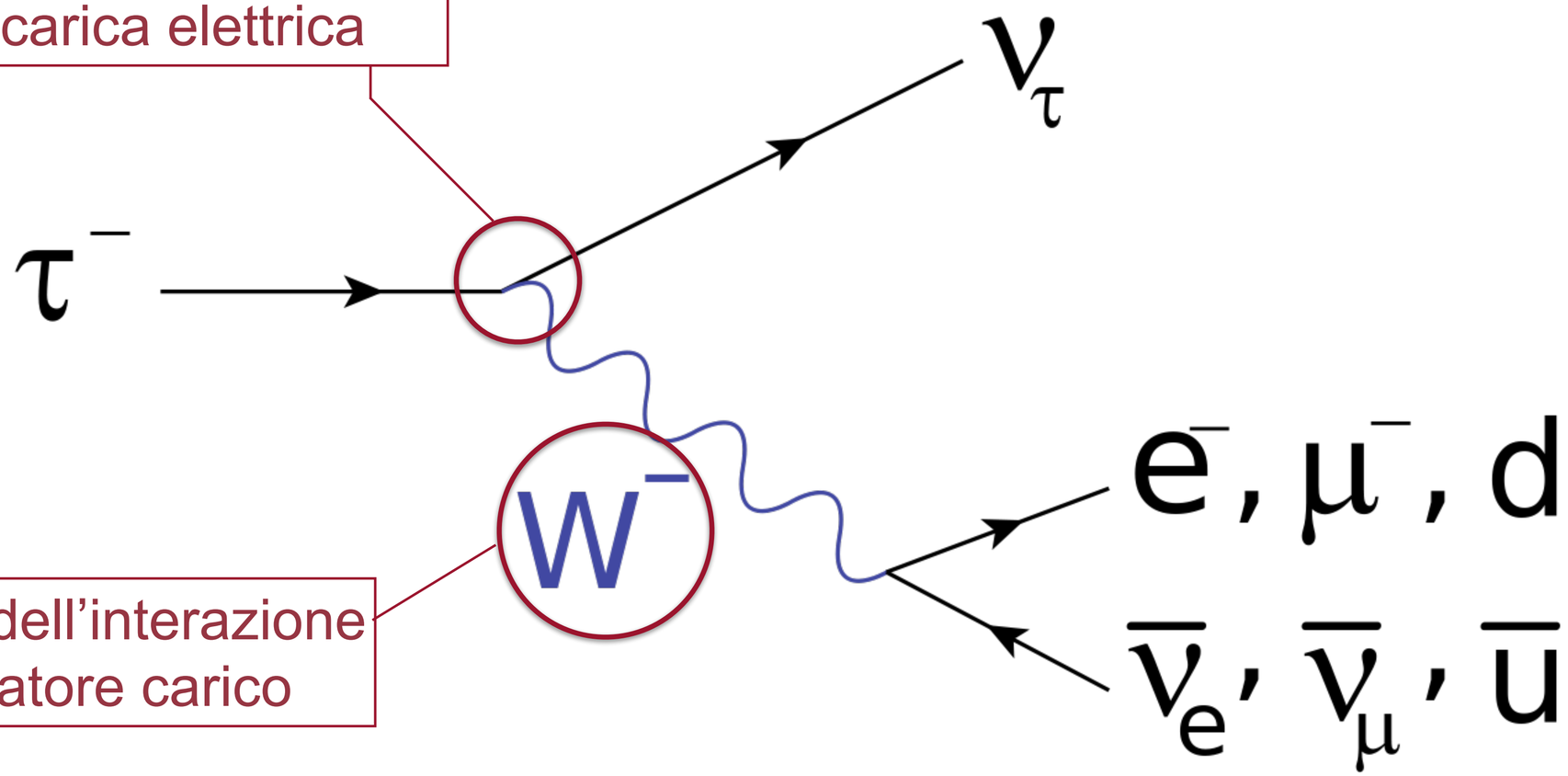
n


τ^-
ν_τ
W^-
e^-, μ^-, d
$\bar{\nu}_e, \bar{\nu}_\mu, \bar{u}$

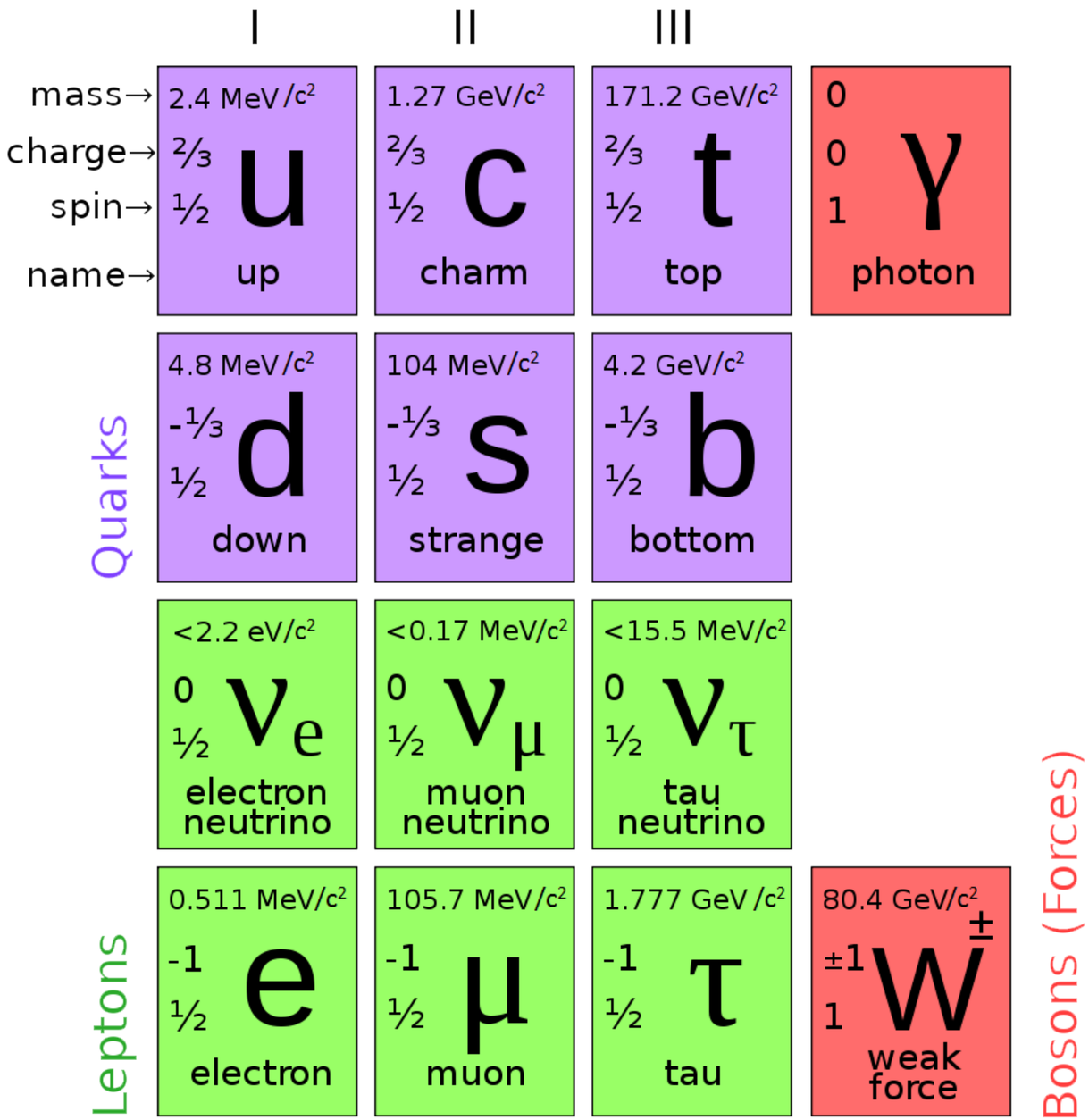
Conservazione di
energia
quantità di moto
carica elettrica

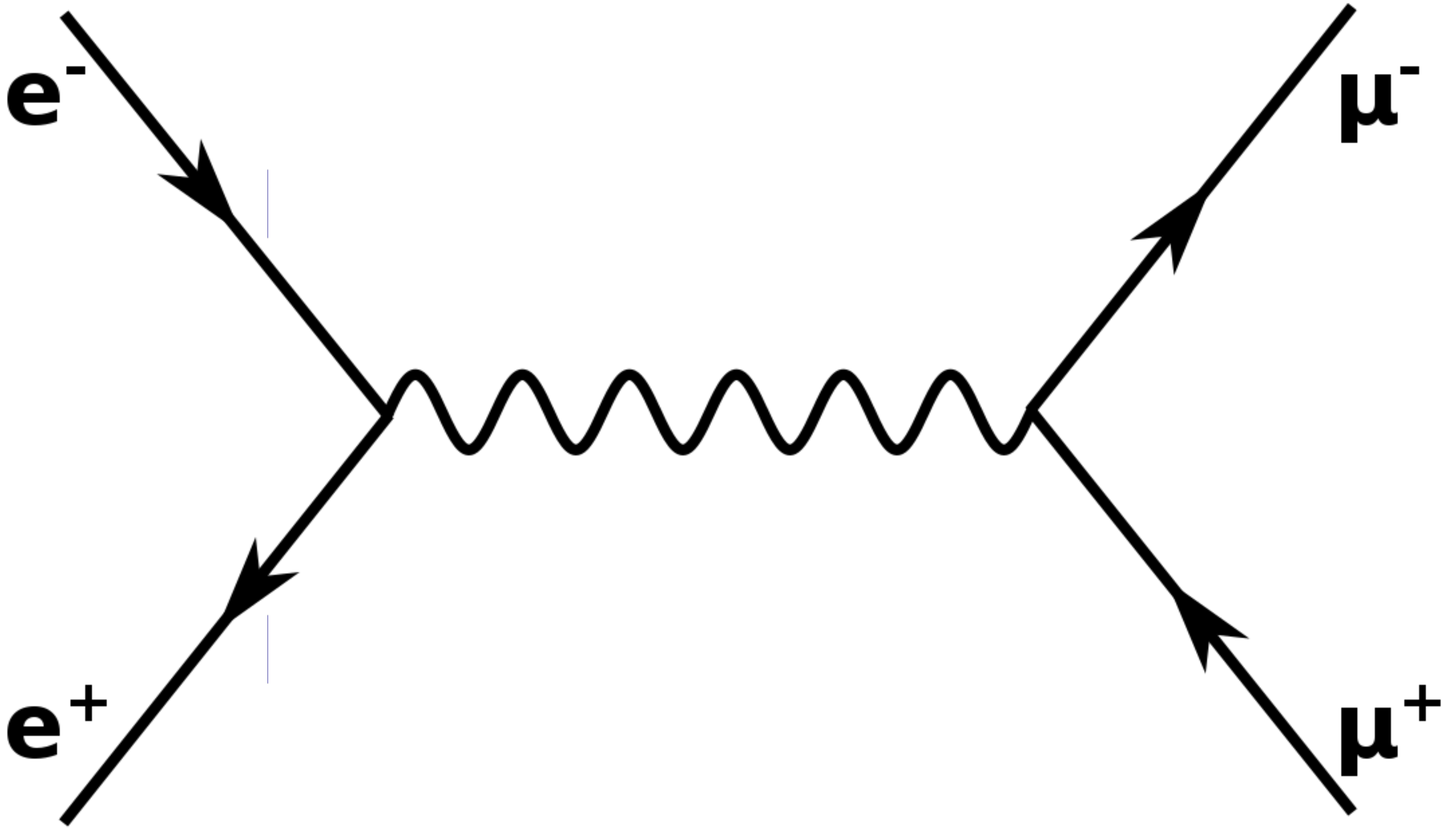


Conservazione di
energia
quantità di moto
carica elettrica

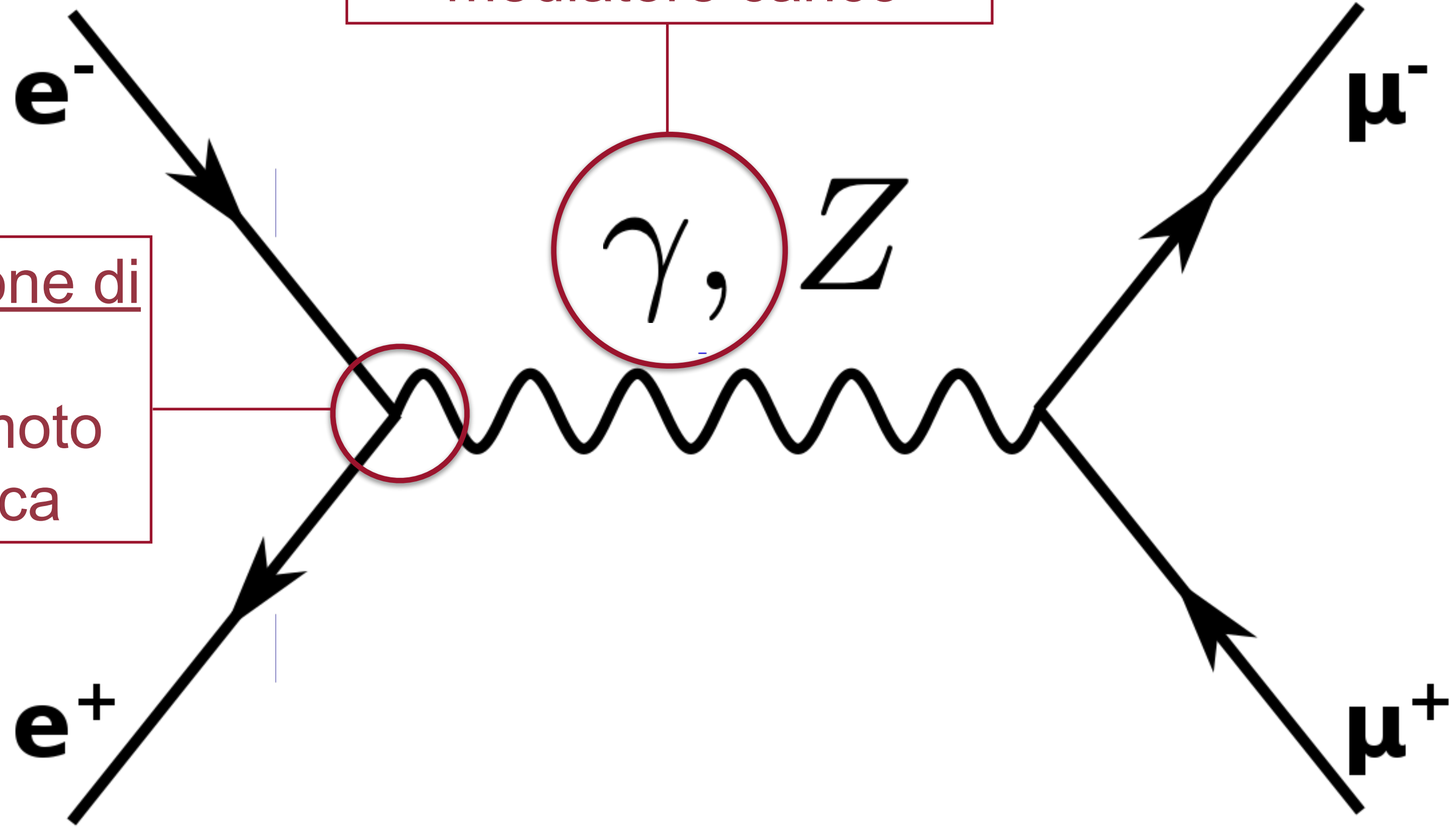


quanto dell'interazione
mediatore carico

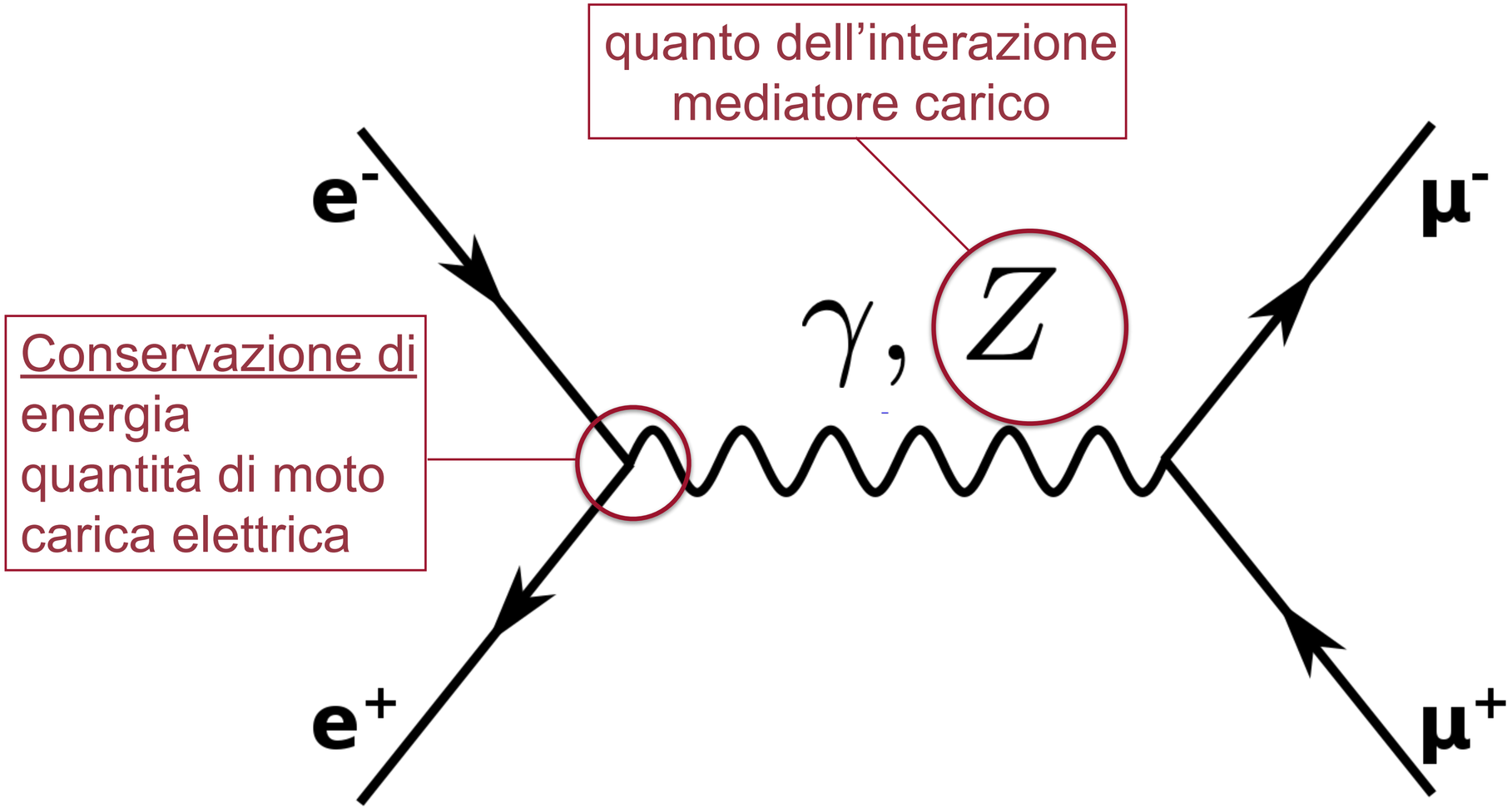

I
II
III
mass→
charge→
spin→
name→
2.4 MeV/c²
⅔
½
u
up
1.27 GeV/c²
⅔
½
c
charm
171.2 GeV/c²
⅔
½
t
top
0
0
1
γ
photon
Quarks
4.8 MeV/c²
-⅓
½
d
down
104 MeV/c²
-⅓
½
s
strange
4.2 GeV/c²
-⅓
½
b
bottom
<2.2 eV/c²
0
½
νe
electron neutrino
<0.17 MeV/c²
0
½
νμ
muon neutrino
<15.5 MeV/c²
0
½
ντ
tau neutrino
Leptons
0.511 MeV/c²
-1
½
e
electron
105.7 MeV/c²
-1
½
μ
muon
1.777 GeV/c²
-1
½
τ
tau
80.4 GeV/c²
±1
1
W±
weak force
Bosons (Forces)

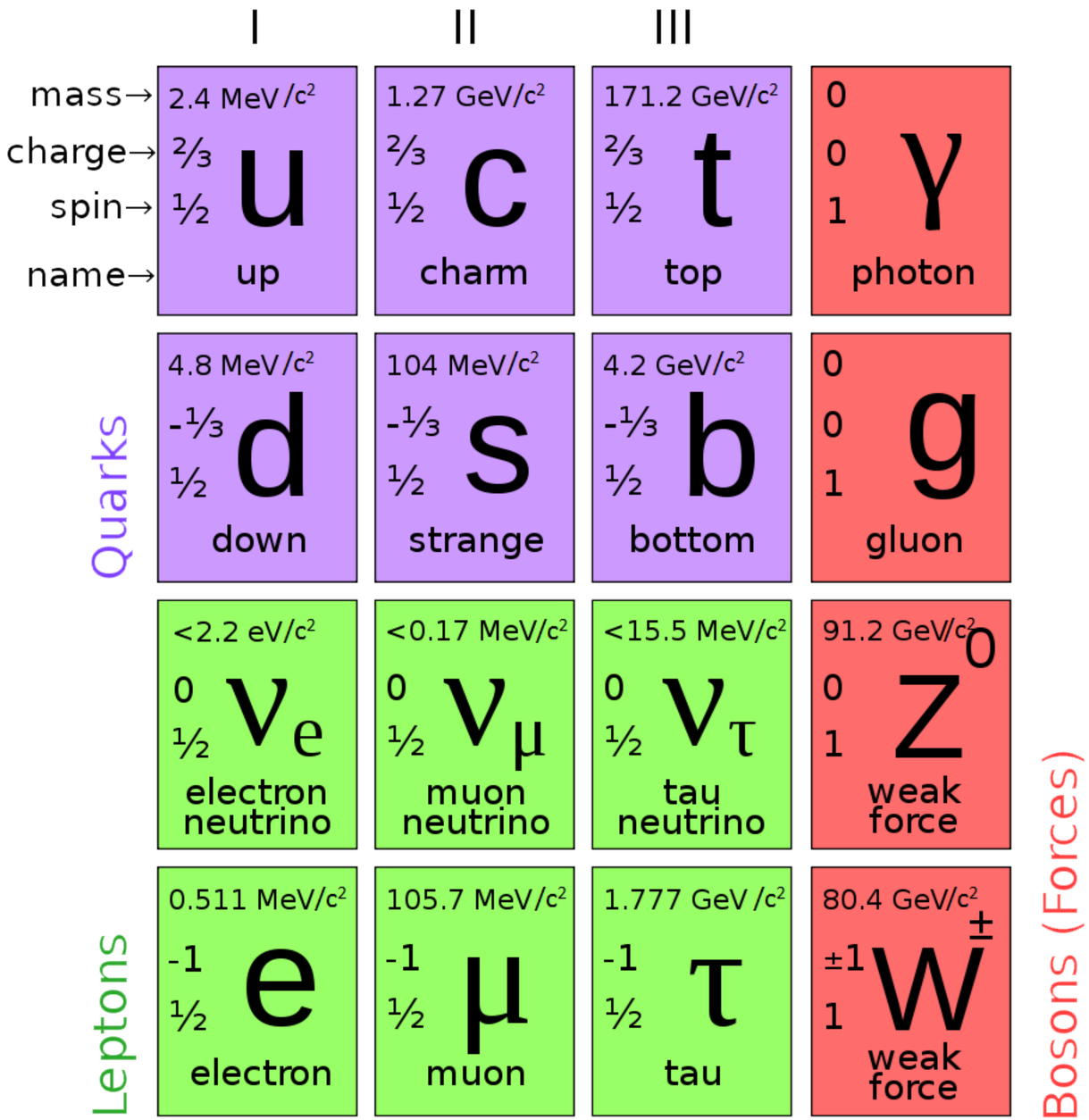

e-
μ-
e+
μ+

quanto dell'interazione
mediatore carico



Conservazione di
energia
quantità di moto
carica elettrica


quanto dell’interazione
mediatore carico
Conservazione di
energia
quantità di moto
carica elettrica
e-
e+
γ, Z
μ-
μ+


I
II
III
mass→
charge→
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2.4 MeV/c²
⅔
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⅔
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charm
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⅔
½
t
top
0
0
1
γ
photon
Quarks
4.8 MeV/c²
-⅓
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d
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104 MeV/c²
-⅓
½
s
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4.2 GeV/c²
-⅓
½
b
bottom
0
0
1
g
gluon
<2.2 eV/c²
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½
νμ
muon neutrino
<15.5 MeV/c²
0
½
ντ
tau neutrino
91.2 GeV/c²
0
0
1
Z0
weak force
Leptons
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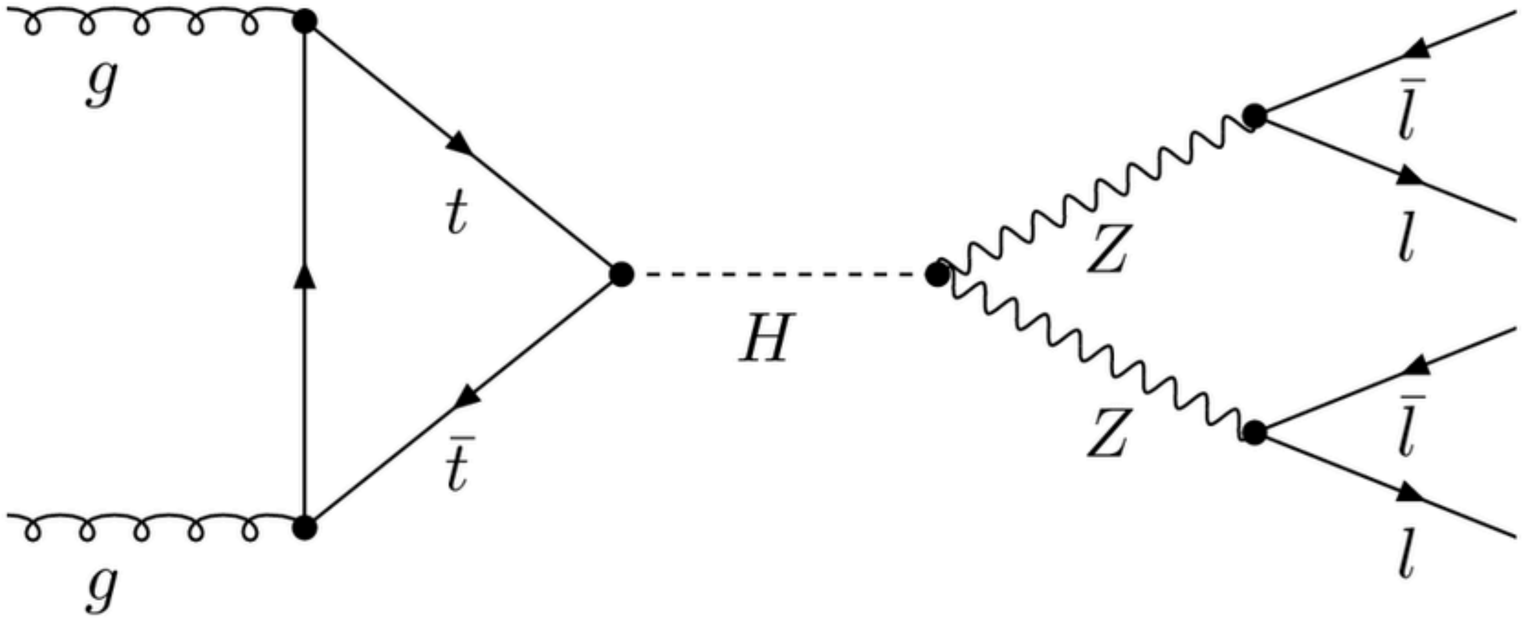
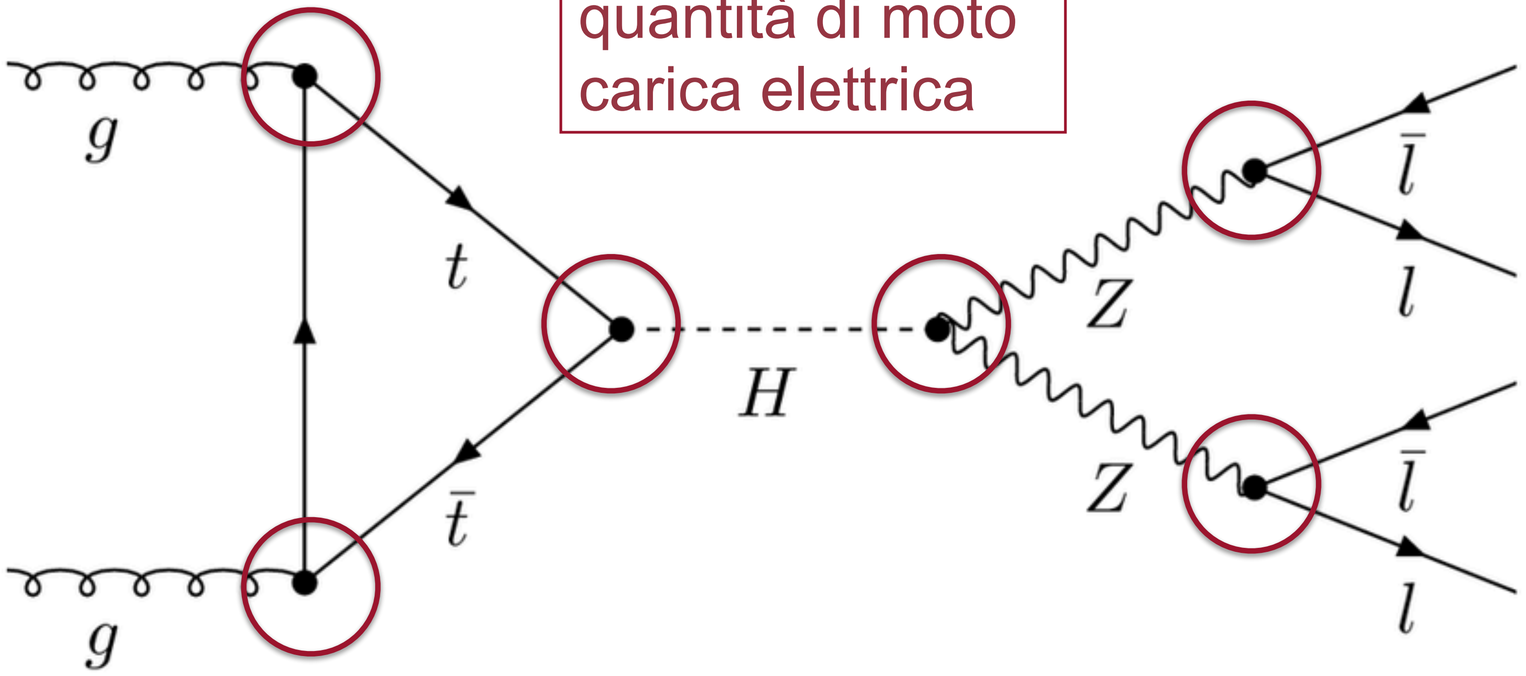
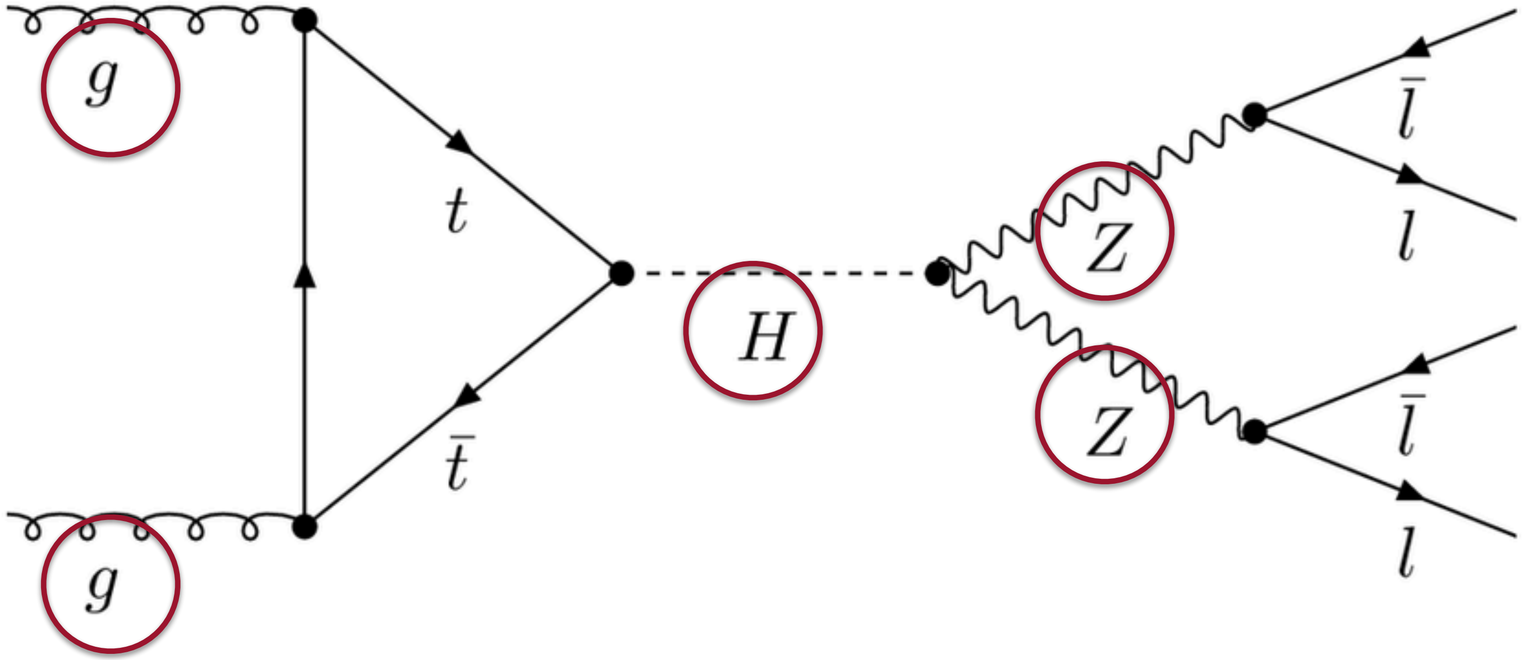
½
e
electron
105.7 MeV/c²
-1
½
μ
muon
1.777 GeV/c²
-1
½
τ
tau
80.4 GeV/c²
±1
1
W±
weak force
Bosons (Forces)

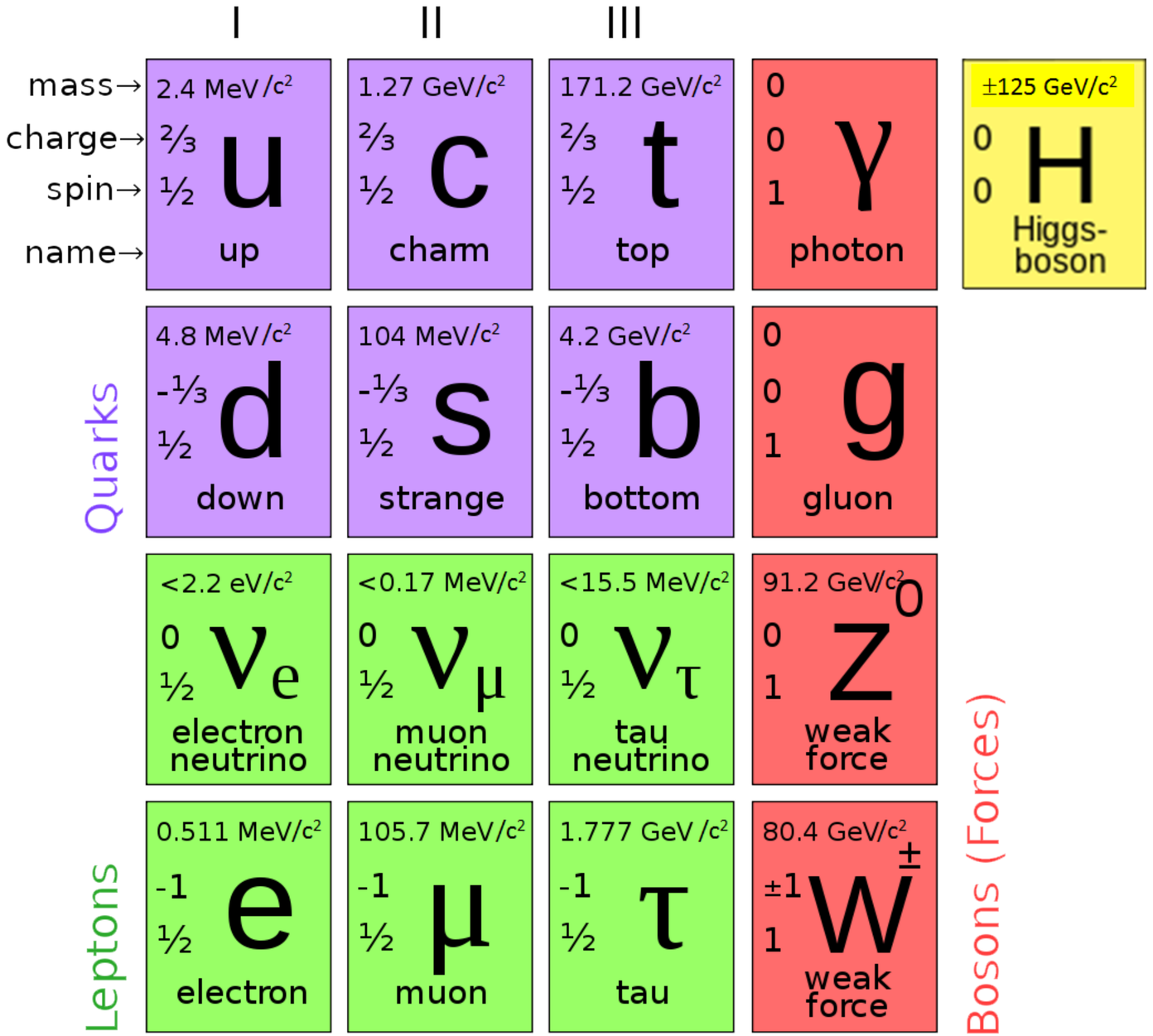

g
g
t
$\bar{t}$
H
Z
Z
$\bar{l}$
l
$\bar{l}$
l

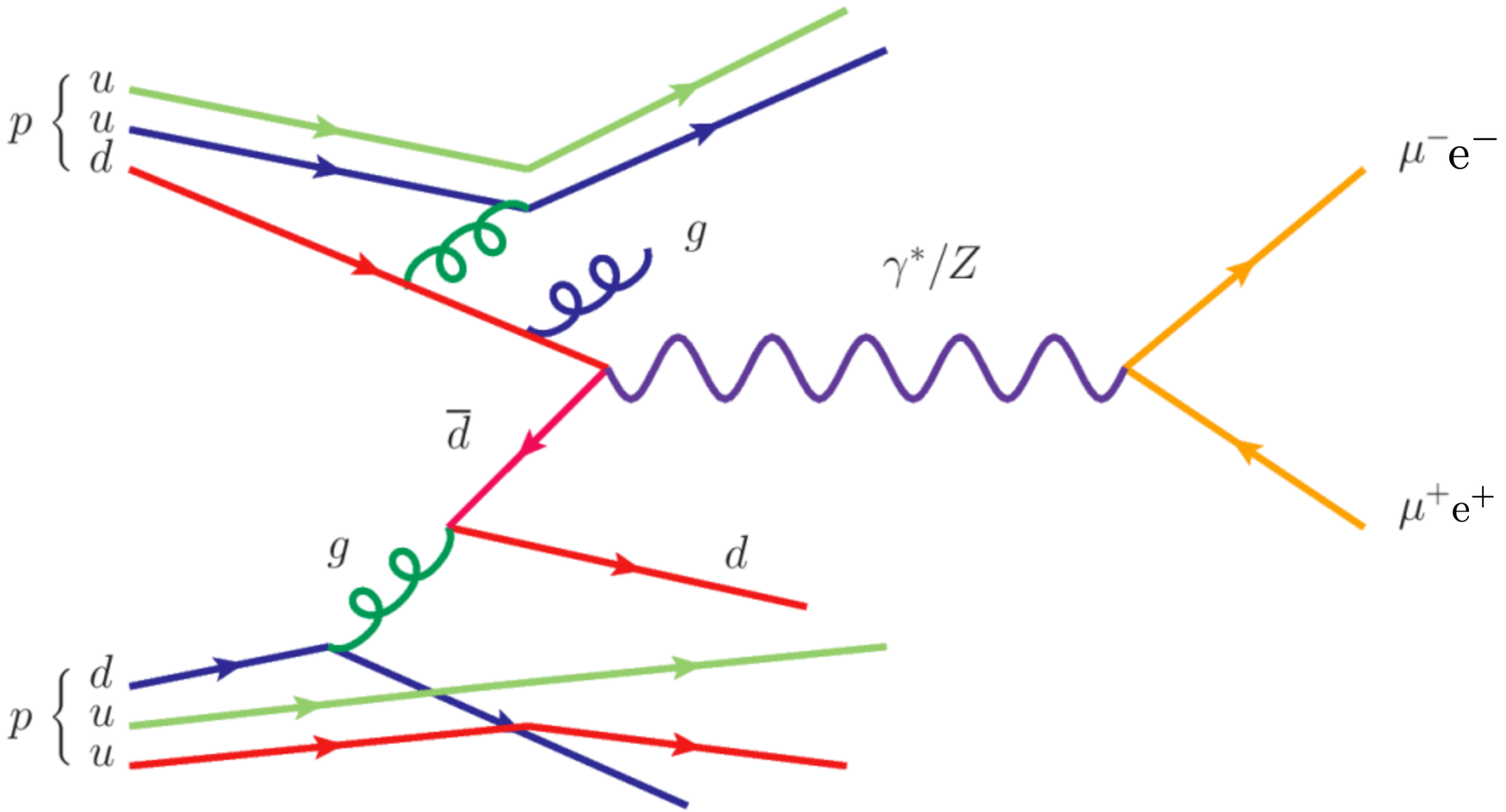
Conservazione di
energia
quantità di moto
carica elettrica

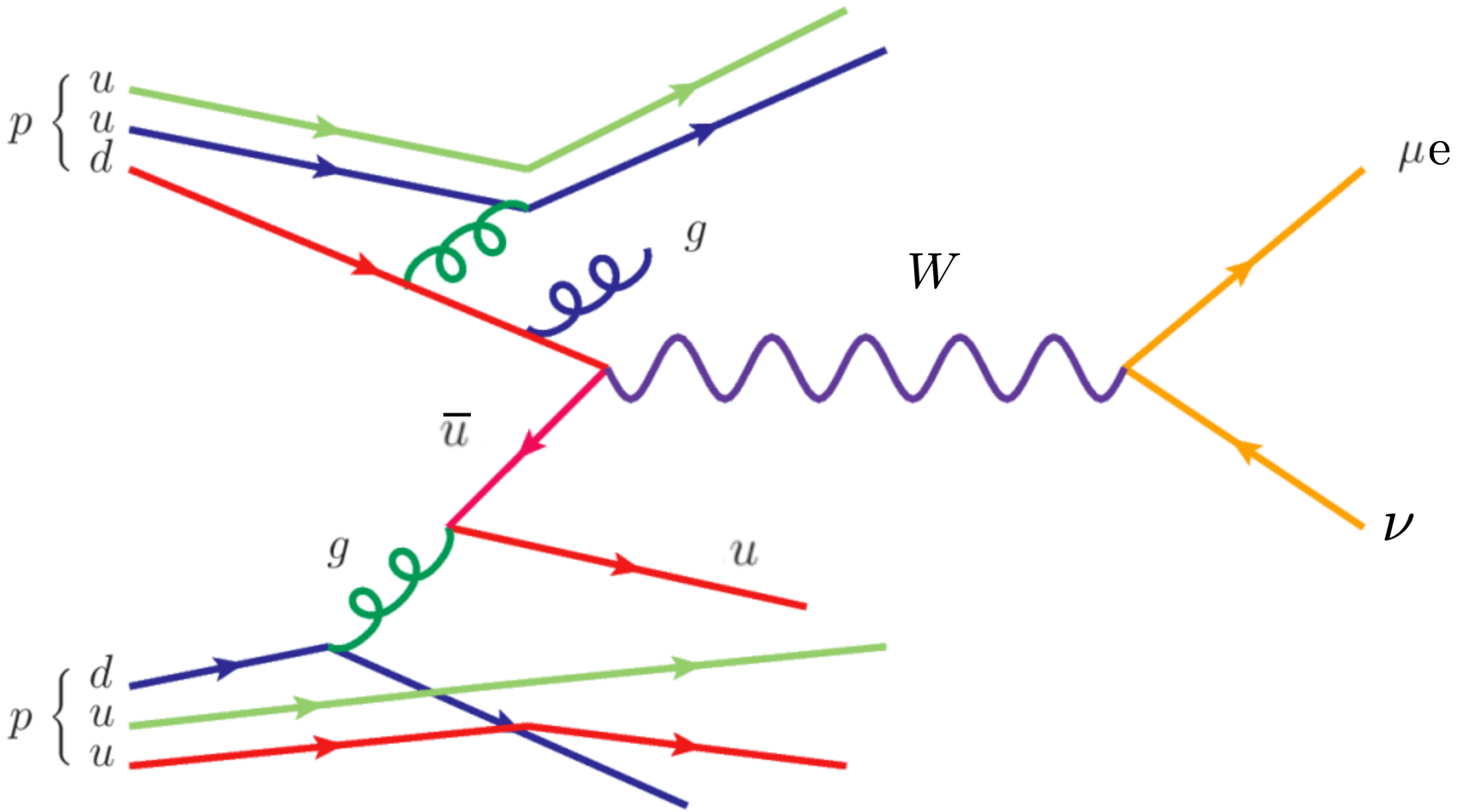


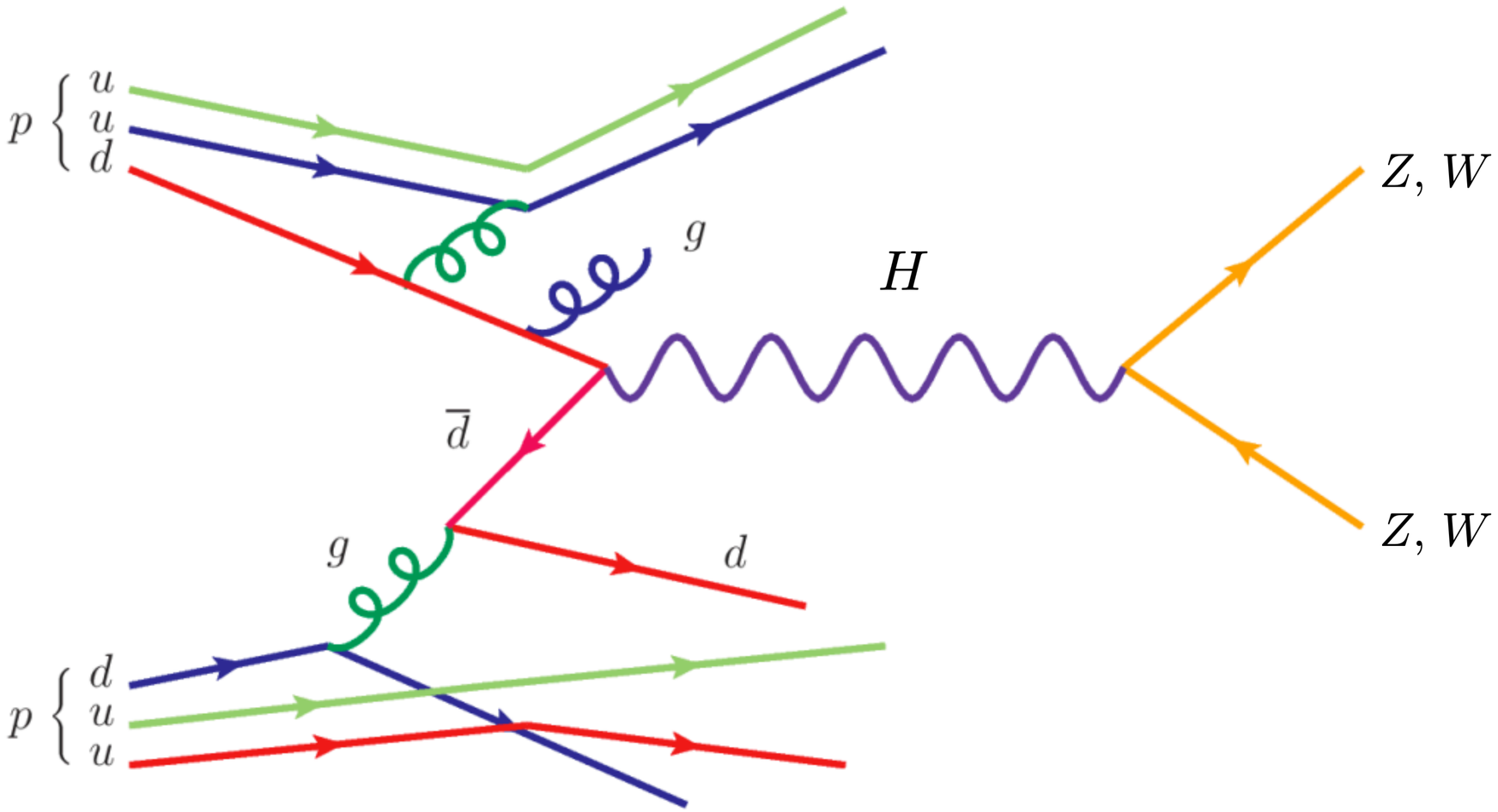
quanti delle interazioni




I
II
III
mass→
charge→
spin→
name→
2.4 MeV/c²
⅔
½
u
up
1.27 GeV/c²
⅔
½
c
charm
171.2 GeV/c²
⅔
½
t
top
0
0
1
γ
photon
±125 GeV/c²
0
0
H
Higgs-boson
Quarks
4.8 MeV/c²
-⅓
½
d
down
104 MeV/c²
-⅓
½
s
strange
4.2 GeV/c²
-⅓
½
b
bottom
0
0
1
g
gluon
<2.2 eV/c²
0
½
νe
electron neutrino
<0.17 MeV/c²
0
½
νμ
muon neutrino
<15.5 MeV/c²
0
½
ντ
tau neutrino
91.2 GeV/c²
0
0
1
Z0
weak force
Leptons
0.511 MeV/c²
-1
½
e
electron
105.7 MeV/c²
-1
½
μ
muon
1.777 GeV/c²
-1
½
τ
tau
80.4 GeV/c²
±1
1
W±
weak force
Bosons (Forces)


p
u
u
d
g
γ*/Z
μ⁻e⁻
d̄
g
d
μ⁺e⁺
p
d
u
u


p
u
u
d
g
W
μe
ū
g
u
ν
p
d
u
u


p
u
u
d
g
H
Z, W
$\overline{d}$
g
d
Z, W
p
d
u
u