il bosone di Higgs

in un bicchiere d'acqua

Marco Delmastro
www.borborigmi.org


PETZL

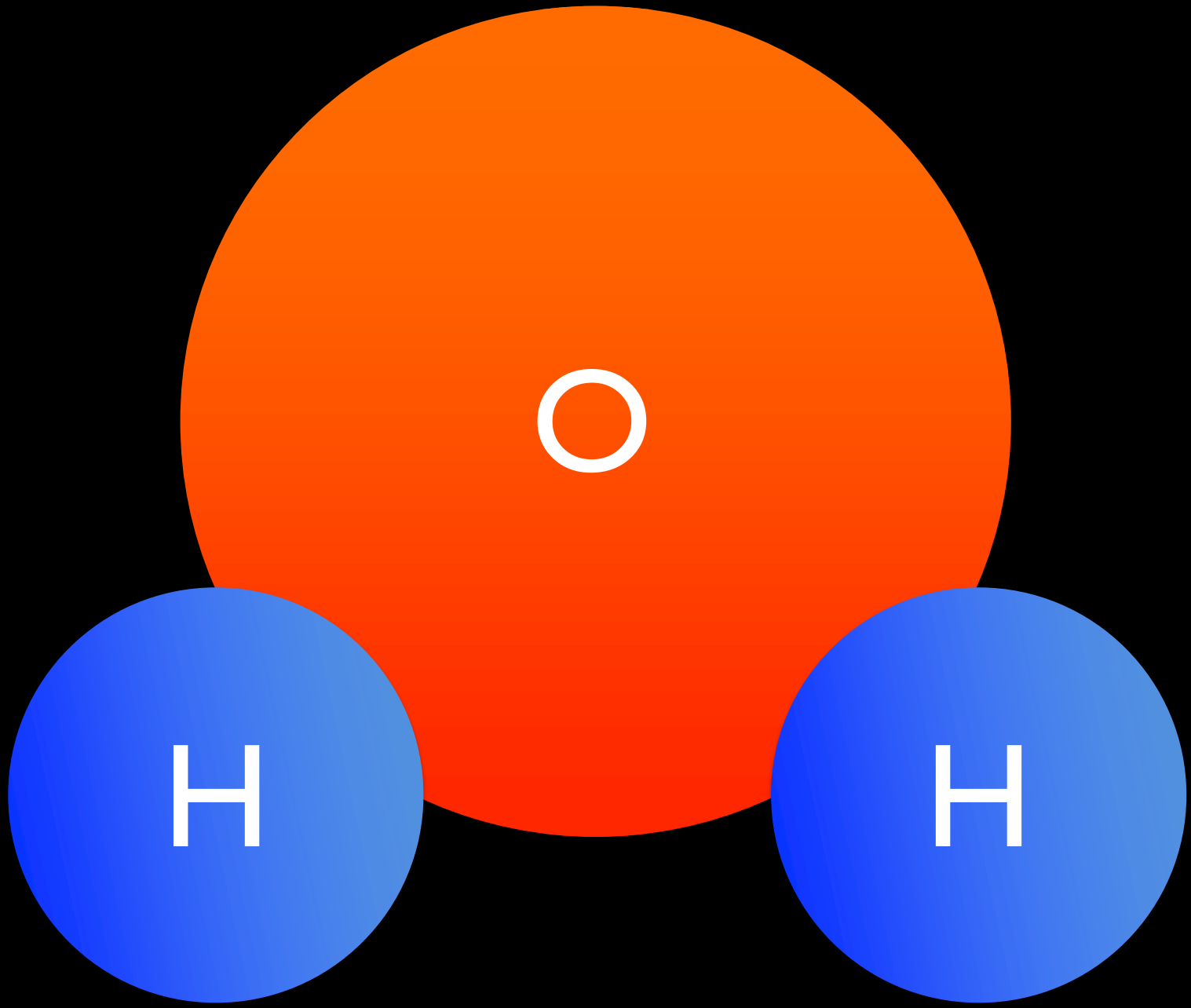
6.000.000 .000.000.000 .000.000.000

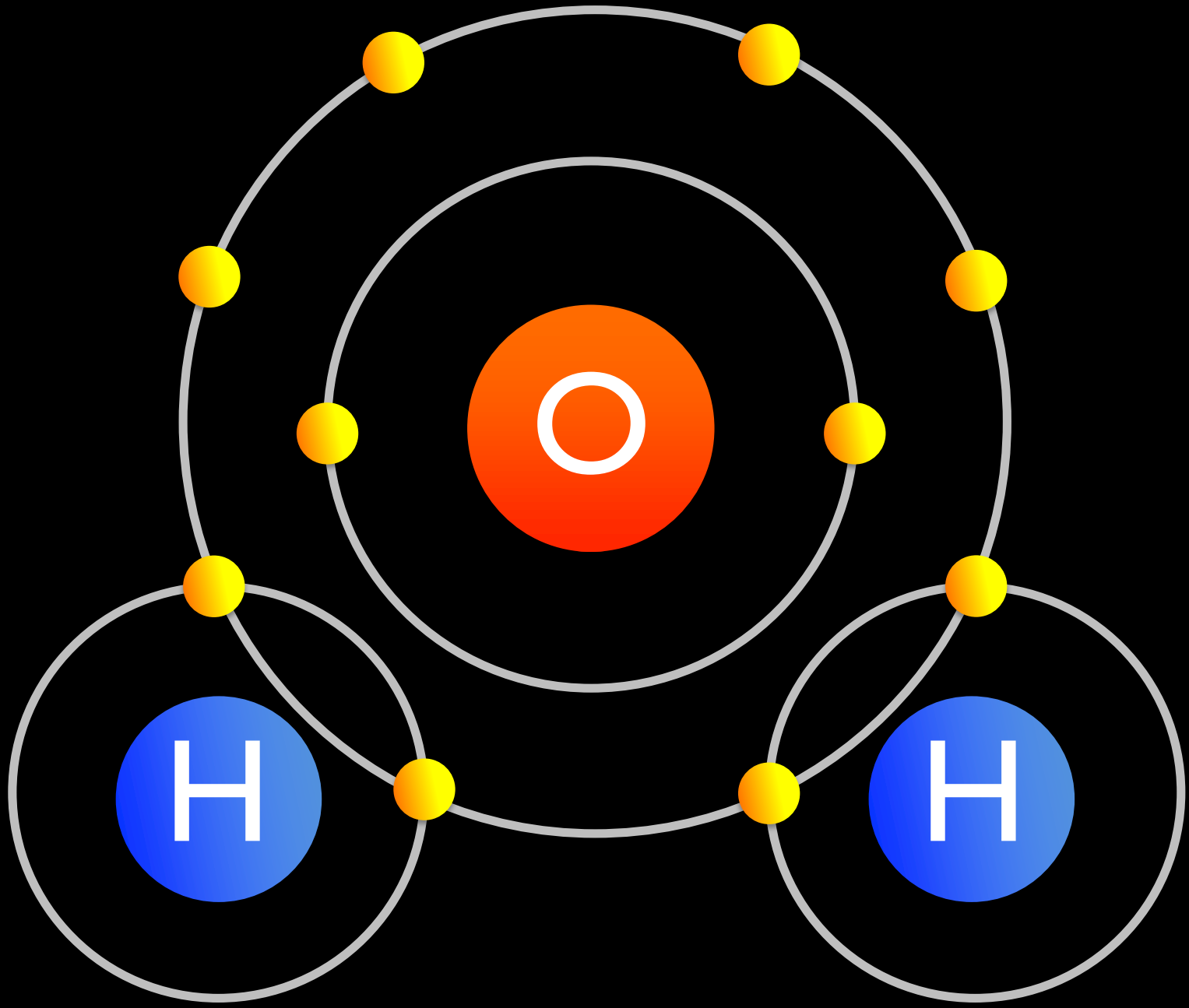
di molecole d'acqua

1 mole H_2O ~18 g

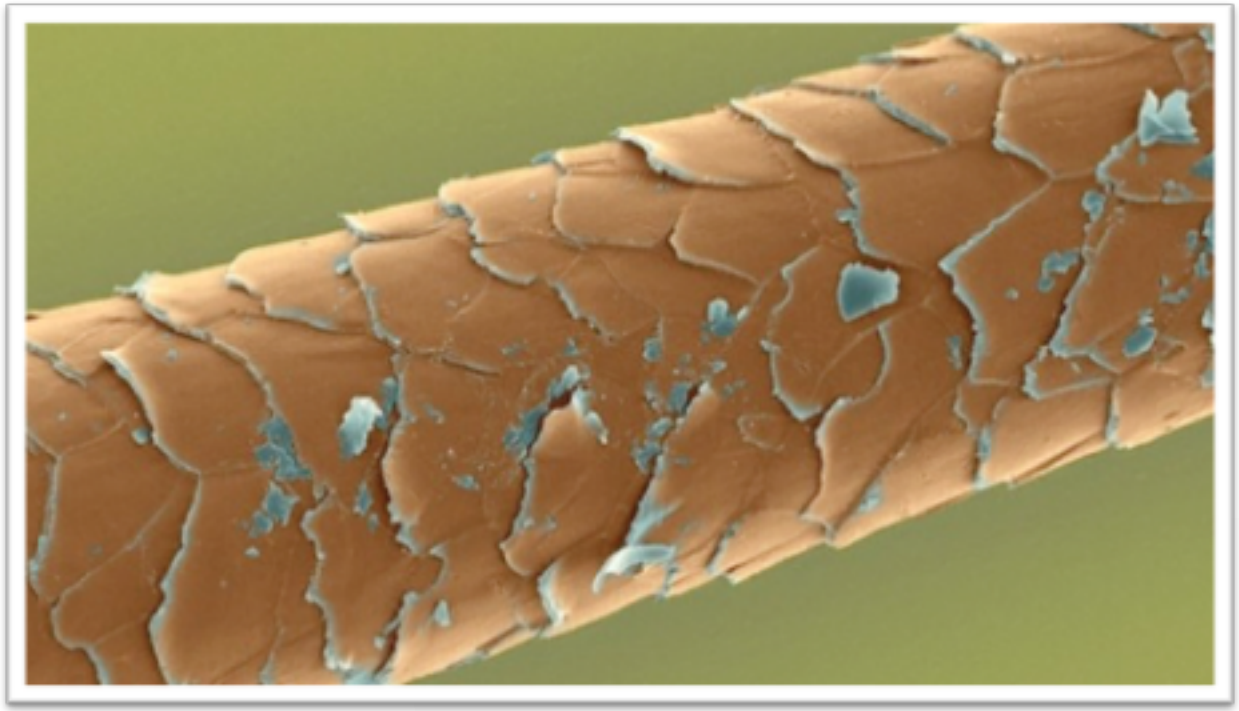
1 bicchiere H_2O (180 ml) ~ 10 moli

1 mole = 6.022×10^{23} molecole


O
H
H


O
H
H


U.S.A. HERITAGE U.S.A.



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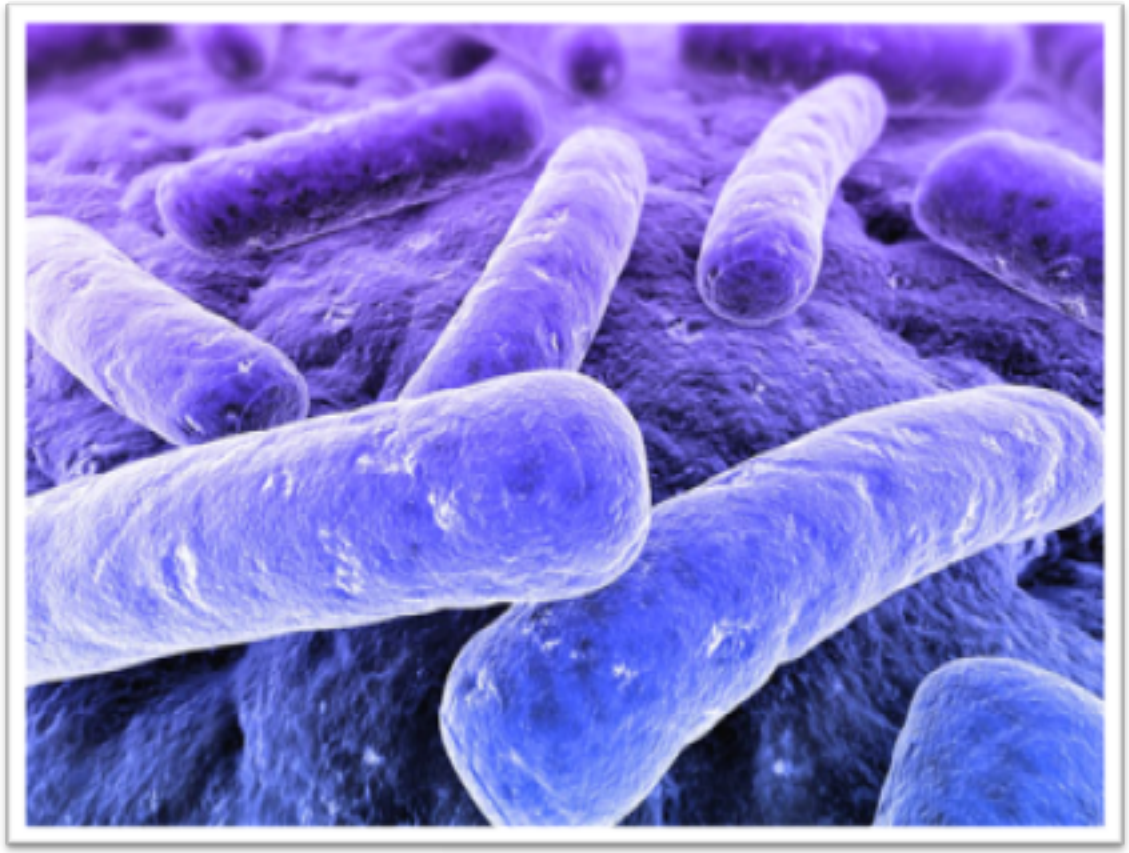
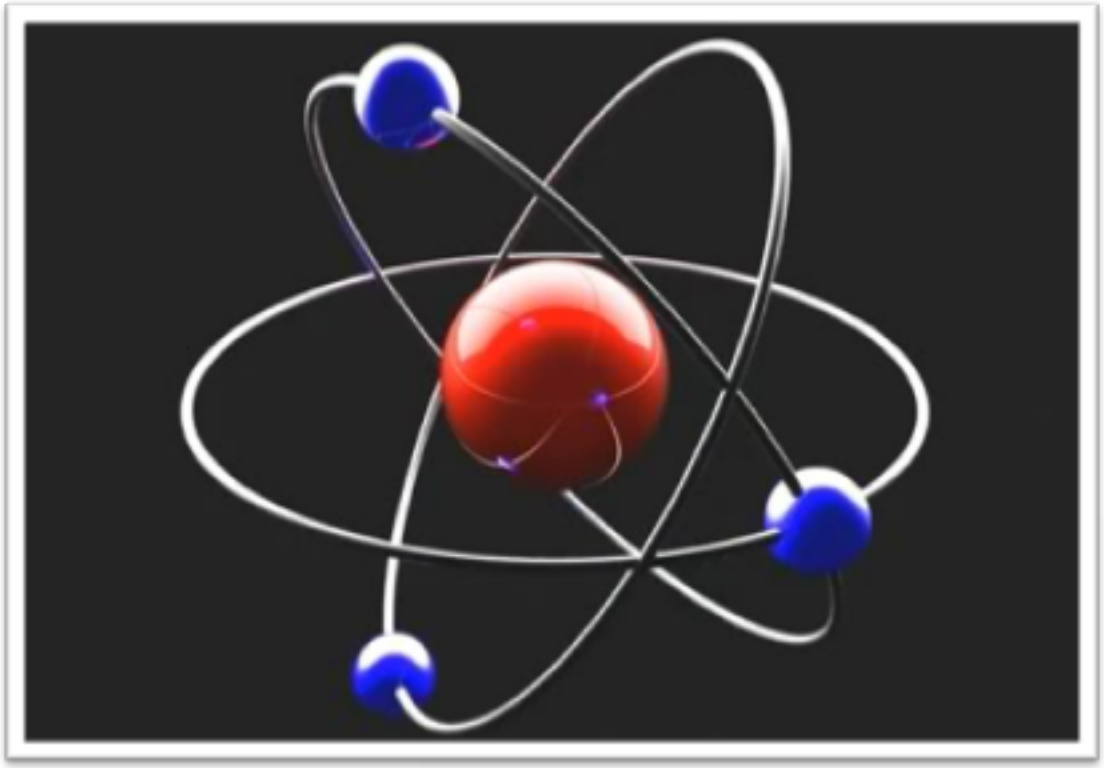


18

24



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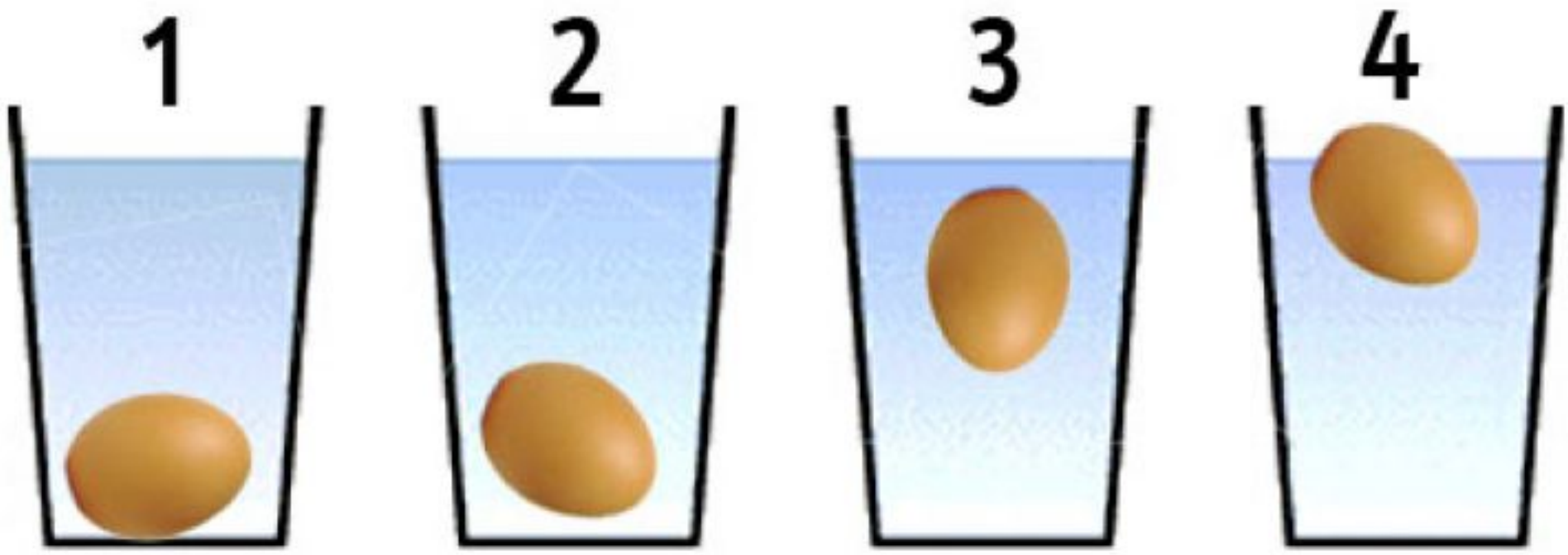
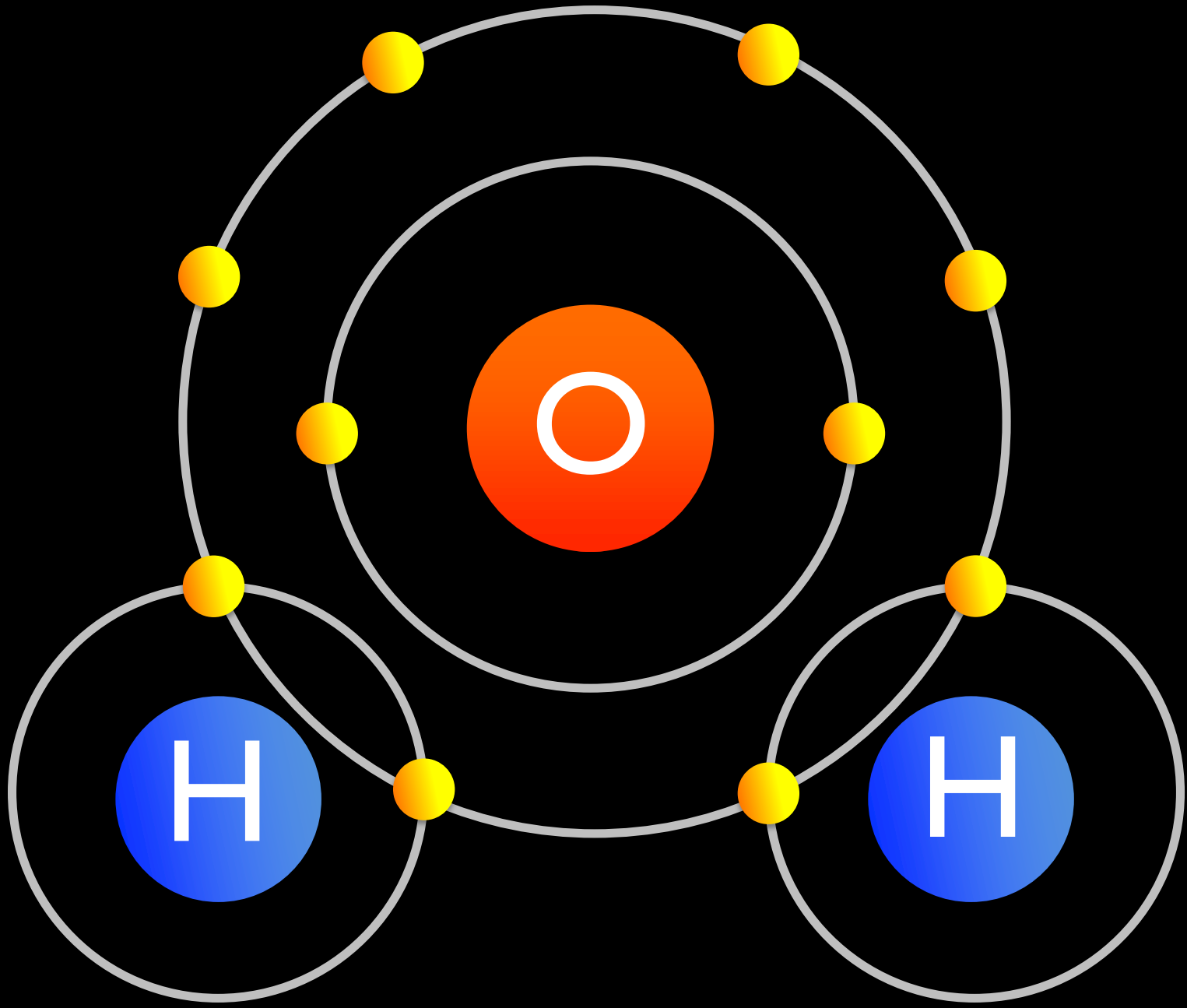
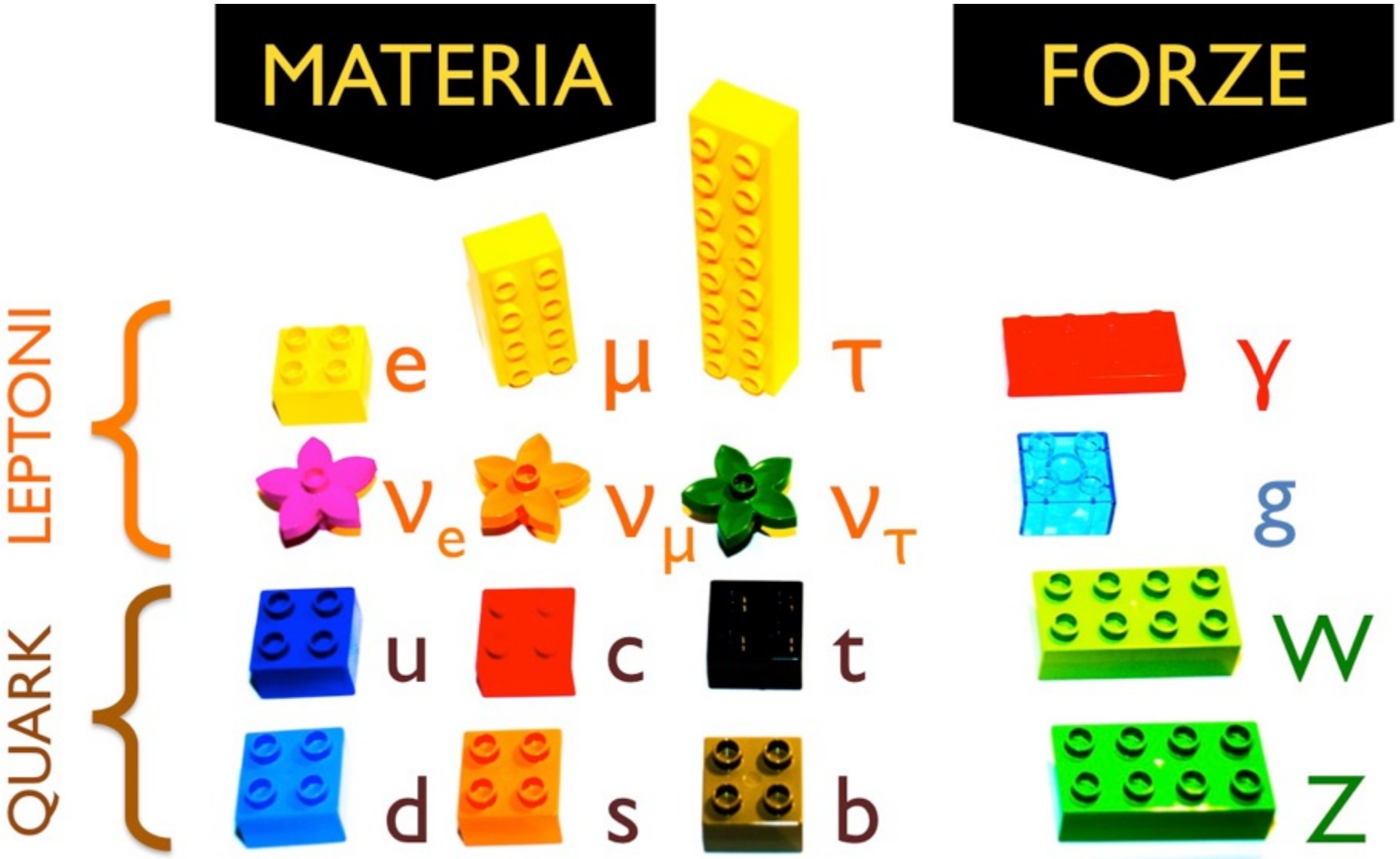

1
2
3
4


O
H
H

$$\mathcal{L} = -\frac{1}{4} F_{\mu\nu} F^{\mu\nu}$$

$$+ i \not{F} \not{D} \psi + h.c$$


MATERIA
FORZE
LEPTONI
QUARK
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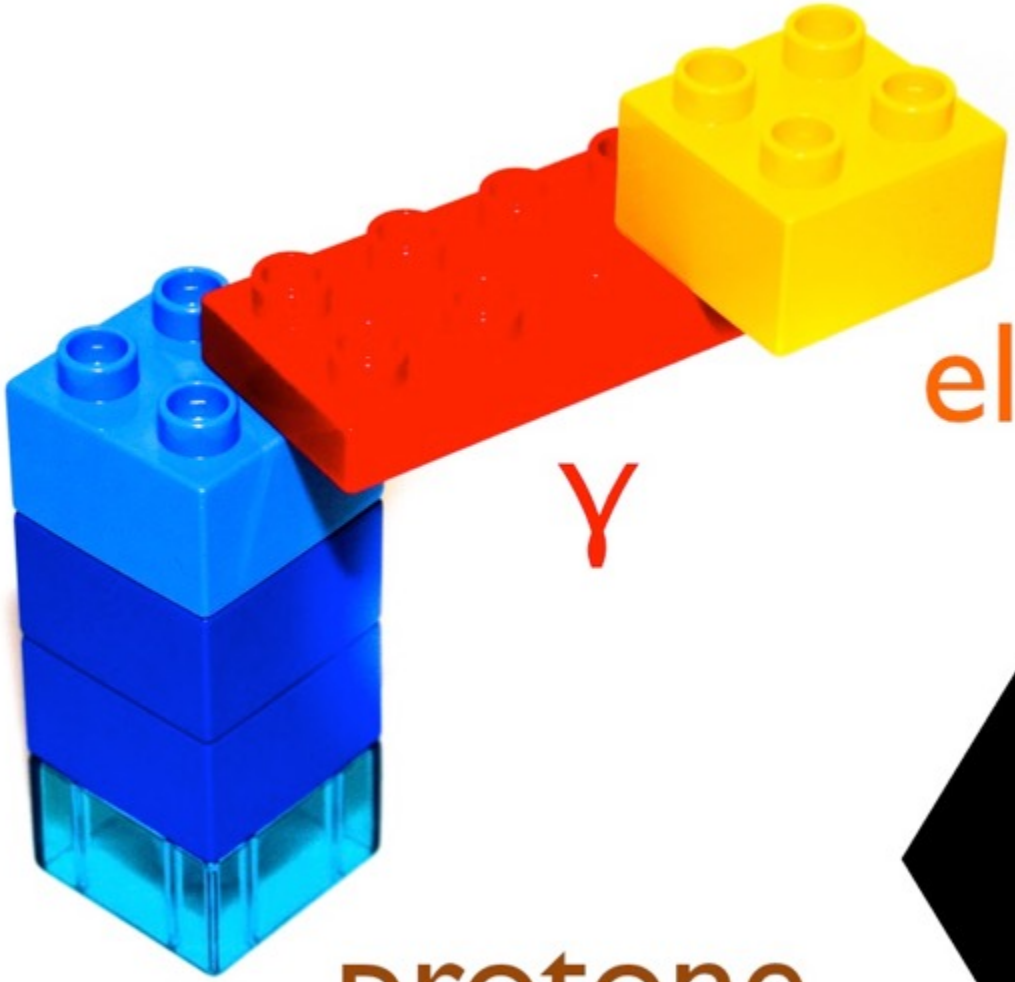
ν_e
ν_μ
ν_τ
g
u
c
t
W
d
s
b
Z

NEUTRONE

PROTONE

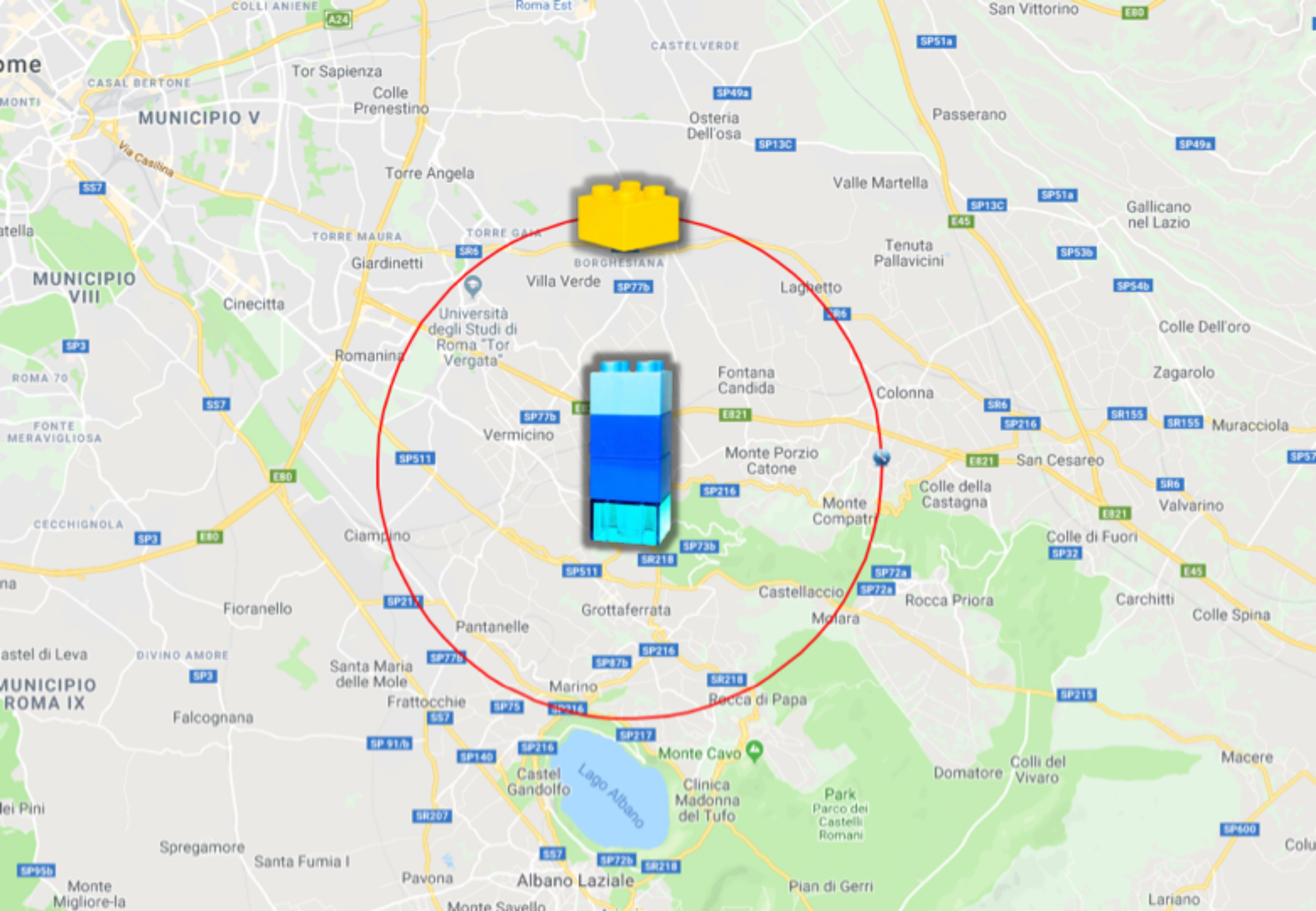


elettrone

y

protone

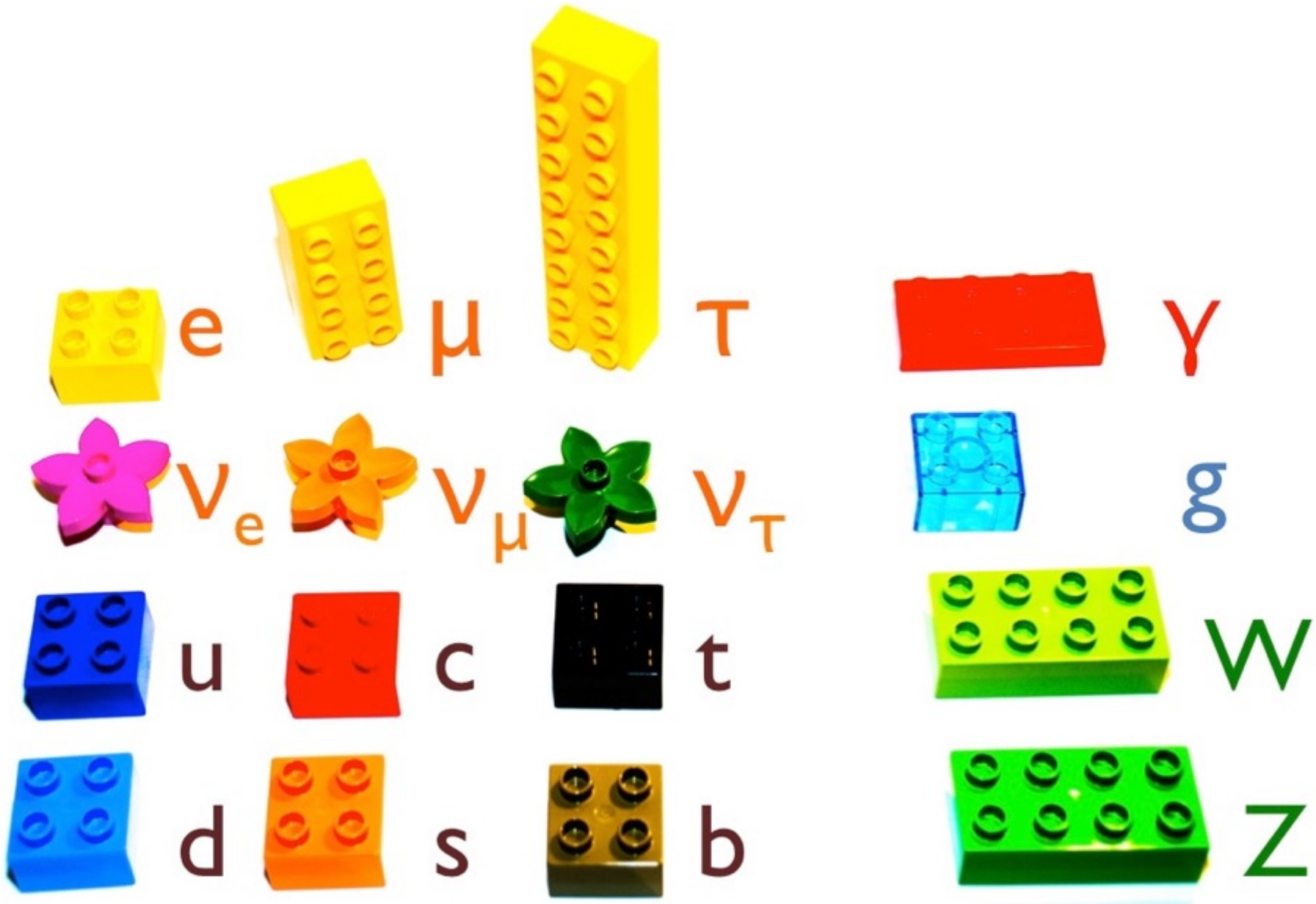
IDROGENO


COLLI ANIENE
A24
Roma Est
San Vittorino
E80
CASTELVERDE
SP51a
Tor Sapienza
CASAL BERTONE
Colle Prenestino
SP49a
Osteria Dell'osa
Passerano
MUNICIPIO V
SP13C
SP49a
Via Casilina
Torre Angela
Valle Martella
SS7
SP51a
SP13C
Gallicano nel Lazio
E45
TORRE MAURA
TORRE GAIA
SR6
Tenuta Pallavicini
SP53b
BORGHESIANA
Giardinetti
Villa Verde
SP77b
Laghetto
SP54b
MUNICIPIO VIII
Cinecitta
Università degli Studi di Roma "Tor Vergata"
SR6
Colle Dell'oro
SP3
Romanina
Fontana Candida
Zagarolo
ROMA 70
SS7
Colonna
SR6
SP216
SR155
SR155
Muracciola
FONTE MERAVIGLIOSA
SP77b
E821
Vermicino
SP511
Monte Porzio Catone
E821
San Cesareo
SP57
E80
SP216
Colle della Castagna
SR6
Valvarino
CECCHIGNOLA
SP3
E80
Ciampino
Monte Compatri
E821
Colle di Fuori
SP73b
SP32
SR218
SP511
SP72a
E45
SP72a
Castellaccio
Rocca Priora
Carchitti
SP217
Fioranello
Grottaferrata
Molara
Colle Spina
Pantanelle
SP216
astel di Leva
DIVINO AMORE
SP77b
SP87b
Santa Maria delle Mole
SP3
Marino
SR218
MUNICIPIO ROMA IX
Frattocchie
Rocca di Papa
SP215
SP73
SS7
Falcognana
SP217
SP216
Monte Cavo
SP91b
SP140
Castel Gandolfo
Lago Albano
Clinica Madonna del Tufo
Domatore
Colli del Vivaro
Macere
Park Parco dei Castelli Romani
dei Pini
SR207
SP600
Spregamore
Santa Fumia I
SS7
SP72b
SR218
SP95b
Pavona
Albano Laziale
Pian di Gerri
Monte Migliore-la
Monte Savello
Lariano

neutrone → protone

45

58


e
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ν_e
ν_μ
ν_τ
g
u
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W
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1897

J. J. Thomson

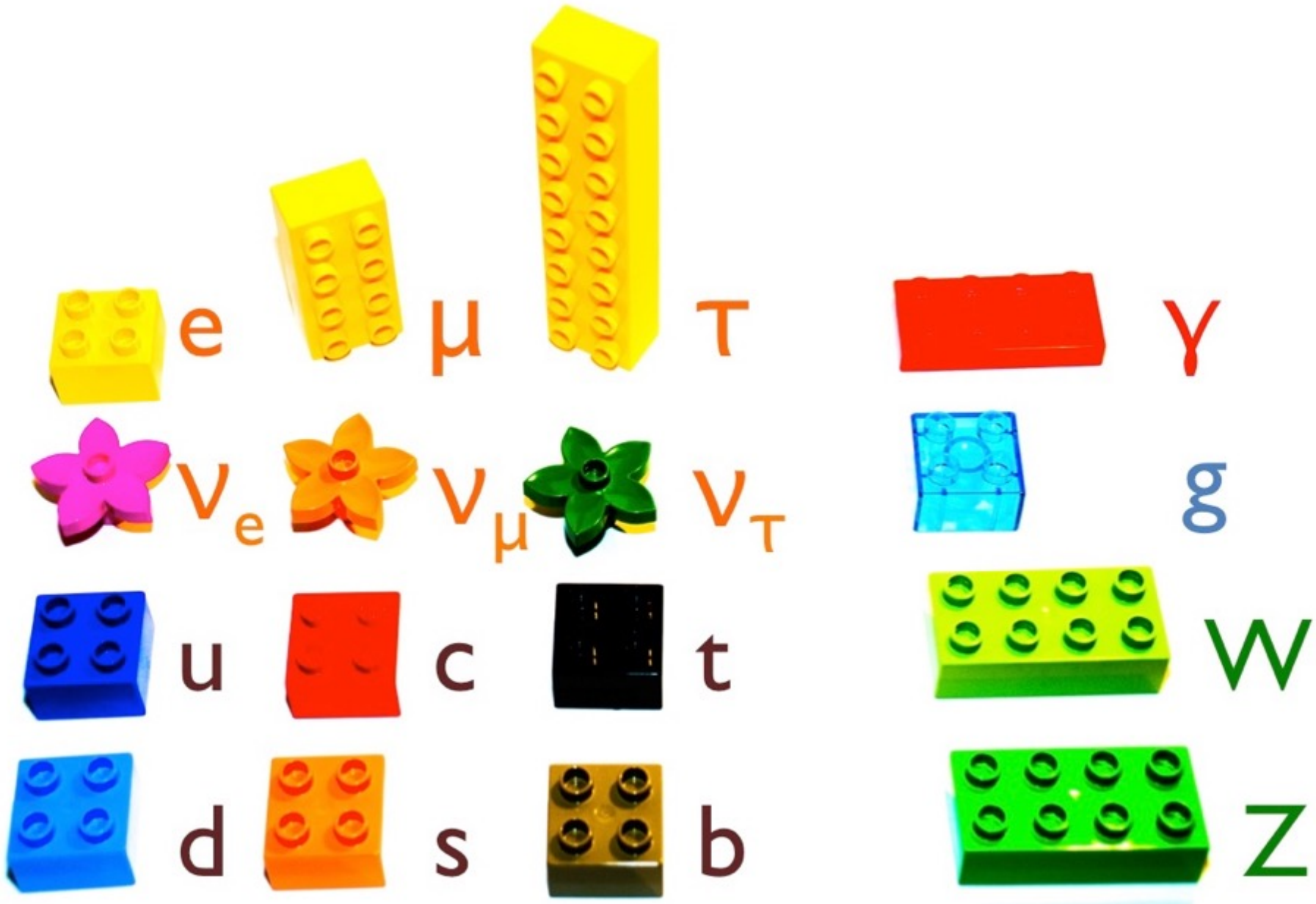
elettrone

2000

DONUT Collaboration

neutrino tau

ν_T


e
μ
τ
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d
s
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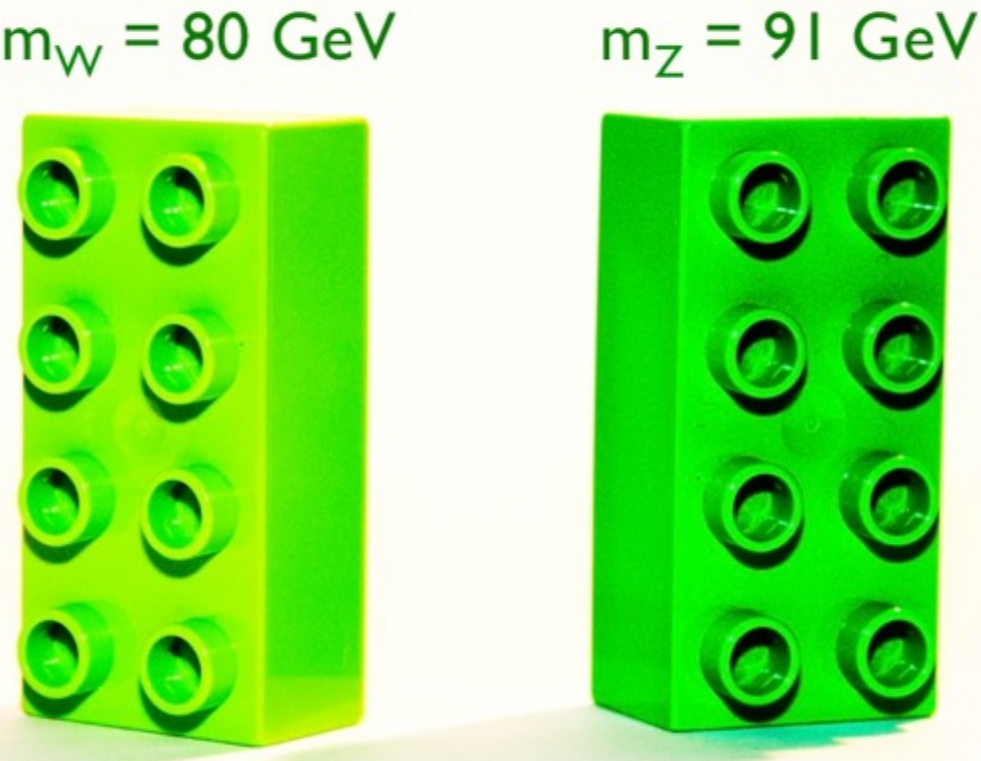
Z

Perché

le particelle hanno massa

?

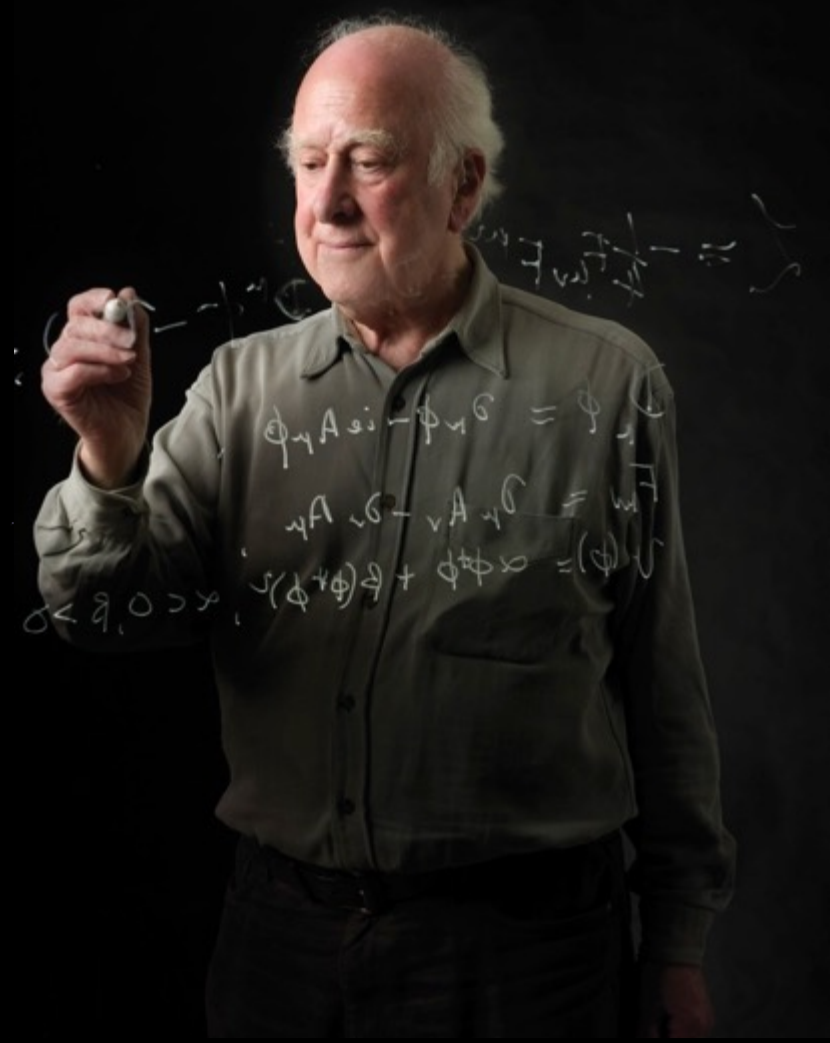


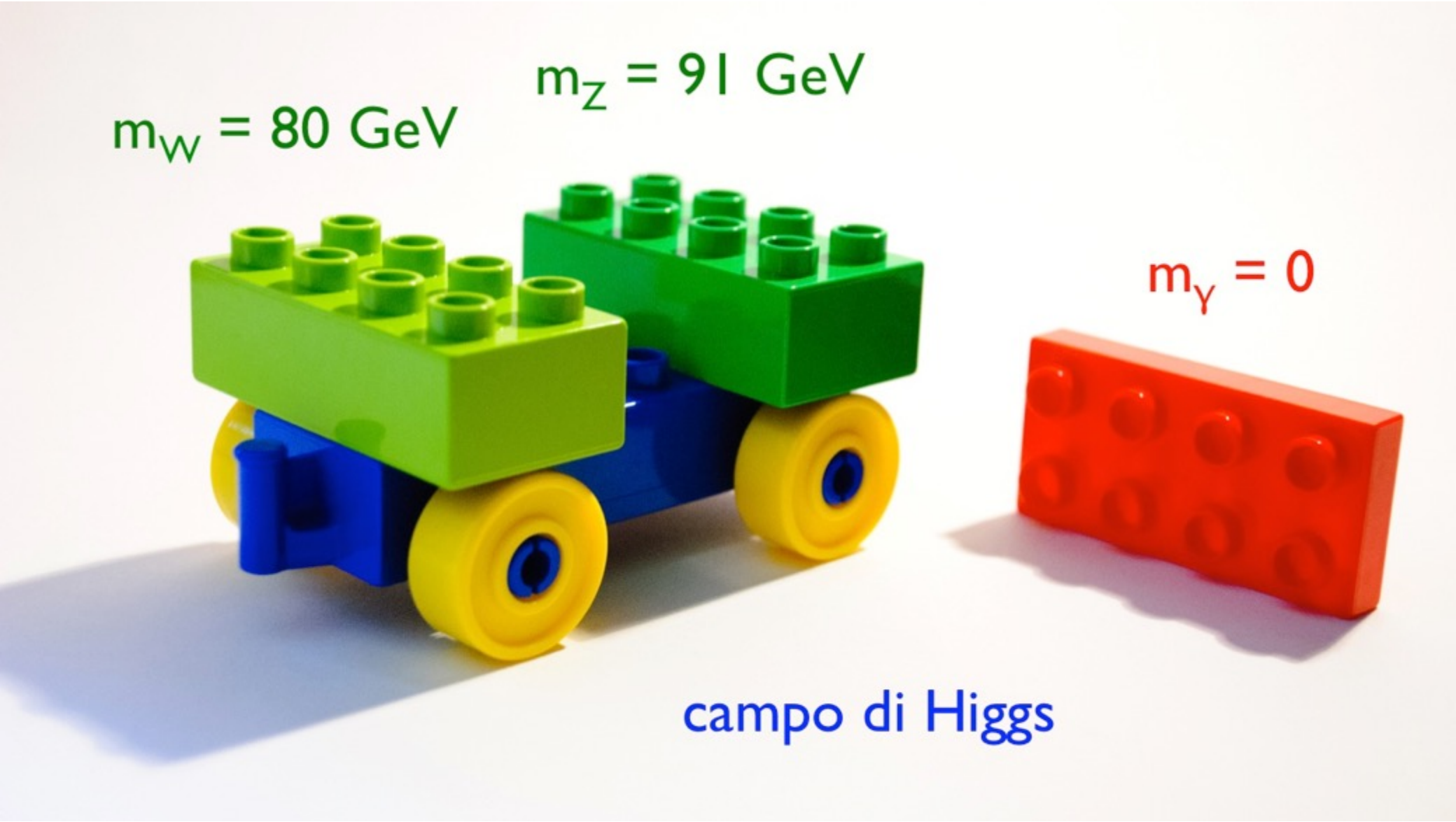
$$\mathcal{L} = -\frac{1}{4} F_{\mu\nu} F^{\mu\nu}$$

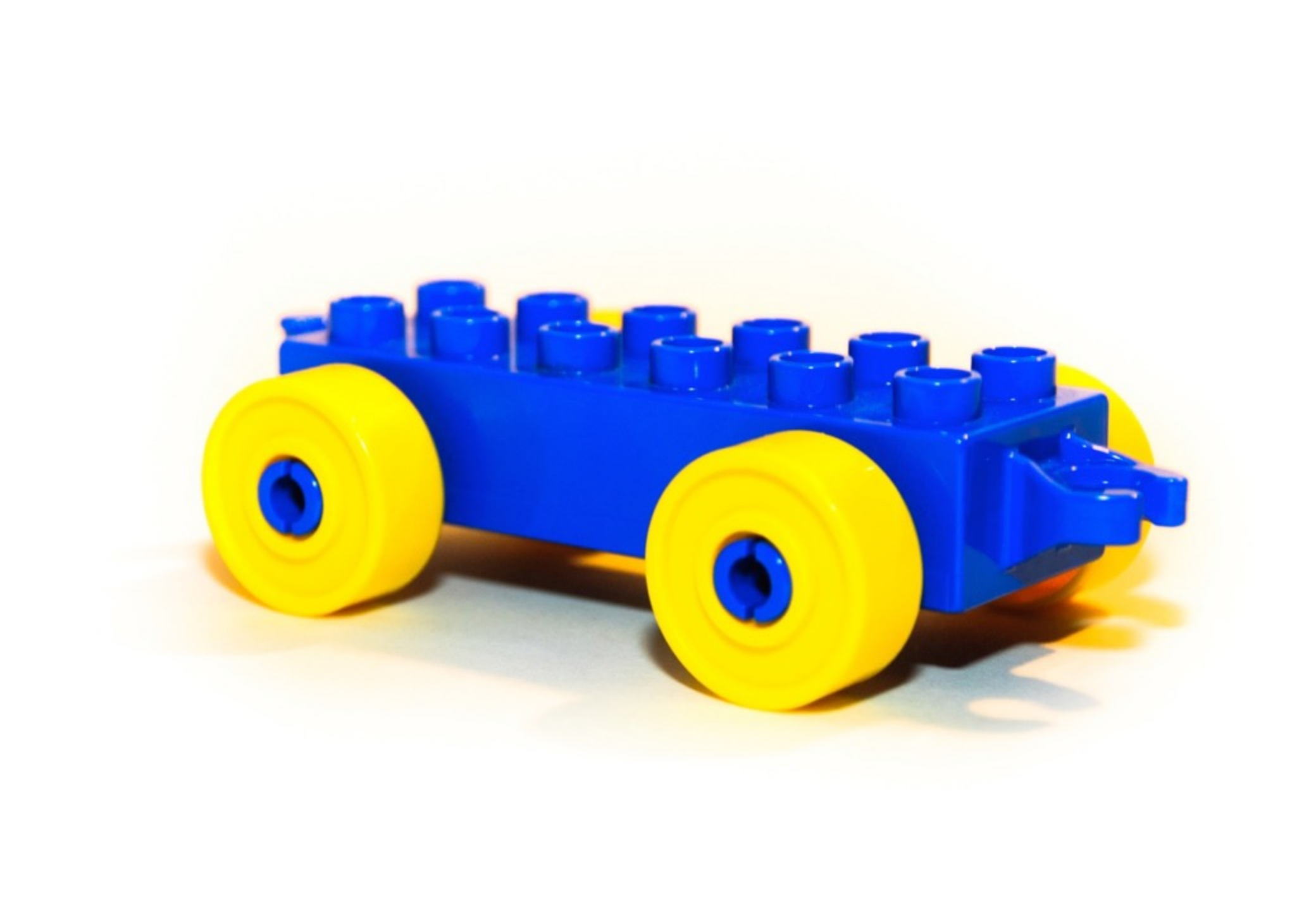
$$+ i \not{F} \not{D} \psi + h.c$$

$$+ \psi_i y_{ij} \psi_j \phi + h.c$$

$$+ |D_\mu \phi|^2 - V(\phi)$$

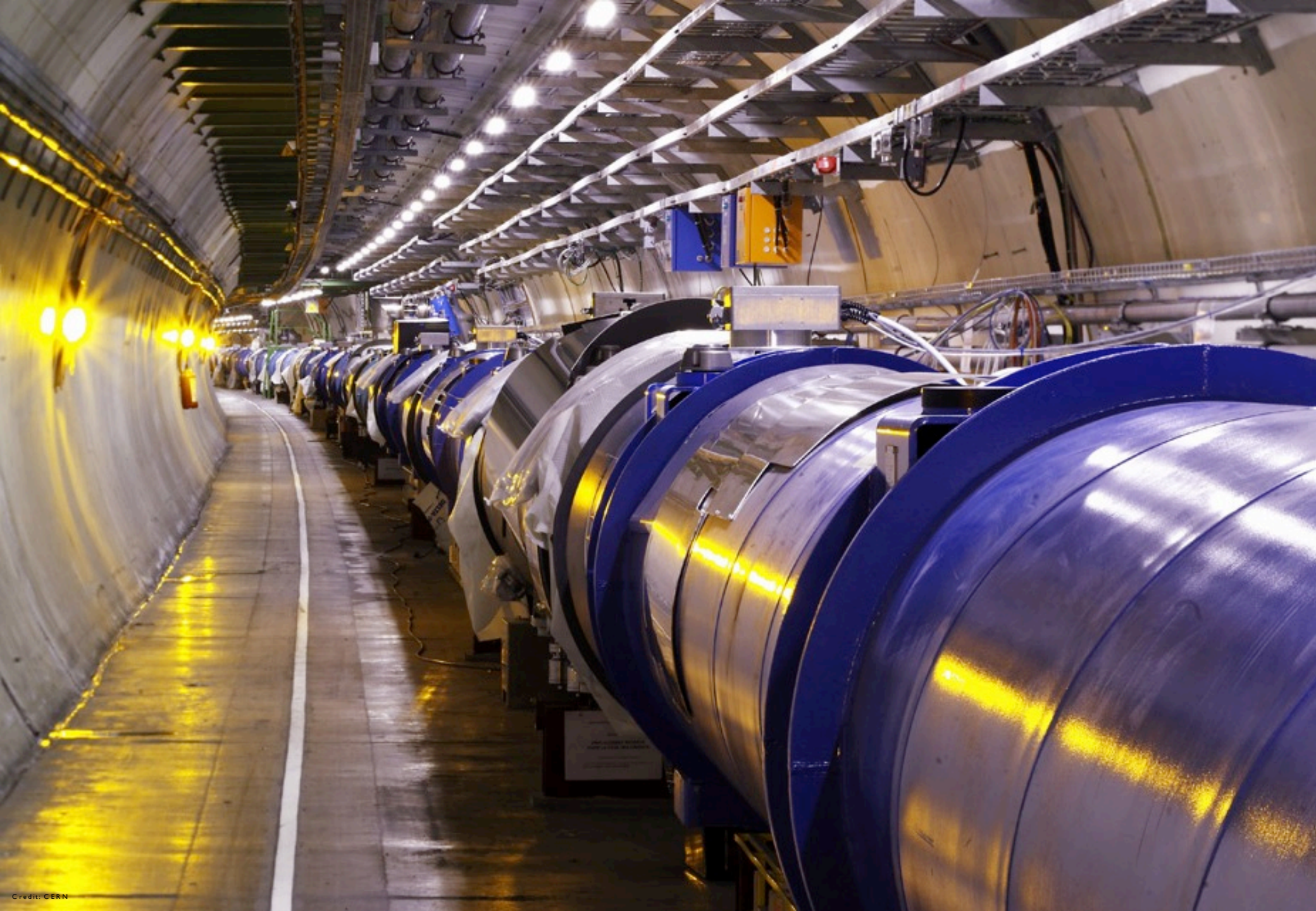



m_Z = 91 GeV
m_W = 80 GeV
m_γ = 0
campo di Higgs

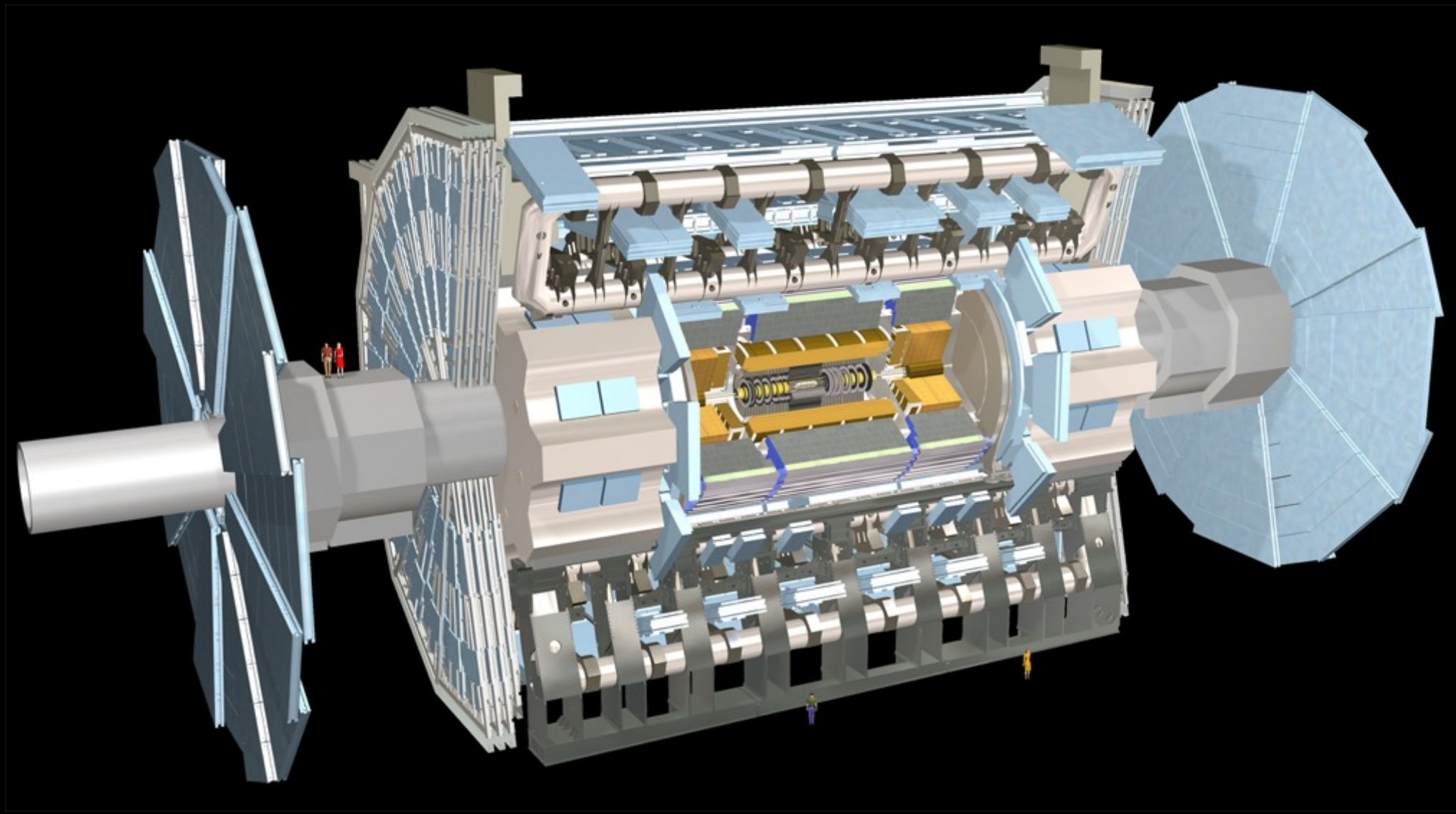



CERN
30
Credit: CERN


LHCb
ATLAS
CERN Meyrin
CERN Prévessin
SPS 7 km
SUISSE
FRANCE
CMS
ALICE
LHC 27 km
Credit: CERN



Credit: CERN



Credit: CERN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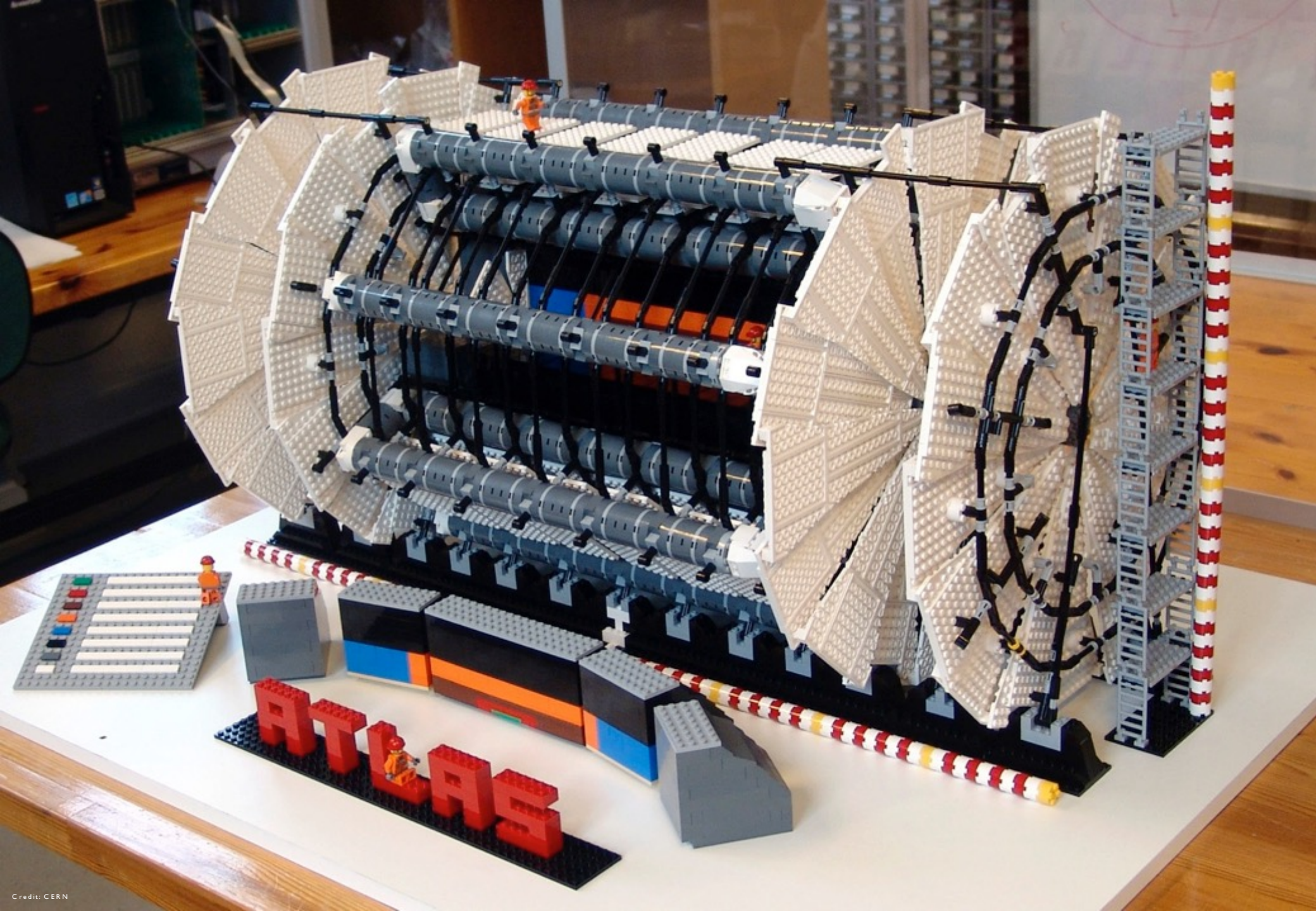
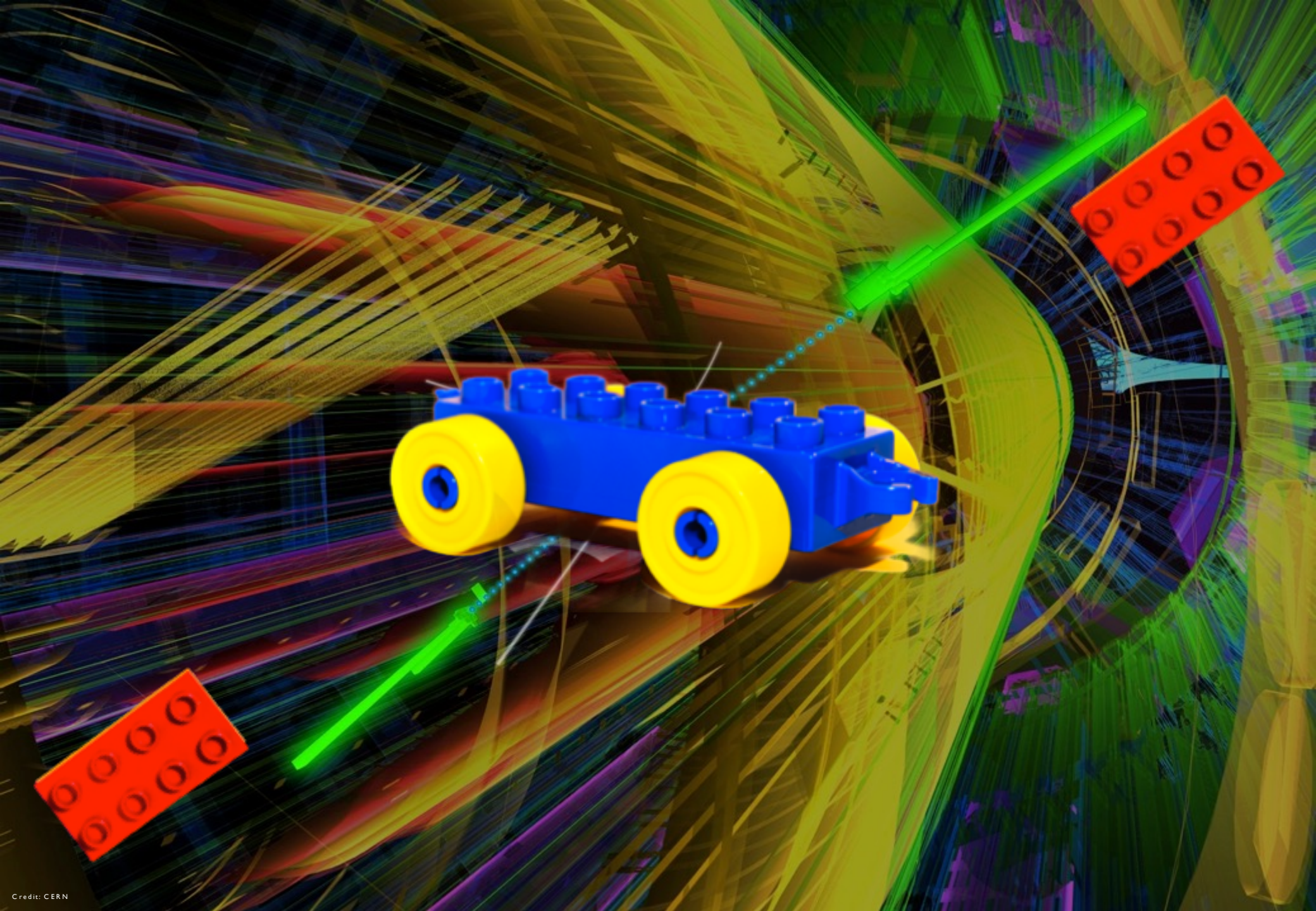


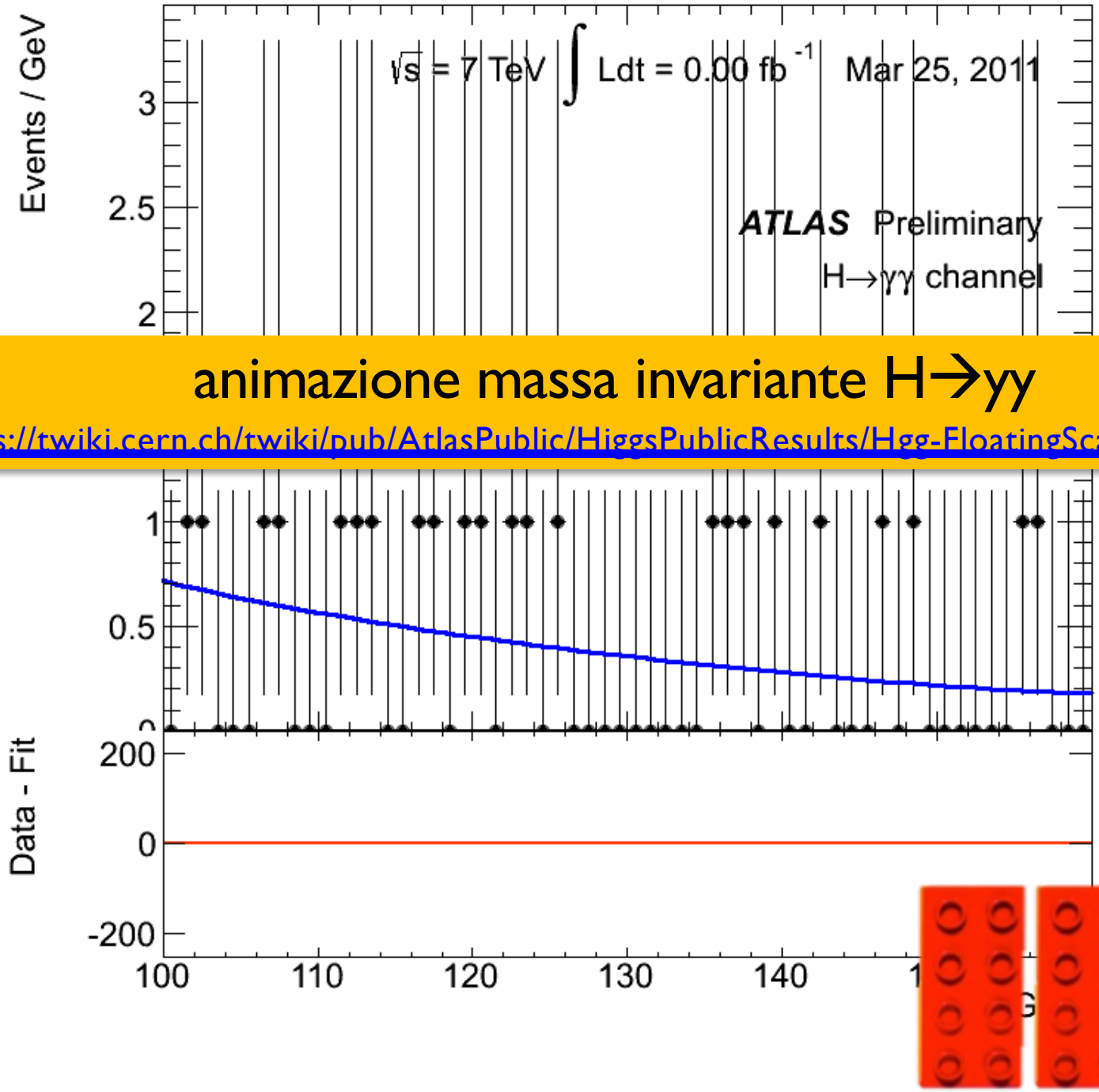
Credit: CERN

video
ATLAS Experiment
“Event with two photons”
https://www.youtube.com/watch?v=bTdMUJZr4Fs

Credit: CERN



Credit: CERN



animazione massa invariante H→yy

https://twiki.cern.ch/twiki/pub/AtlasPublic/HiggsPublicResults/Hgg-FloatingScale-Short2.gif


ATLAS Preliminary
Obs.
Exp.
Expected from SM Higgs at given m
Combined results: the excess
ATLAS Preliminary
Maximum excess
Local
Global significance:

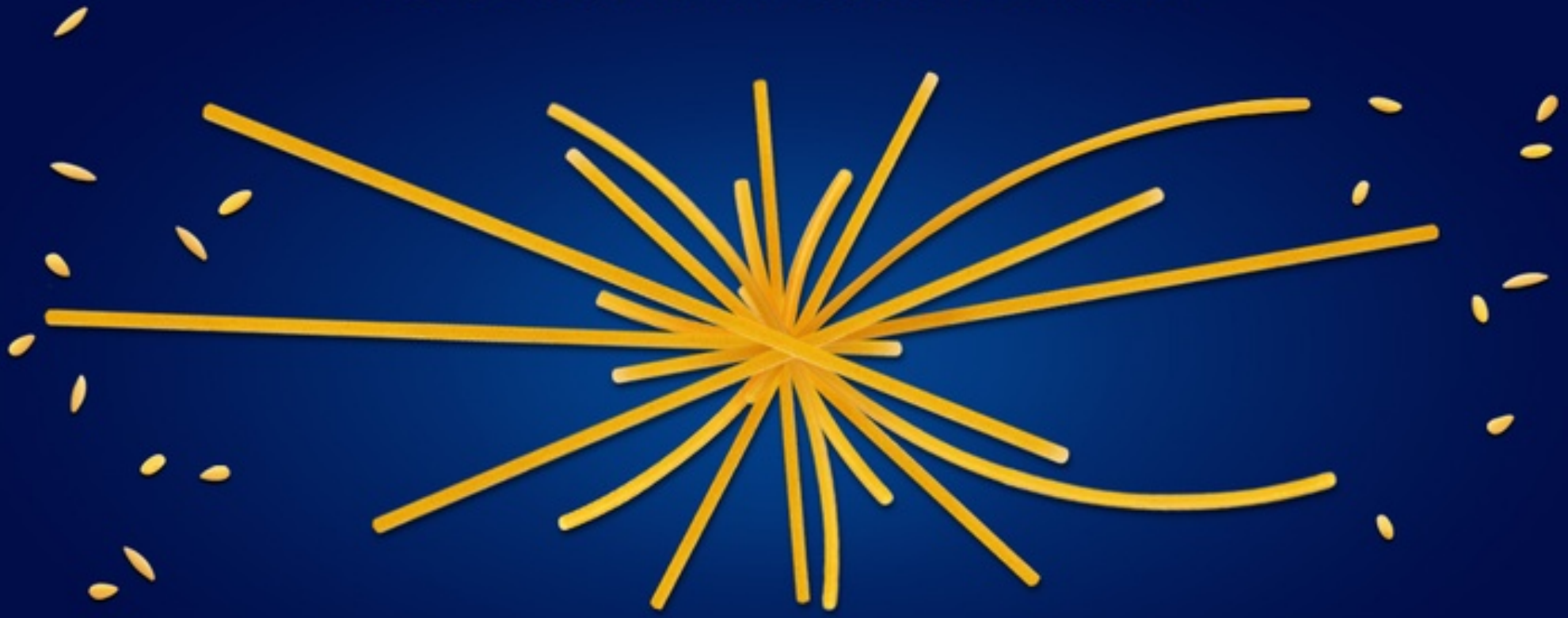
Credit: CERN

Credit: CERN

Credit: CERN

I BOSONI DI HIGGS

DOPO QUASI 50 ANNI TROVATA LA RICETTA



AL CERN CONSIGLIANO LA FORMULA POMODORO E BASILICO.

Barilla

un caffè all'anno

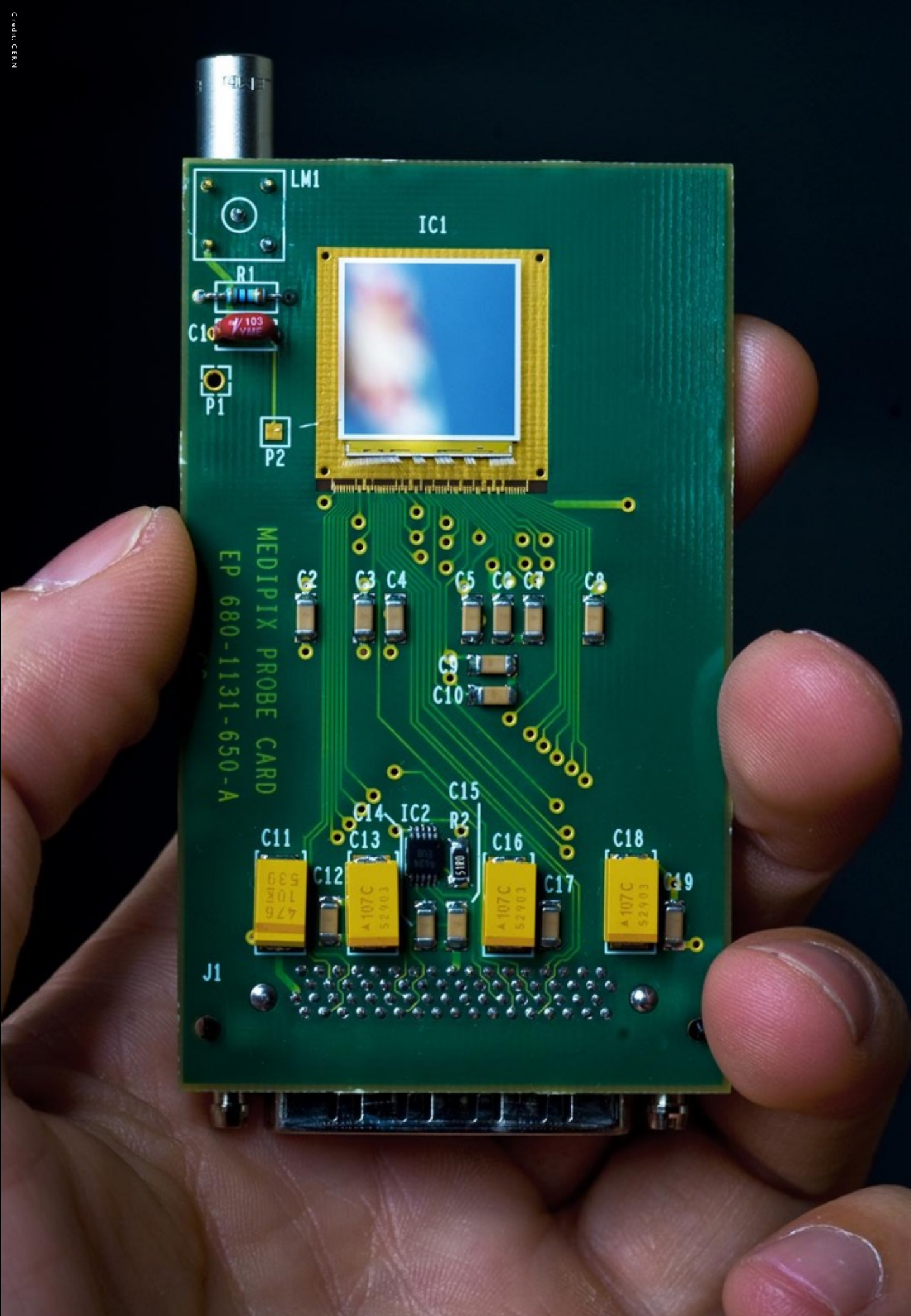
a testa
negli ultimi
dieci anni


Urbi et Orbi

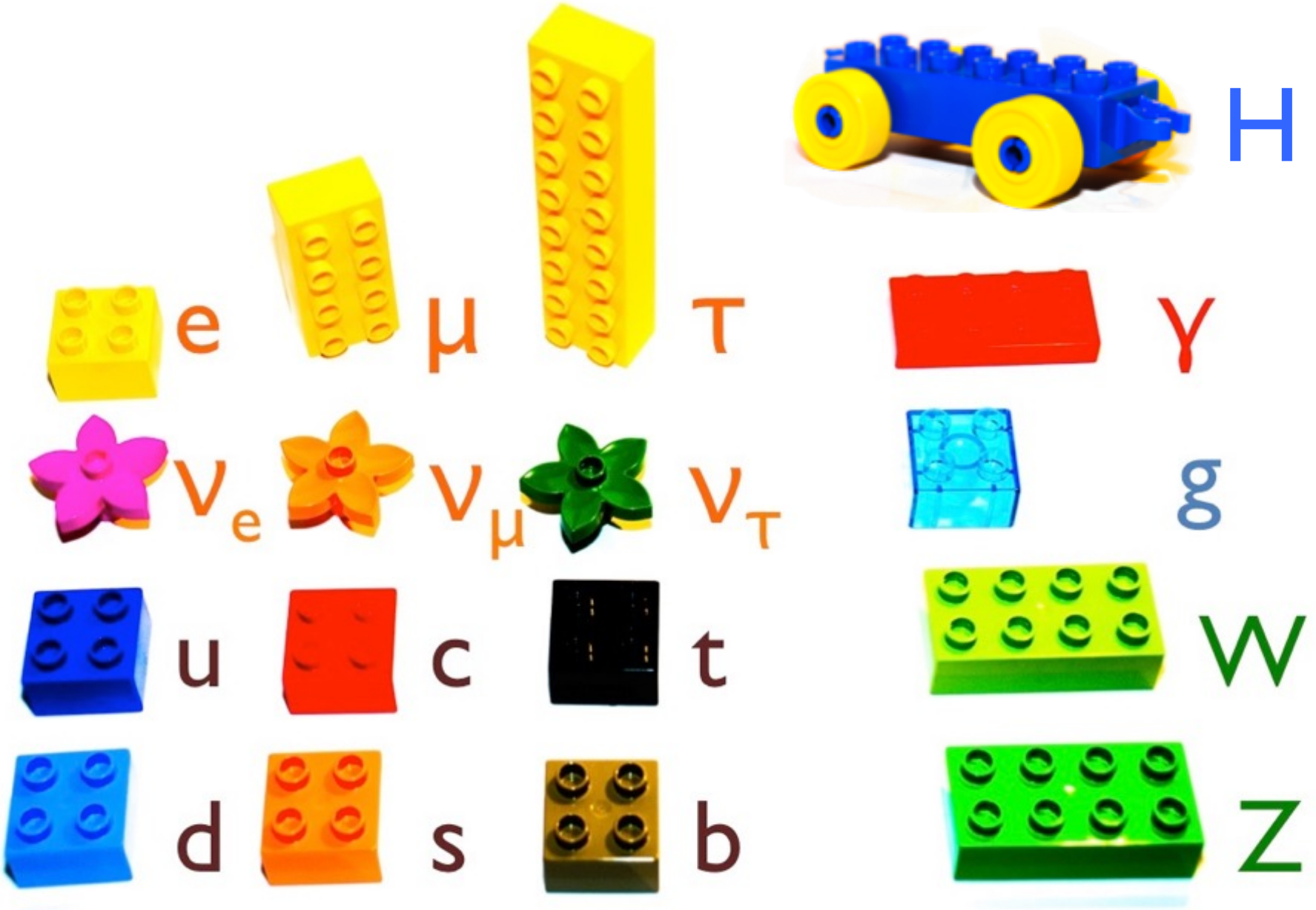
Credit: CERN

Credit: CERN

Credit: CERN


LM1
IC1
R1
C1
P1
P2
MEDIPIX PROBE CARD
EP 680-1131-650-A
C2
C3
C4
C5
C6
C7
C8
C9
C10
C15
C14
IC2
R2
C11
C13
C16
C18
C12
C17
C19
J1

Crédit: CERN


H
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μ
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ν_τ
g
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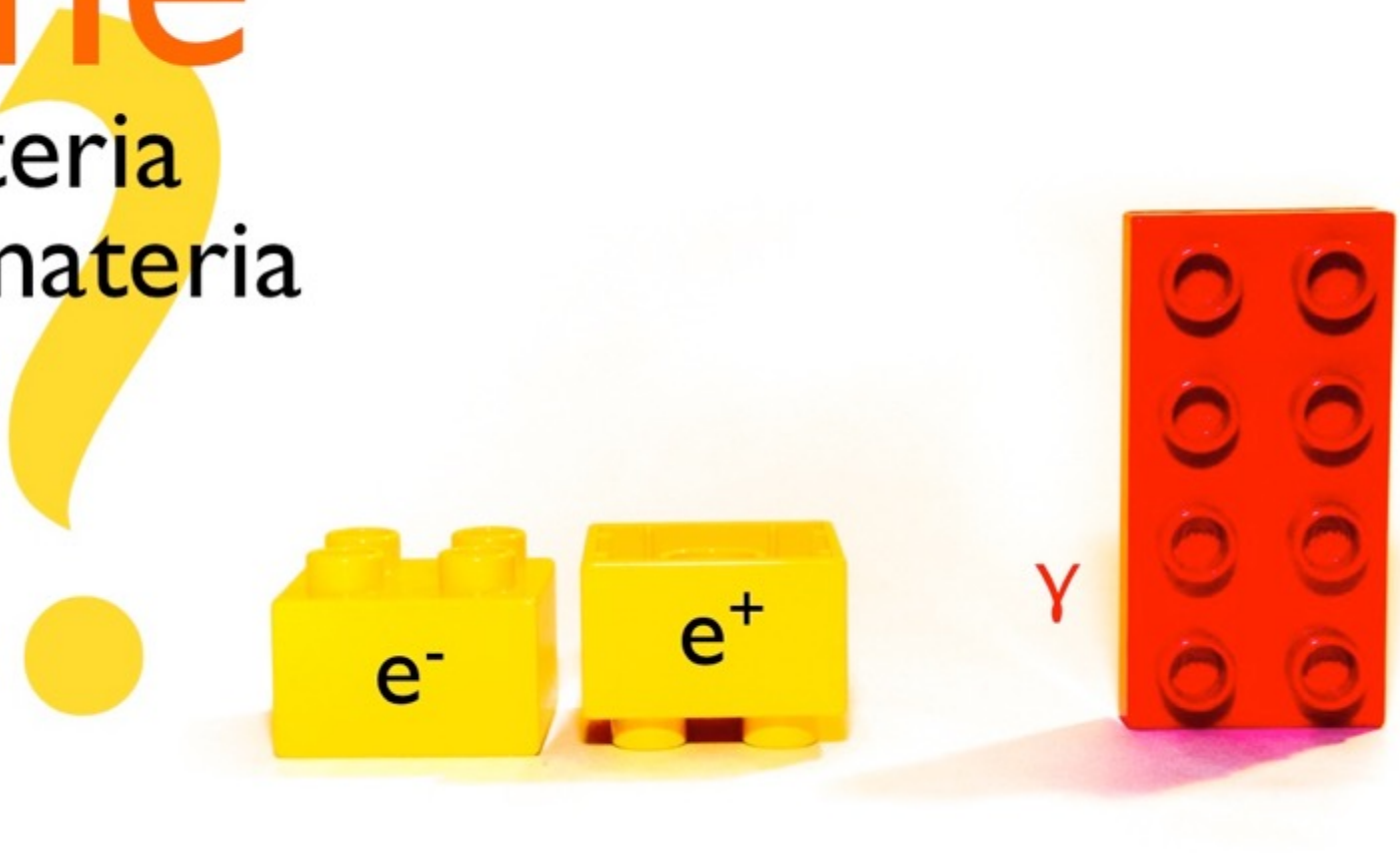
d
s
b
Z

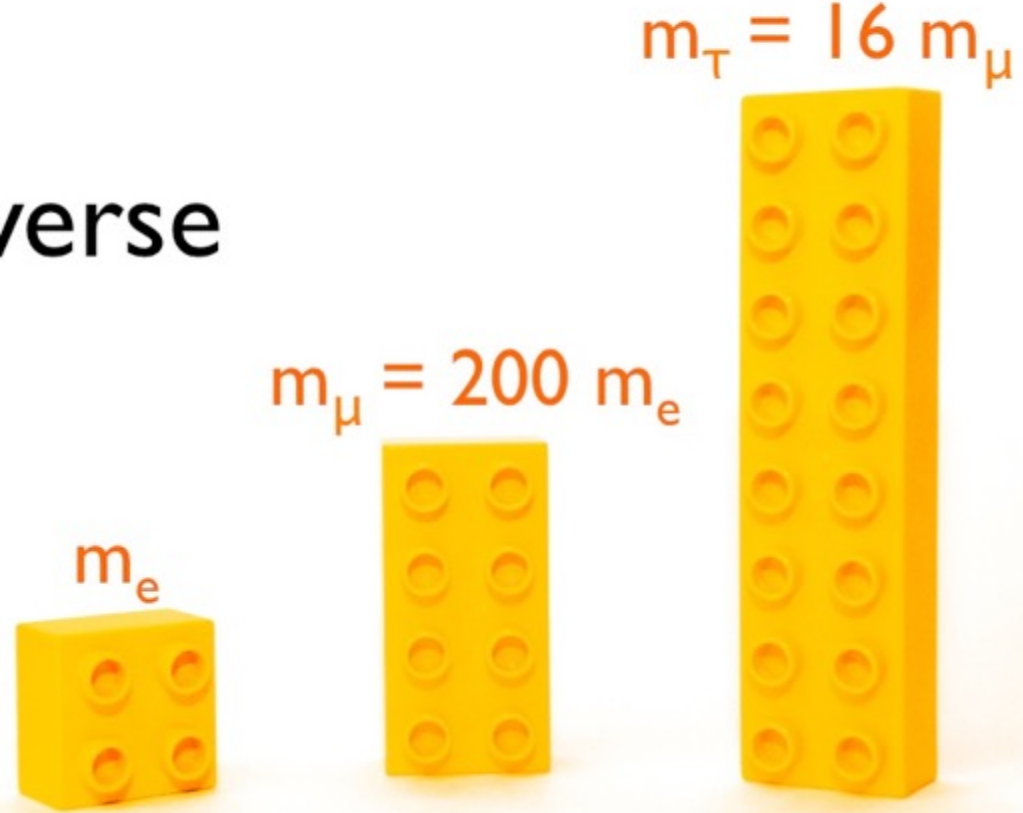
Perché

c'è più materia che antimateria



Perché

particelle simili
hanno masse diverse



Perché

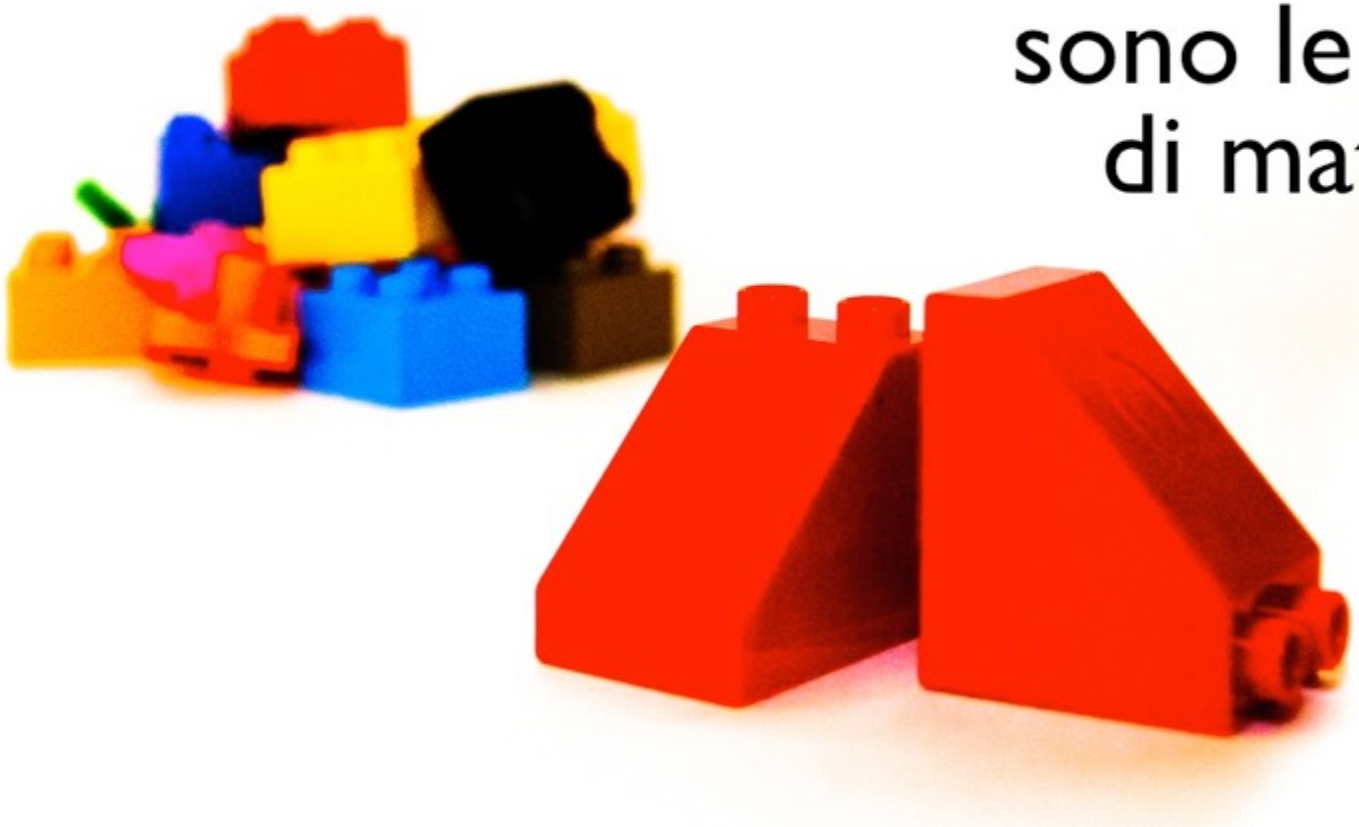
ci sono tre famiglie
di particelle

?

Dove

sono le particelle
di materia oscura

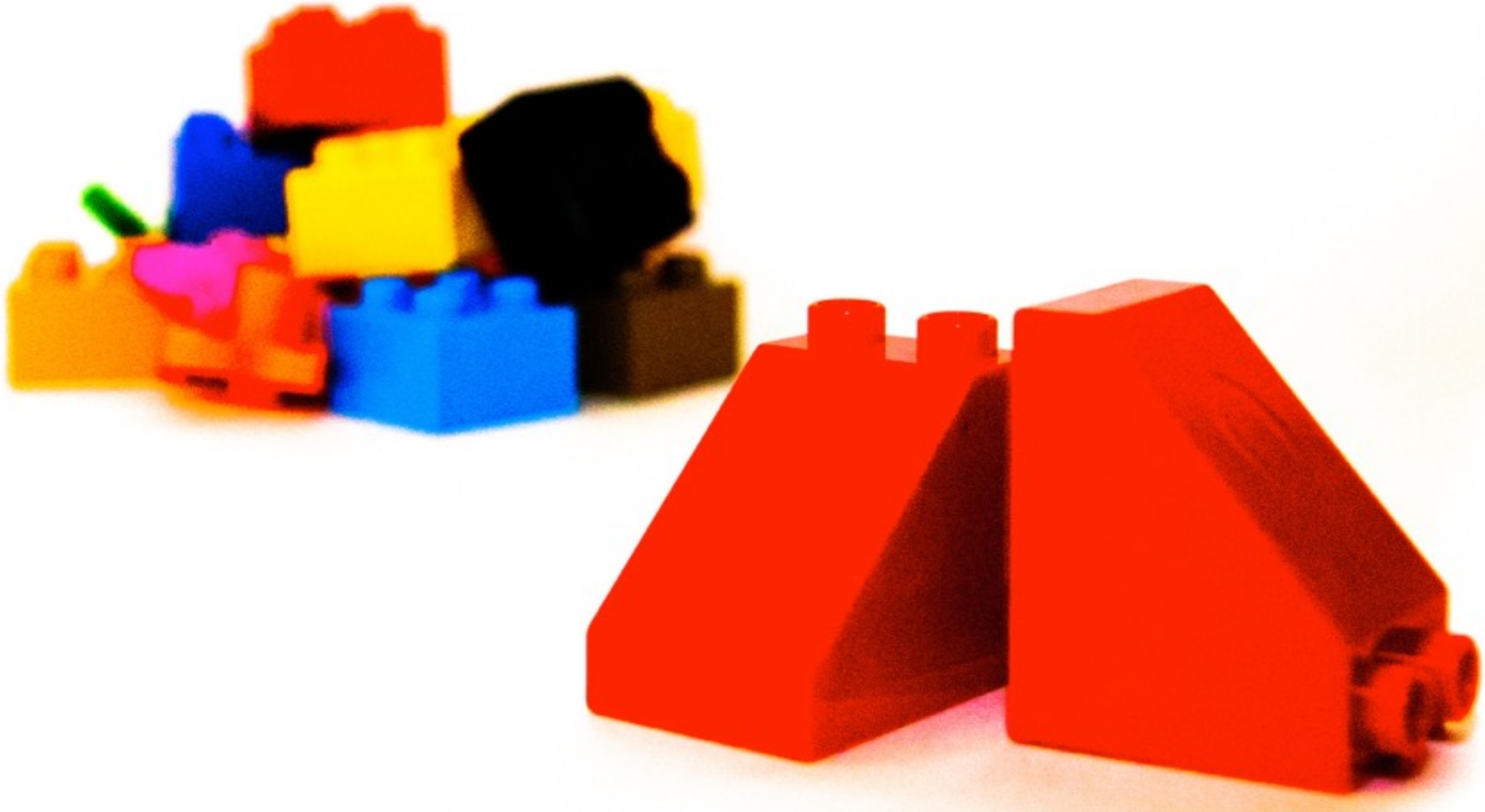
?

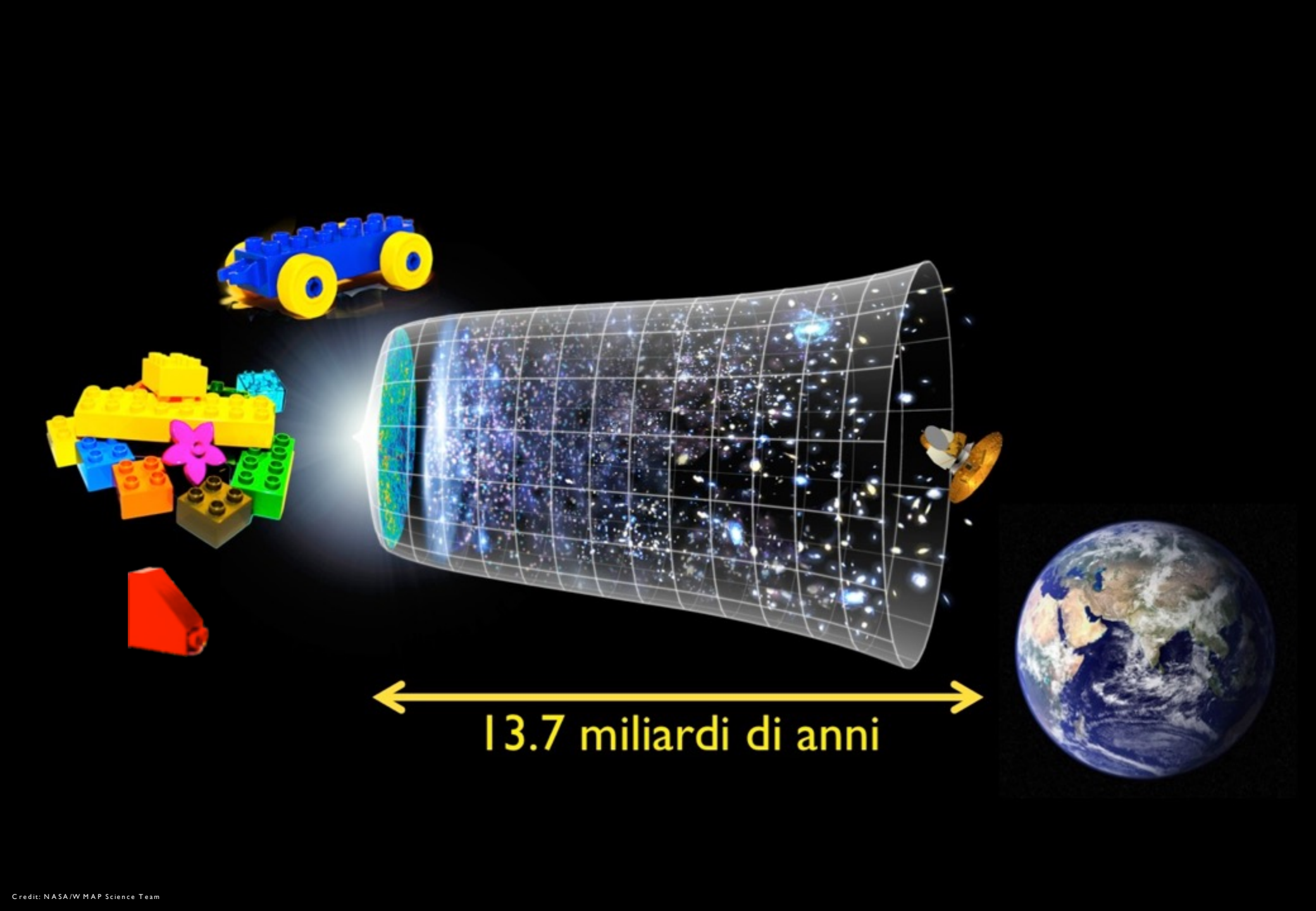


ATLAS Control Room

https://twitter.com/ATLASexperiment/status/584644854958915585

2018?





Credit: NASA/WMAP Science Team

Credit: Tony Bricker (Flickr)


Marco Delmastro
Particelle familiari
Le avventure della fisica e del bosone di Higgs, con Pulce al seguito
Editori Laterza