

8.701

Introduction to Nuclear
and Particle Physics

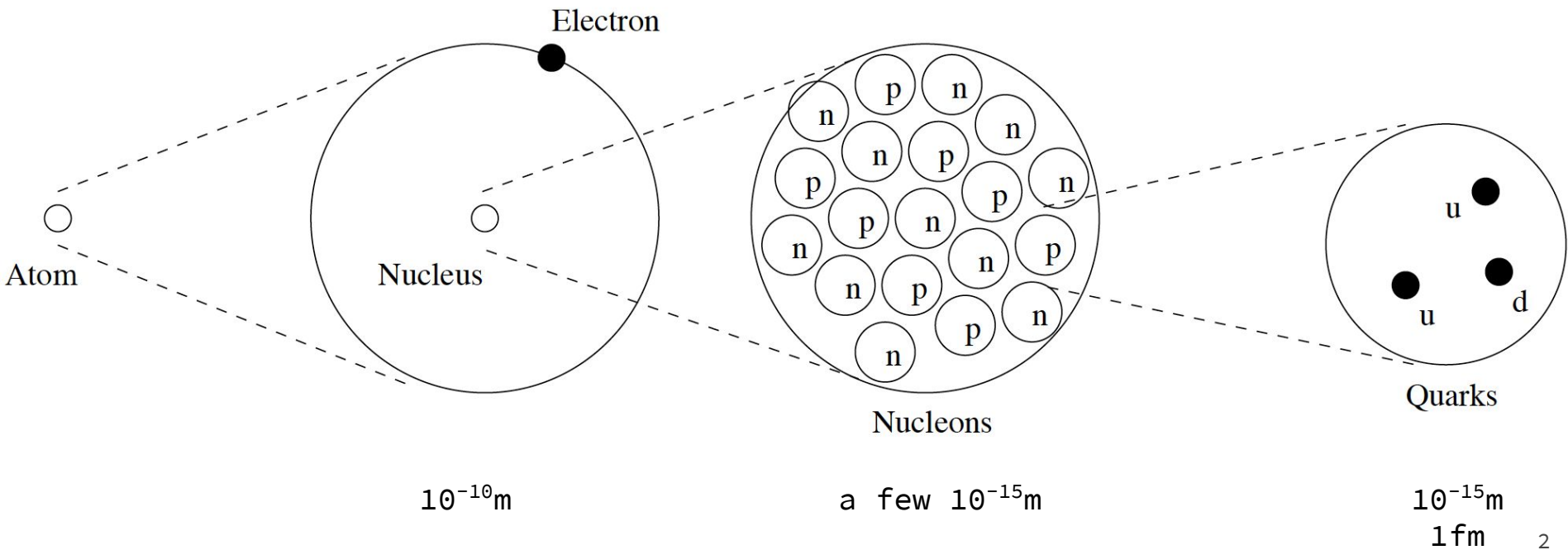
Markus Klute - MIT

0. Introduction

0.6 Particles

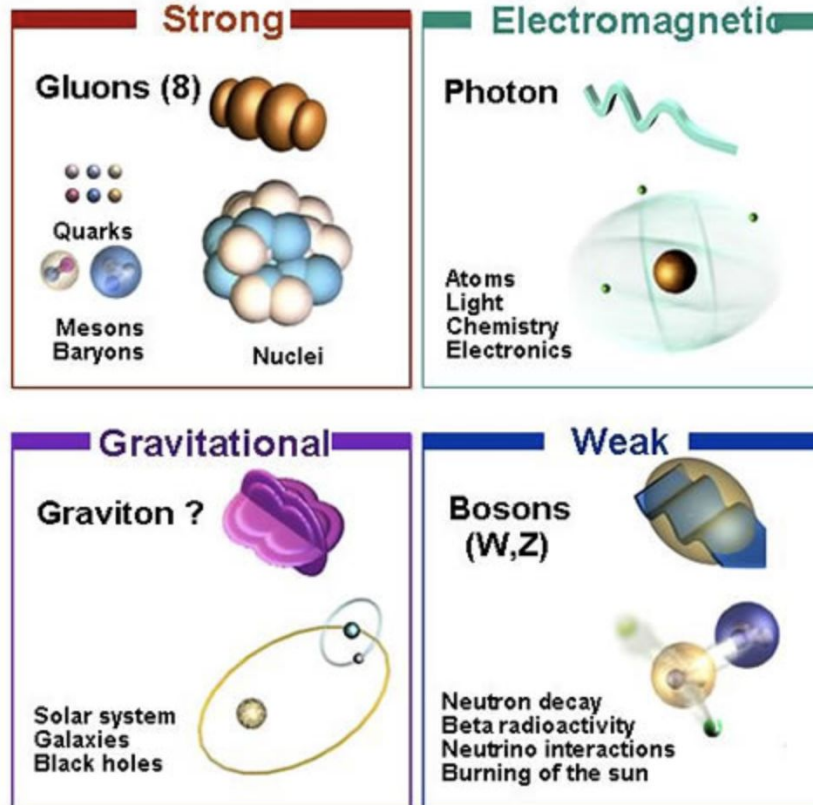


Introduction



Force Particles

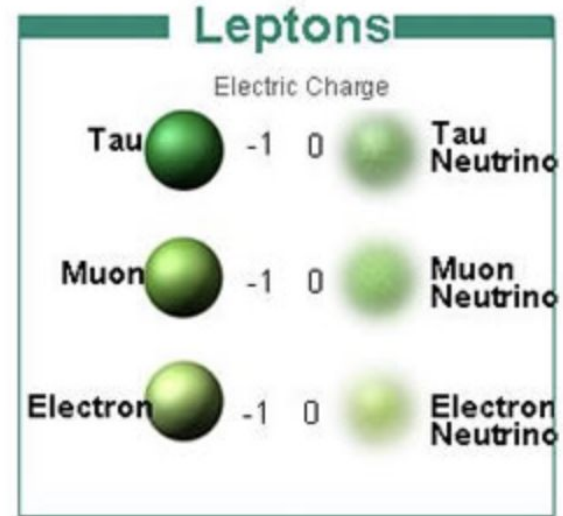
Force	Name	Symbol	Number	EM charge
Strong	Gluons	g	8	0
EM	Photon	γ	1	0
Weak	W and Z	W^{\pm}, Z^0	3	$\pm 1, 0$



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Matter Particles

	Generation			Charge Units of e	Feels the force of		
	1 st	2 nd	3 rd		Strong	EM	Weak
U-Type Quarks ($\times 3$ colours)	u	c	t	$+2/3$	Y	Y	Y
D-Type Quarks ($\times 3$ colours)	d	s	b	$-1/3$	Y	Y	Y
Charged Leptons	e	μ	τ	-1	N	Y	Y
Neutral Leptons (Neutrinos)	ν_e	ν_μ	ν_τ	0	N	N	Y

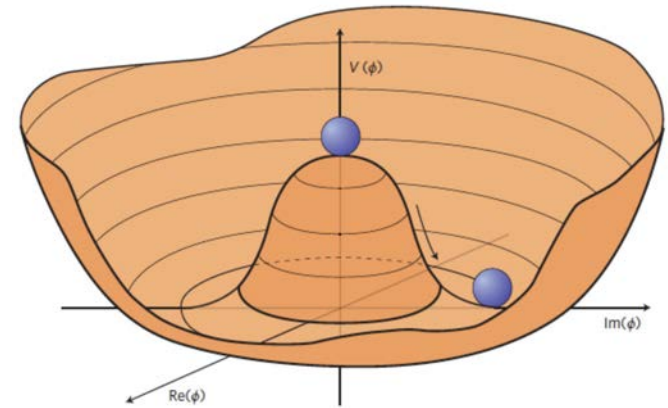
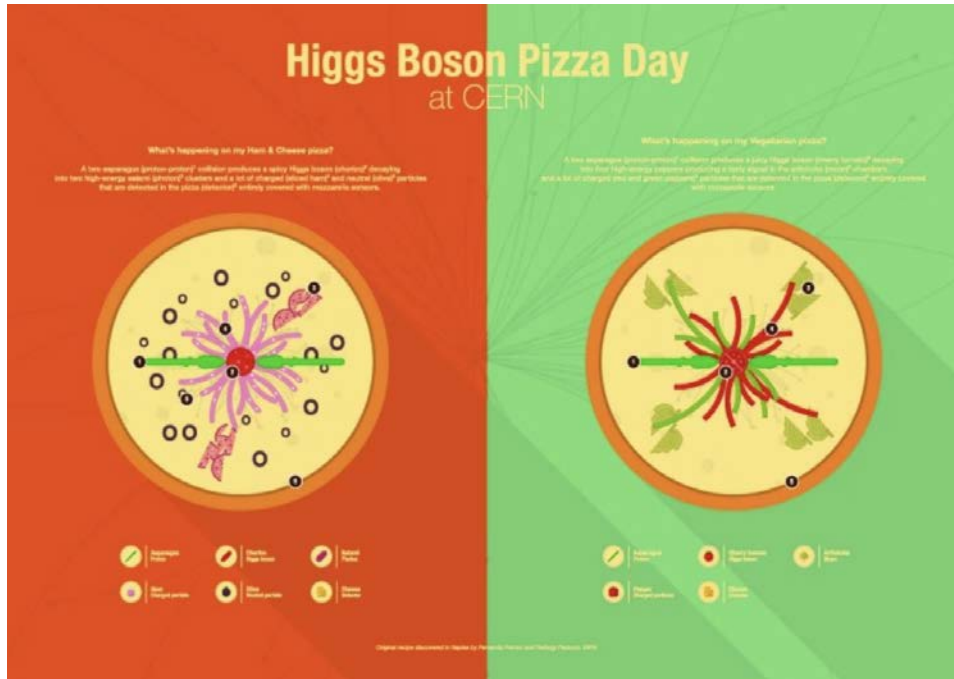


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$$m_e = 9.11 \times 10^{-31} \text{ kg}, \quad m_\mu = 1.88 \times 10^{-28} \text{ kg}, \quad m_\tau = 3.17 \times 10^{-27} \text{ kg}$$

The Higgs Boson

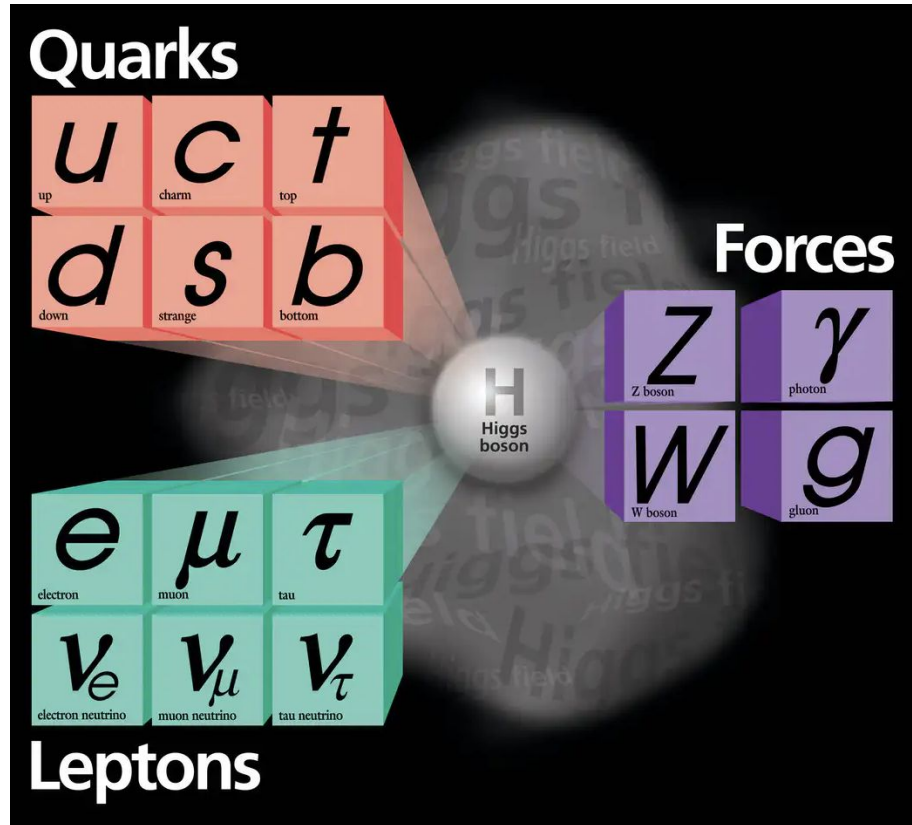
Name	Symbol	Number	Charge
Higgs	H	1	0



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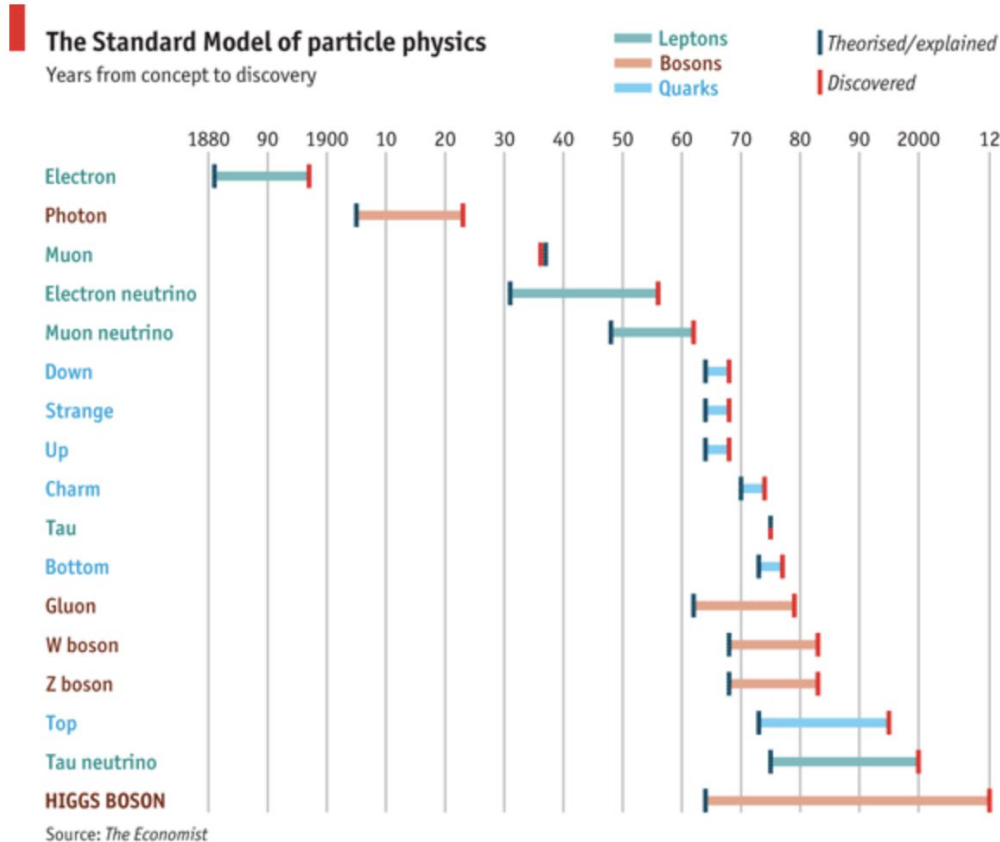
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Elementary Particle



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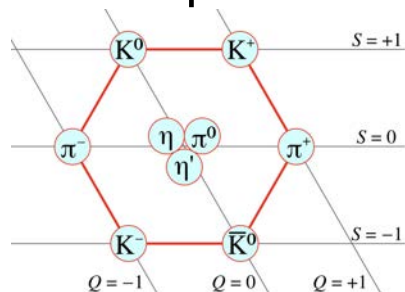
Timeline of Discoveries



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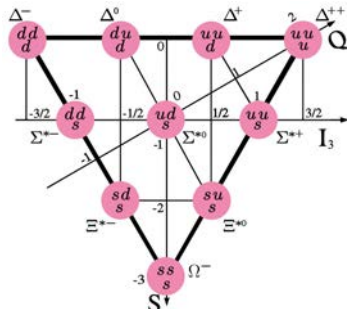
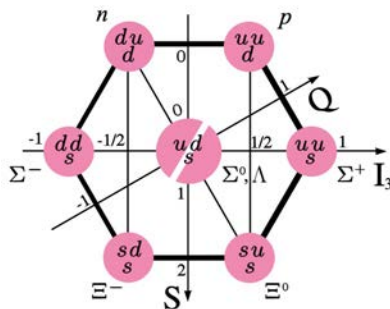
Composite Particles and Hadrons

Mesons: quark-antiquark states; bosons

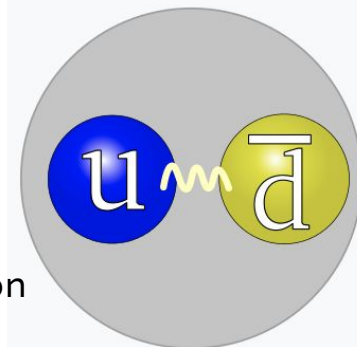


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Baryons: three-quark states; fermions

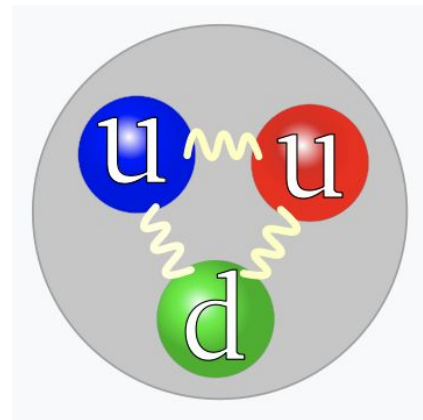


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Pion

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Proton

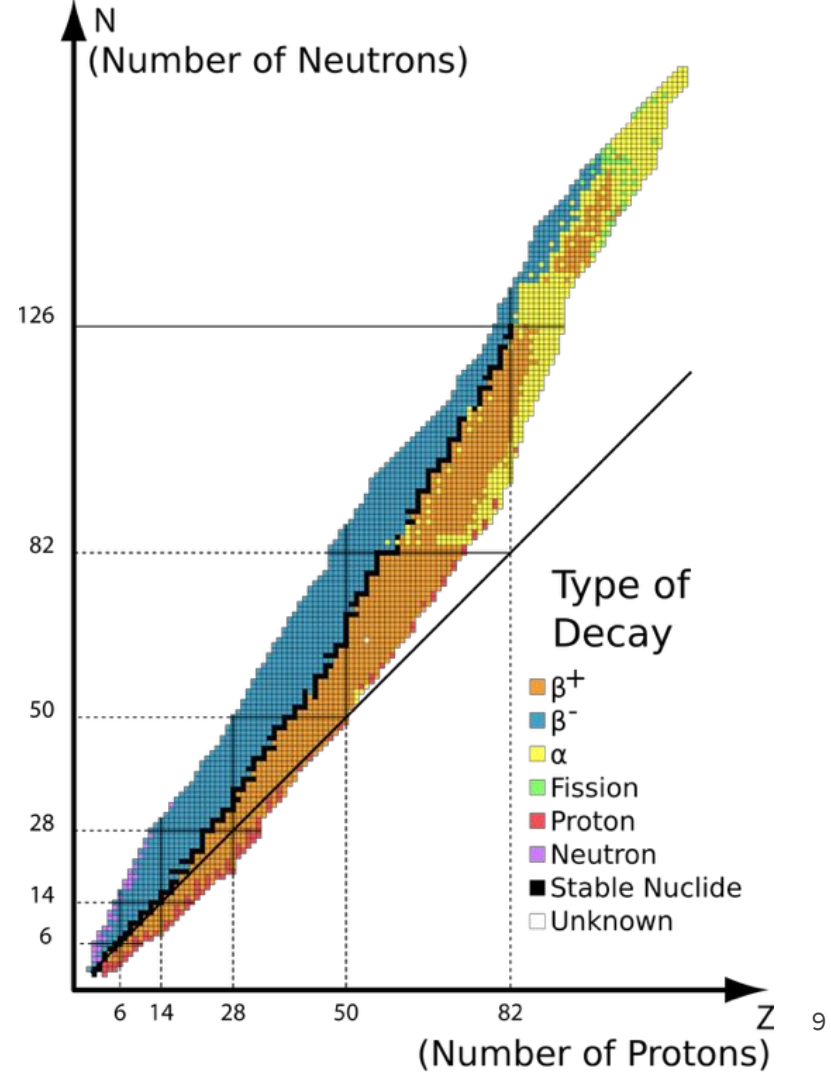
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Nuclei

Bound state of protons and neutrons through the strong force.

Can be described by number of protons, Z , (atomic number) and number of neutrons, N . The sum $Z+N$ is denoted atomic mass A

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8.701 Introduction to Nuclear and Particle Physics
Fall 2020

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