DIVING INTO HIGH ENERGY PHYSICS

BY
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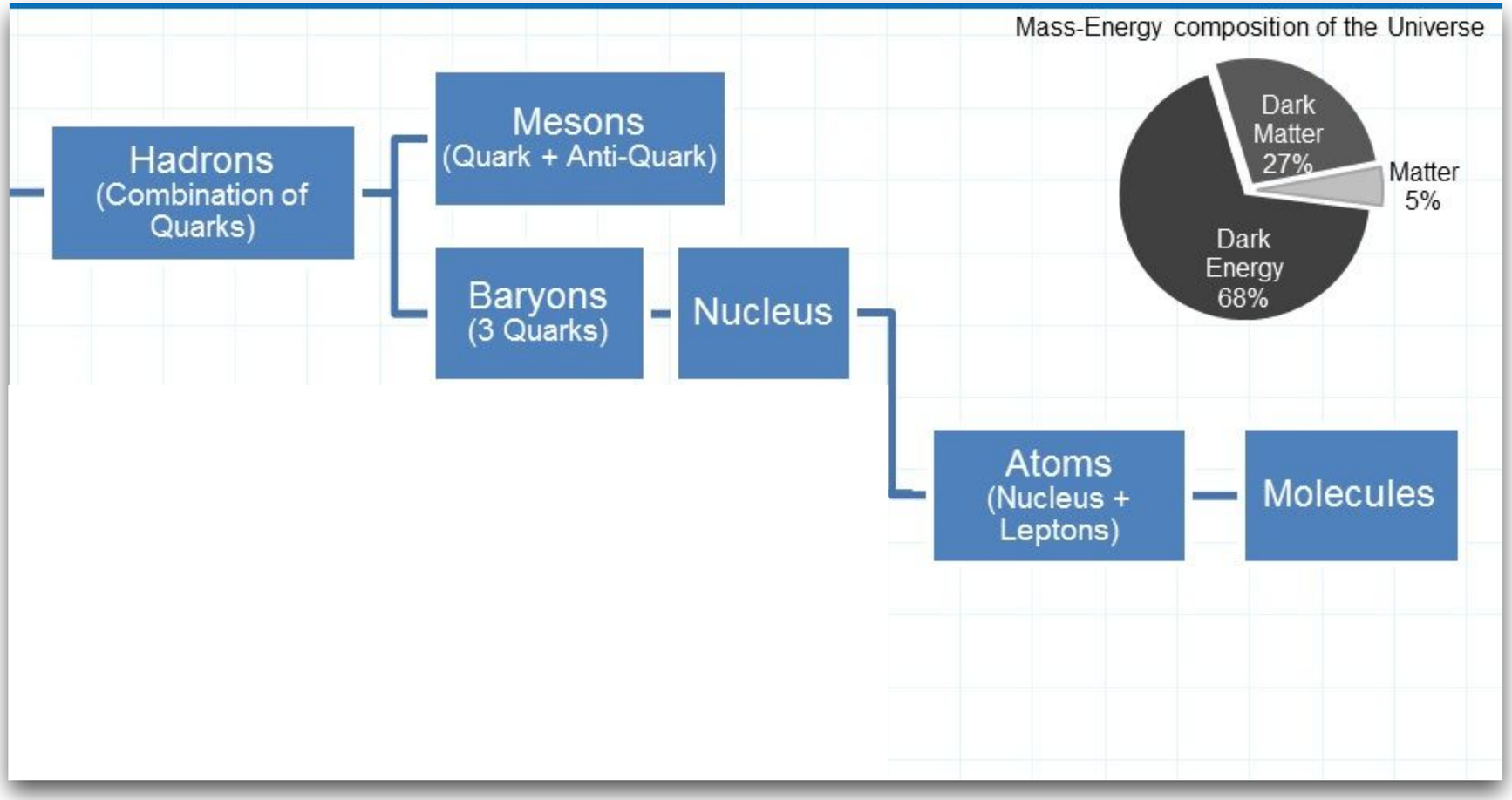
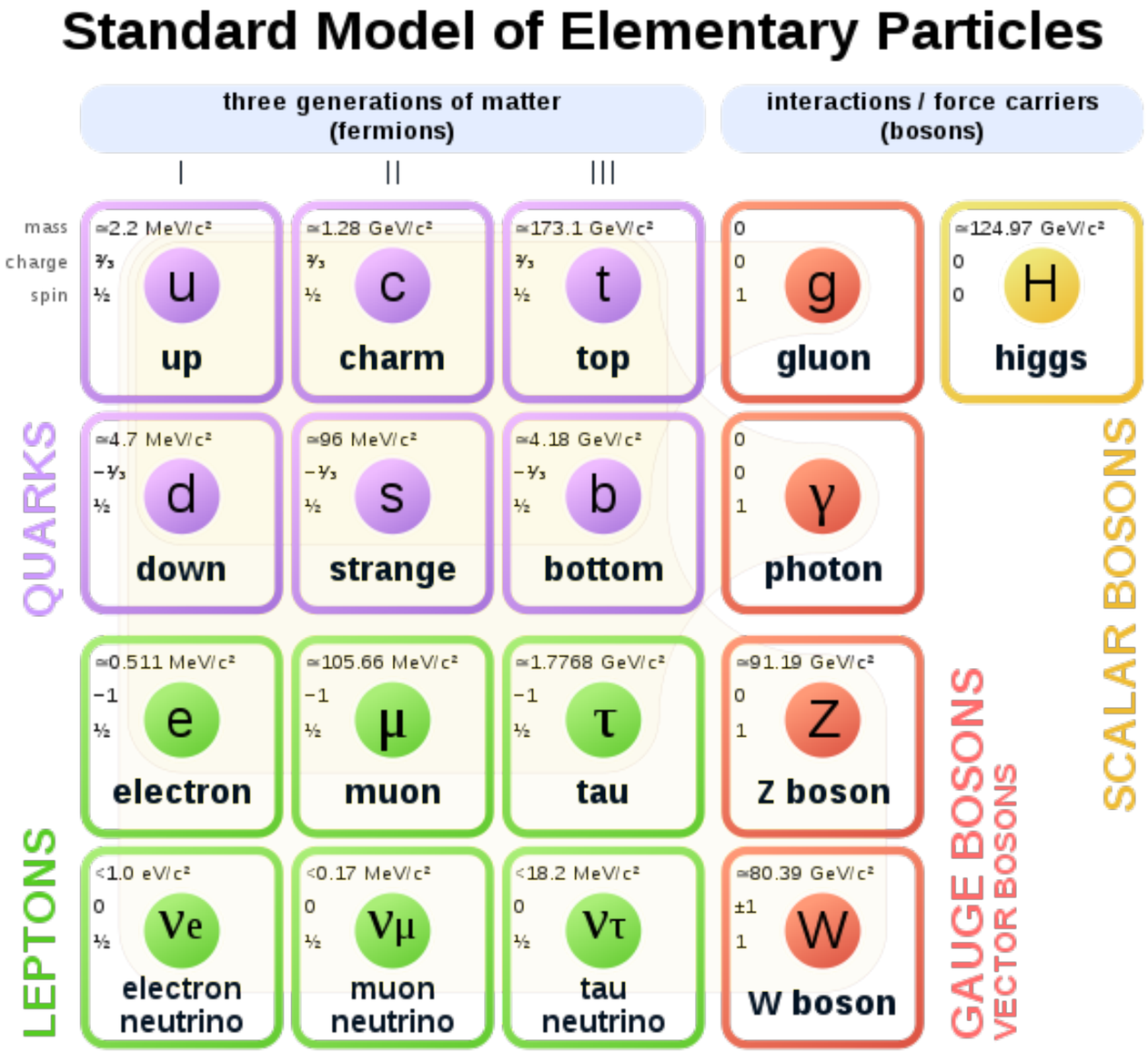


BUILDING BLOCKS

Fundamental particles

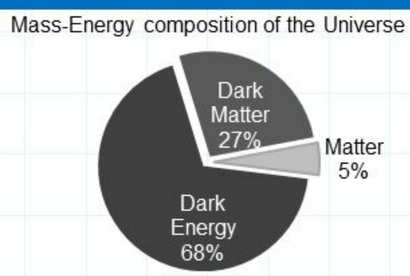


FORCE CARRIERS

Fundamental Force Particles

Force	Particles Experiencing	Force Carrier Particle	Range	Relative Strength*
Gravity acts between objects with mass	all particles with mass	graviton (not yet observed)	infinity	much weaker ↓ much stronger
Weak Force governs particle decay	quarks and leptons	W^+, W^-, Z^0 (W and Z)	short range	
Electromagnetism acts between electrically charged particles	electrically charged	γ (photon)	infinity	
Strong Force** binds quarks together	quarks and gluons	g (gluon)	short range	

Standard Model of Physics and the 'Theory of Everything'



Elementary Particles

- Fermions
  - Matter
  - Antimatter
- Bosons
  - Force Carriers
  - Scalar

	1st Generation	2nd Generation	3rd Generation
Quarks	u up (2/3, 1/2)	c charm (2/3, 1/2)	t top (2/3, 1/2)
	d down (-1/3, 1/2)	s strange (-1/3, 1/2)	b bottom (-1/3, 1/2)
Leptons	e electron (-1, 1/2)	μ muon (-1, 1/2)	τ tau (-1, 1/2)
	ν_e electron neutrino (0, 1/2)	ν_μ muon neutrino (0, 1/2)	ν_τ tau neutrino (0, 1/2)

Quarks → Hadrons (Combination of Quarks) → Mesons (Quark + Anti-Quark) / Baryons (3 Quarks) → Nucleus → Atoms (Nucleus + Leptons) → Molecules

Gluons (g) (0, 1)	Strong force (Binding atomic nucleus)	Grand Unified Theory
Photons (γ) (0, 1)	Electromagnetism	Electroweak Theory
W & Z Bosons (±1, 1) & (0,1)	Weak force (Radioactivity & Nuclear fusion)	Electroweak Theory
Graviton (1,1) (Hypothetical)	Gravitational force (Weakest)	THEORY OF EVERYTHING
Higgs Boson (H) (0, 0)		

Boson-Fermion interaction
Photon- W Boson interaction
In bracket's: charge, spin

Meson

Particle anti particle pair
Don't annihilate, why?

Mesons $q\bar{q}$					
Symbol	Name	Quark content	Electric charge	Mass GeV/c^2	Spin
π^+	pion	$u\bar{d}$	+1	0.140	0
K^-	kaon	$s\bar{u}$	–1	0.494	0
ρ^+	rho	$u\bar{d}$	+1	0.770	1
B^0	B-zero	$d\bar{b}$	0	5.279	0
η_c	eta-c	$c\bar{c}$	0	2 .980	0

Antimatter

How does it differ from matter?

FACTS


THANK YOU