S Kenanom u fiziku čestica

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in Inštitut Jožef Stefan, Ljubljana, Slovenija

Kenan-fest, PMF Sarajevo, 6.6.2019.

Studij fizike na Odsjeku za fiziku PMF u Sarajevu
(1972-1976)

Teorijska fizika na Odsjeku za fiziku PMF

Kenan Suruliz

- Klasična maehanika (1973/74)
- Matematičke metode fizike (1974/75)
- Kvantna teorija polja (1975/76)

Kenan Suruliz

Obrazovanje:

- Diplomirani fizičar, Prirodno-matematički fakultet Univerziteta u Sarajevu (1966). Diplomski rad: Simetrije i zakoni sačuvanja.

- Magistar fizičkih nauka, PMF u Sarajevu (1970). Magistarski rad: Kvantna teorija slabog gravitacionog polja.

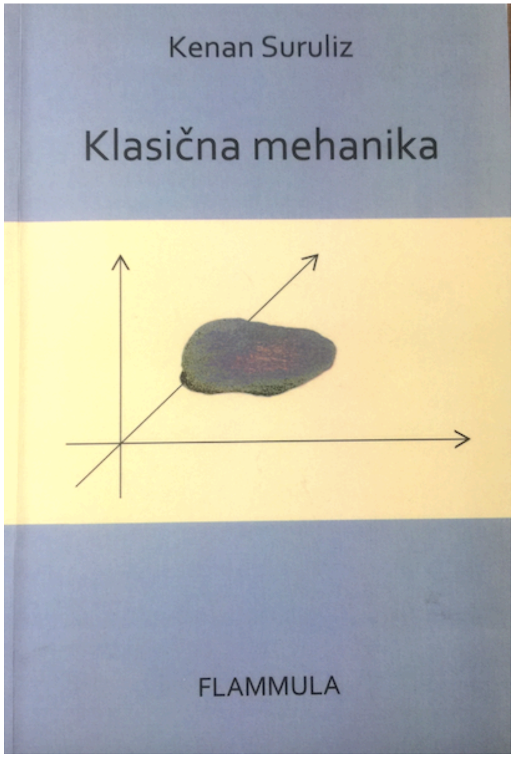
- Doktor fizičkih nauka, PMF u Sarajevu (1988). Doktorska disertacija: Duboko neelastično raspršenje i elementarne čestice.

Kenan Suruliz

Teorijska fizika

Matematika

Računarske metode



Sadržaj

MATEMATIČKE METODE FIZIKE - I Kenan Suruliz

Kenan Suruliz

MATEMATIČKE METODE FIZIKE - I

FLAMMULA

"Matematičke metode fizike - I" obrađuju bitne dijelove diferencijalnog i integralnog računa funkcija više realnih varijabli, diferencijalne jednadžbe i elemente vektorske analize.

ISBN 978-82-93290-01-8

MATEMATIČKE METODE FIZIKE II Kenan Suruliz

Kenan Suruliz

MATEMATIČKE METODE FIZIKE - II

FLAMMULA

U knjizi "Matematičke metode fizike - I" obrađene su teme ključne za primjenu matematike kako u teorijskoj fizici, tako i u tehnici, od teorije funkcija kompleksne varijable do parcijalnih diferencijalnih jednadžbi drugog reda. Razmotrene su integralne transformacije, prvenstveno Fourierova i Laplaceova, Sturm-Liouvilleov problem uključujući Fourierove redove, kao i specijalne funkcije najvažnije u primjenama u fizici, a isto tako elementi varijacionog računa i integralne jednadžbe.

ISBN 978-82-93290-02-5

Izabrane publikacije:

1) S. Fajfer, K. Suruliz, “A note on deep inelastic scattering in the quark-confining potential models”, Lett. Nuovo Cimento **42**, 39 (1985)

2) S. Fajfer, K. Suruliz, R. J. Oakes, “Effective low-energy, large-N Lagrangian calculation of the $K \to \pi\pi\pi\gamma$ decay modes”,
Phys. Rev. **D42**, 3875 (1990)

3) S. Fajfer, K. Suruliz, R. J. Oakes, “Isospin–violating radiative decays of the η meson”,
Phys. Rev. **D44**, 295 (1991)

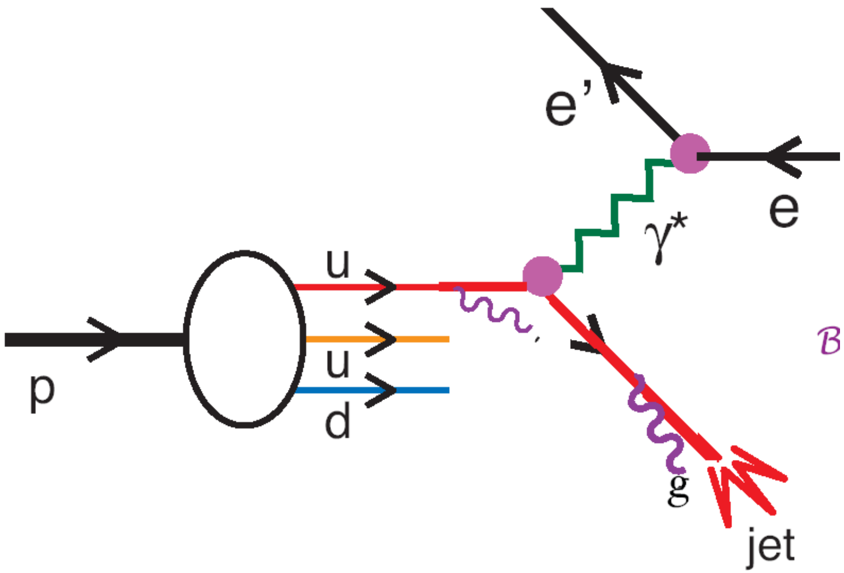
4) S. Fajfer, K. Suruliz, R. J. Oakes, “$\tau \to \omega\pi\nu_\tau$ decay”,
Phys. Rev. **D46**, 1195 (1992)

5) S. Fajfer, A. Ilakovac, D. Tadić, K. Suruliz, “$\Lambda_c \to p\bar{K}^0\pi\pi$ and $\Lambda_c \to p\bar{K}^0$ decay rates”,
Z. Phys. **C 62**, 421 (1994)

Duboko neelastično raspršenje

Rutherfordov eksperiment 1911, raspršenje α čestica na atomu
Postojanje atomskog jezgra

Kenanova doktorska disertacija

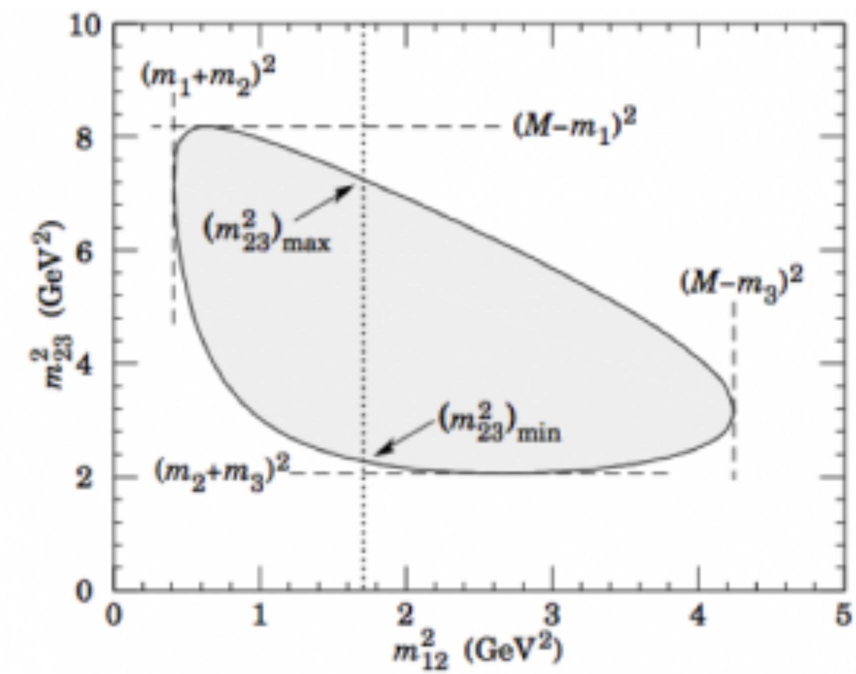


Za procese raspršenja elektrona na nukleonu, sa
velikom prenesenom energijom
proton je razbijen na sastavne dijelove: partoni

Nastajenje Teorije jakih interakcija:
Opis interakcije kvarkova I gluona

Nekoliko posjeta
Northwestern University, Evanston, USA
(NSF projekti)

Više - čestični fazni prostori



U fizici čestica postoje raspadi
Jedne čestice na dvije ili više njih

A $\rightarrow$ B + C + D + E

Program za integarale po faznom prostoru!

Odsjek za fiziku PMF, 4-ti sprat!

Chi writer!!!


NEUTRINO '96
in SARAJEVO


HEMIJSKI INSTITUT
INSTITUT A FIZIKU

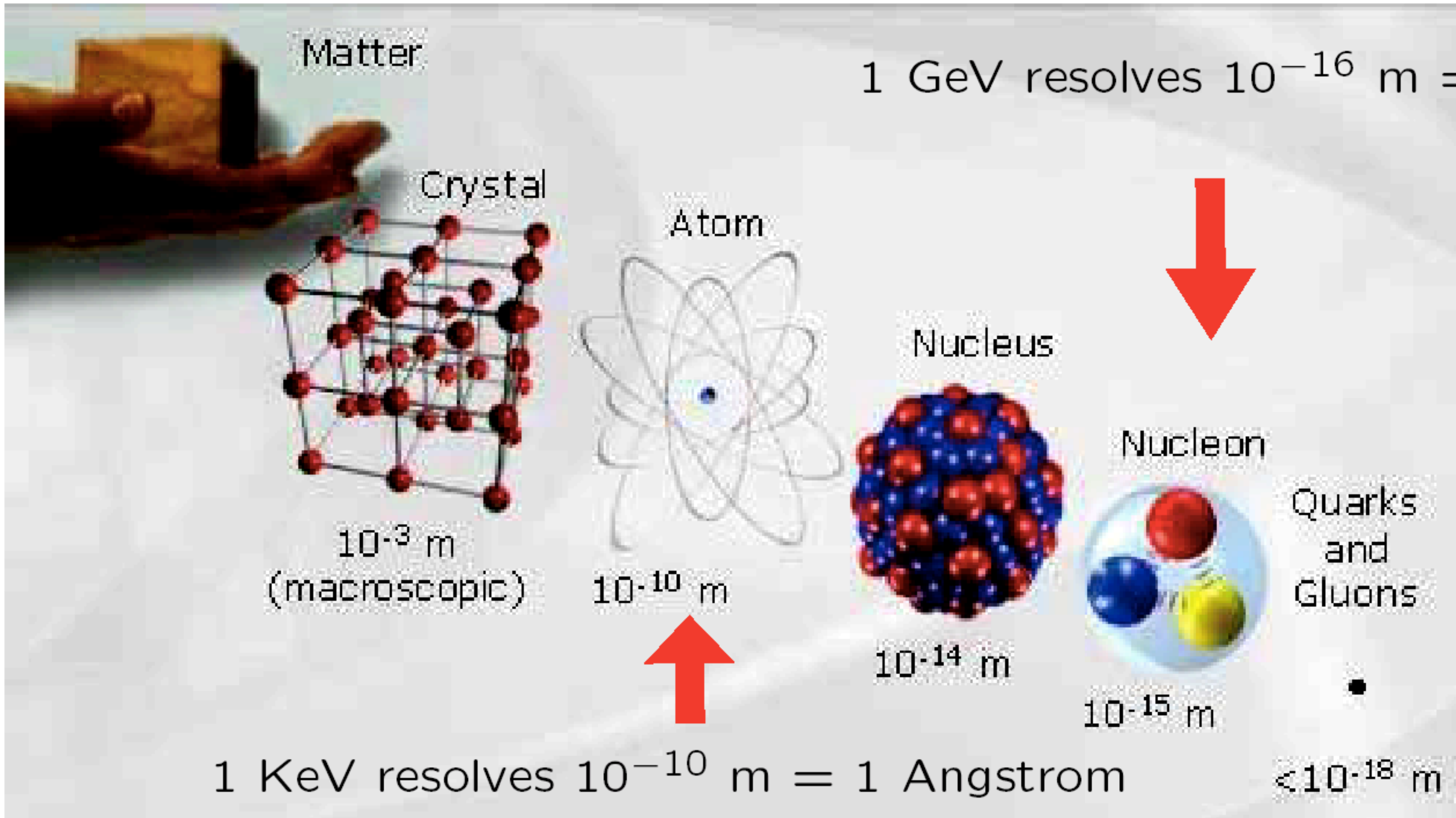
PMF Sarajevo
Odsjek za fiziku
Kenan Suruliz

PMF, Univerzitet u Sarajevu → Fizika elememtarnih čestica

Nekadašnji studenti PMF, u Sarajevu

Naučno-istraživački rad u Fizici čestica:

Damir Bečirević, Universite Paris Sud
Ilja Doršner, Sveučilište u Splitu
Svjetlana Fajfer, Univerza v Ljubljani
Admir Greljo, CERN, Geneve
Ina Šarčević, University of Arizona


Matter
Crystal
10^{-3} m
(macroscopic)
Atom
10^{-10} m
Nucleus
10^{-14} m
Nucleon
10^{-15} m
Quarks and Gluons
$<10^{-18}$ m
1 GeV resolves 10^{-16} m = 0.1 fm
1 KeV resolves 10^{-10} m = 1 Angstrom

Heisenbergov princip neodredjenosti

$$\Delta x \times \Delta p \sim \frac{h}{2\pi}$$

$1 \text{ TeV} \longrightarrow 10^{-19} \text{ m} = 0.0001 \text{ fm}$

$1 \text{ GeV} \longrightarrow 10^{-16} \text{ m} = 0.1 \text{ fm}$

$1 \text{ MeV} \longrightarrow 10^{-13} \text{ m} = 100 \text{ fm}$

$1 \text{ KeV} \longrightarrow 10^{-10} \text{ m} = 1 \text{ Angstrom}$

quantity	HEP unit	value in SI units	natural units $\hbar = c = 1$
length	1 fm	10^{-15} m	1 GeV^{-1} = 0.1975 fm
time	1 s	1 s	1 $\mathrm{GeV}^{-1} = 6.59\times10^{-25}$ s
energy	1 GeV = 10^9 eV	1.602×10^{-10} J	1 GeV
mass (E/c^2)	1 GeV/c^2	1.78×10^{-27} Kg	1 GeV
momentum(E/c)	1 GeV/c	5.34×10^{-19} Kg m s^{-1}	1 GeV
$\hbar = h/2\pi$	6.588×10^{-25} GeV s	1.055×10^{-34} Js	1
c	2.998×10^{23} fm/s	2.998×10^{8}m/s	1
$\hbar c$	0.1975 GeV fm	3.162×10^{-26} Jm	1

Fine structure constant $\alpha = e^2/4\pi = 1/137.06$

Heaviside-Lorentz units $\varepsilon_0 = \mu_0 = \hbar = c = 1$

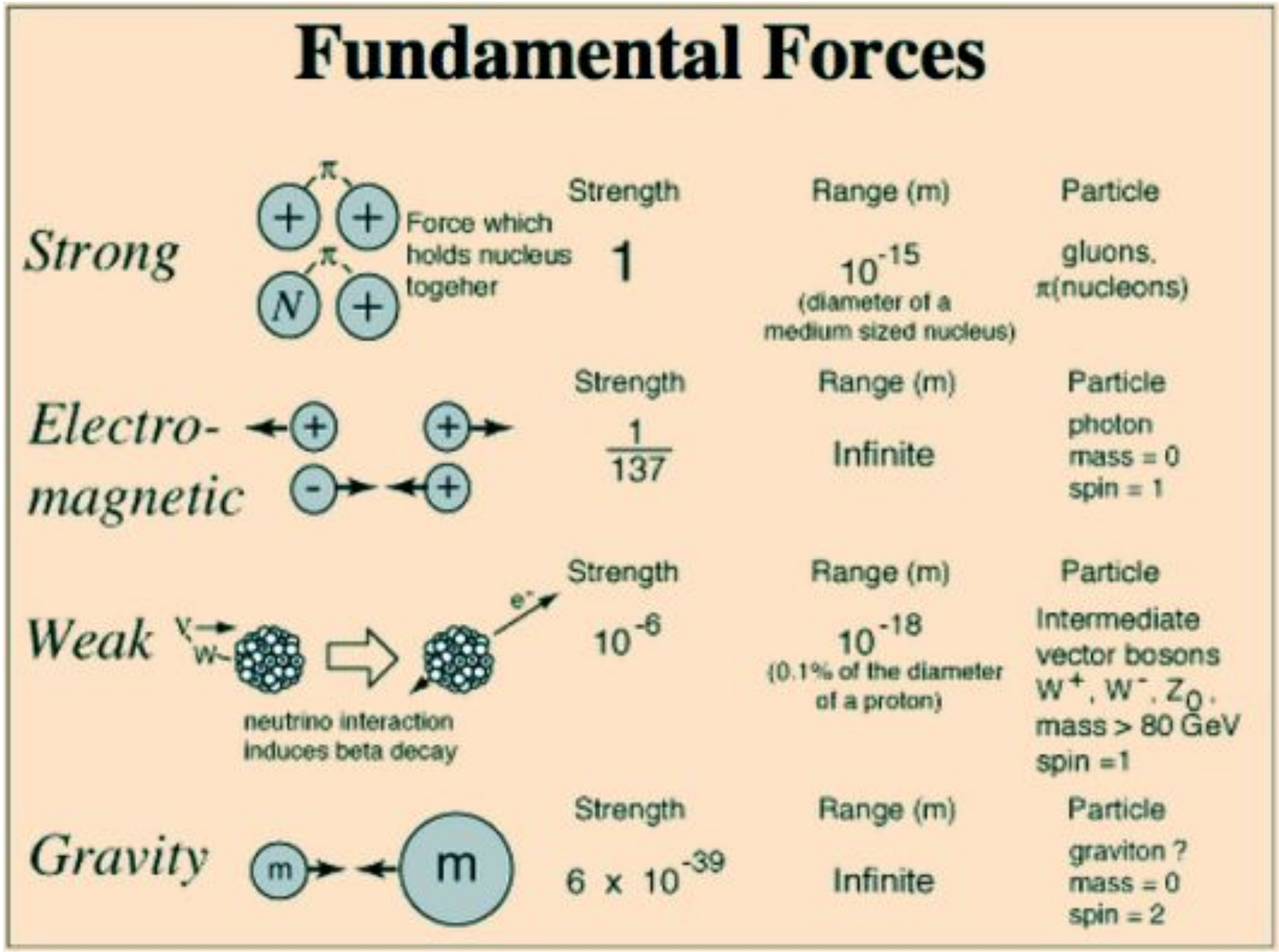
Od Kvantne teorije polja do Fizike čestica

Jaka interakcija

Elektromagnetna interakcija

Slaba interakcija

Gravitaciona interakcija



Standardni model osnovnih interakcija

fermioni
spin 1/2

	leptoni		kvarkovi		
	e 0.511 MeV	ν_e < 0.000003	d 7	u 3	
	μ 106	ν_μ < 0.2	s 120	c 1200	
	τ 1777	ν_τ < 20	b 4300	t 175,000	
	-1	0	$-1/3$	$2/3$	električni naboj

bozoni
spin 1

γ 0	photon	elektromagnetizem
g 0	gluon (8 "colors")	močna interakcija
$W^\pm$ 80,420	Z^0 91,188	slaba interakcija

Elektromagnetna in slaba interakcija

$$\mathcal{L}_{GWS} = \sum_f (\bar{\Psi}_f (i\gamma^\mu \partial\mu - m_f)\Psi_f - eQ_f \bar{\Psi}_f \gamma^\mu \Psi_f A_\mu) +$$

$$+ \frac{g}{\sqrt{2}} \sum_i (\bar{a}_L^i \gamma^\mu b_L^i W_\mu^+ + \bar{b}_L^i \gamma^\mu a_L^i W_\mu^-) + \frac{g}{2c_w} \sum_f \bar{\Psi}_f \gamma^\mu (I_f^3 - 2s_w^2 Q_f - I_f^3 \gamma_5) \Psi_f Z_\mu +$$

$$- \frac{1}{4} |\partial_\mu A_\nu - \partial_\nu A_\mu - ie(W_\mu^- W_\nu^+ - W_\mu^+ W_\nu^-)|^2 - \frac{1}{2} |\partial_\mu W_\nu^+ - \partial_\nu W_\mu^+ +$$

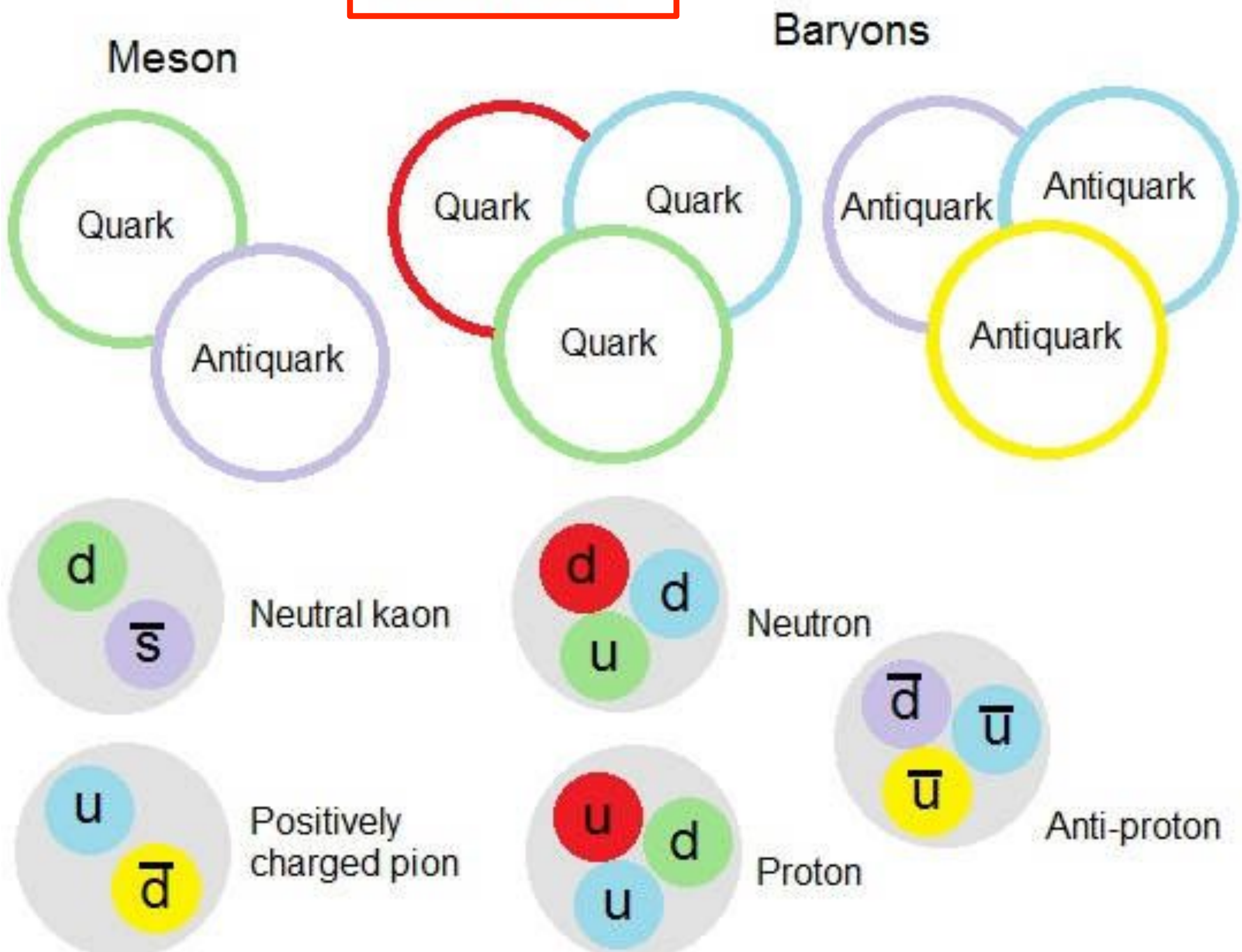
$$- ie(W_\mu^+ A_\nu - W_\nu^+ A_\mu) + ig' c_w (W_\mu^+ Z_\nu - W_\nu^+ Z_\mu|^2 +$$

$$- \frac{1}{4} |\partial_\mu Z_\nu - \partial_\nu Z_\mu + ig' c_w (W_\mu^- W_\nu^+ - W_\mu^+ W_\nu^-)|^2 +$$

$$- \frac{1}{2} M_\eta^2 \eta^2 - \frac{g M_\eta^2}{8 M_W} \eta^3 - \frac{g'^2 M_\eta^2}{32 M_W} \eta^4 + |M_W W_\mu^+ + \frac{g}{2} \eta W_\mu^+|^2 +$$

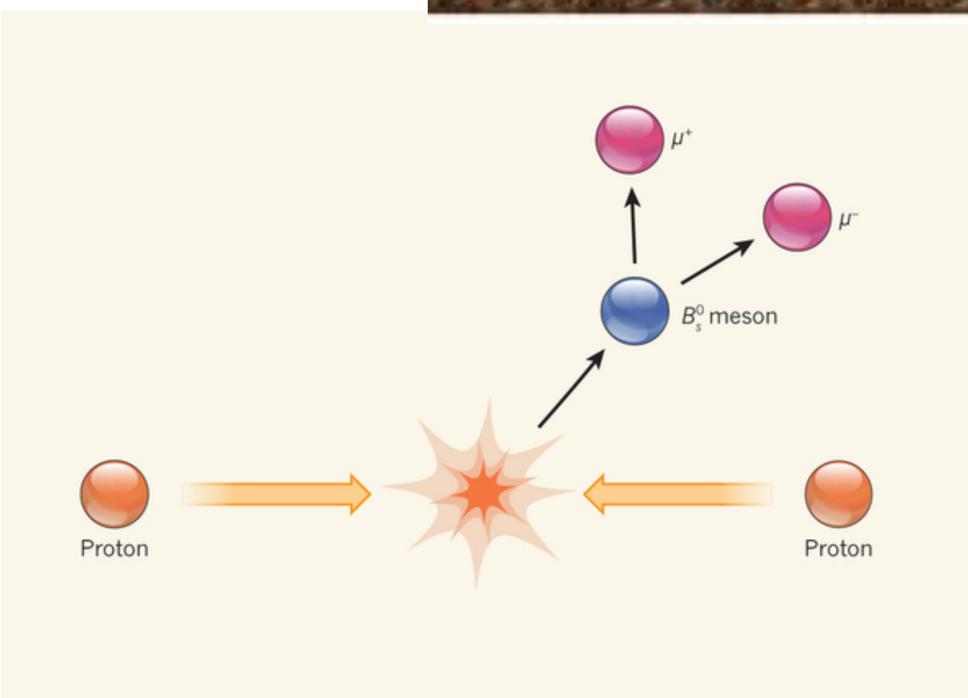
$$+ \frac{1}{2} |\partial_\mu \eta + i M_Z Z_\mu + \frac{ig}{2c_w} \eta Z_\mu|^2 - \sum_f \frac{g}{2} \frac{m_f}{M_W} \bar{\Psi}_f \Psi_f \eta$$

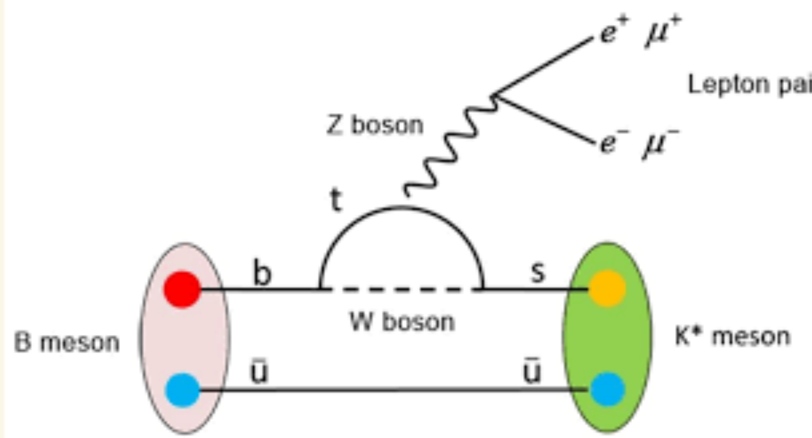
Hadrons



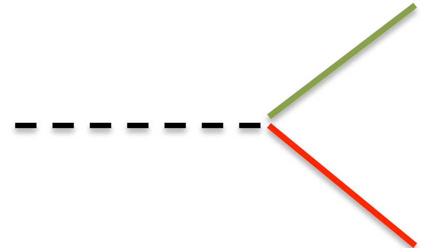
Meson
Baryons
Quark
Antiquark
Quark
Quark
Quark
Antiquark
Antiquark
Antiquark
d
s̄
Neutral kaon
d
d
u
Neutron
d̄
ū
ū
Anti-proton
u
d̄
Positively charged pion
u
d
u
Proton

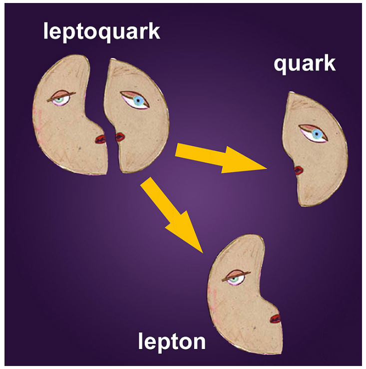

Large Hadron Collider
CMS
p
p
LHCb
ATLAS
ALICE

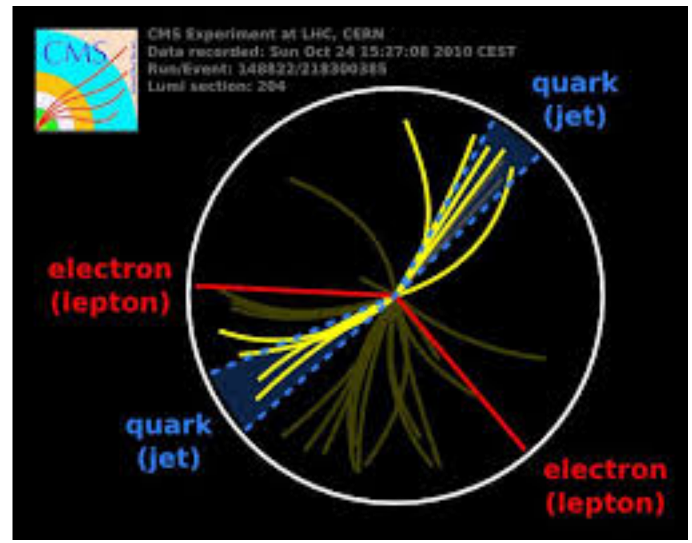

μ^+
μ^-
B_s^0 meson
Proton
Proton


e^+ μ^+
Lepton pair
Z boson
e^- μ^-
t
b
s
W boson
B meson
K* meson
ū
ū

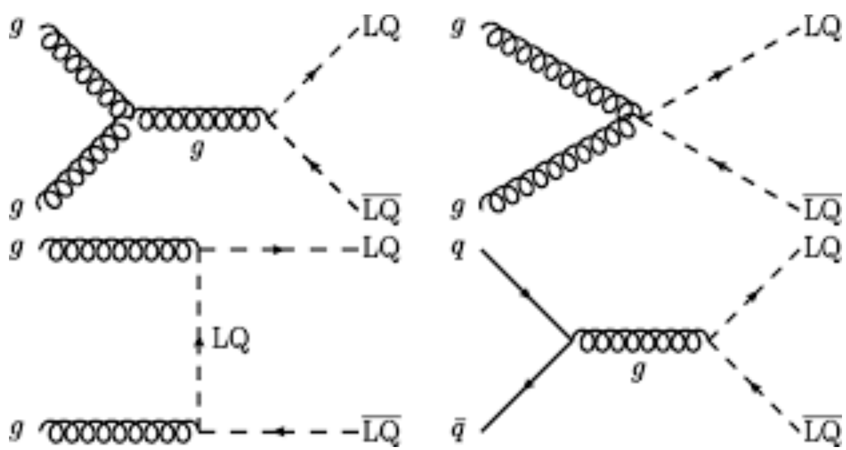
Leptokvarkovi







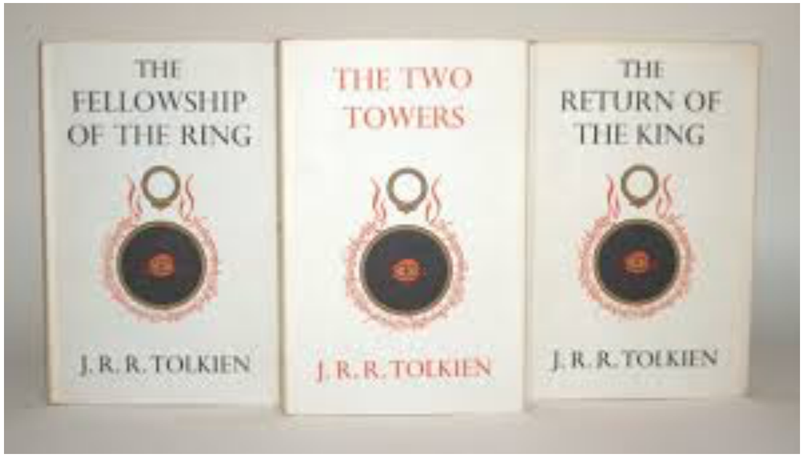
Prenose Interakciju izmedju kvarkova I leptona
Spin 0 ili 1



Damir Bečirević,
Ilja Doršner,
Svjetlana Fajfer,
Admir Greljo,

Kenan izvan fizike

In ancient times the Rings of Power were crafted by the Elven-smiths, and Sauron, the Dark Lord, forged the One Ring, filling it with his own power so that he could rule all others. But the One Ring was taken from him, and though he sought it throughout Middle-earth, it remained lost to him. After many ages it fell by chance into the hands of the hobbit Bilbo Baggins.



Kenanu Surulizu: uz zahvalnost, najbolje želje za dobro zdravlje i puno radosti u svakodnevnom životu!