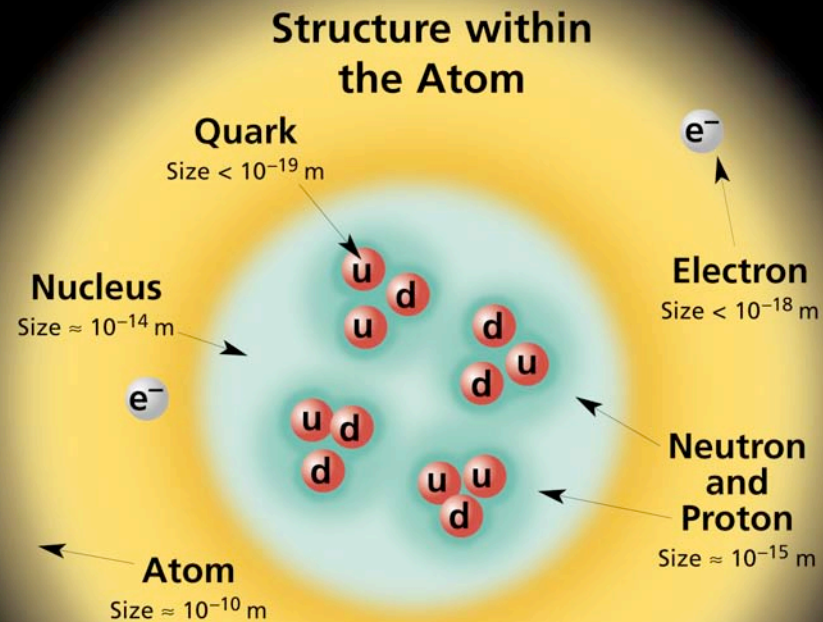


Sub-atomic Mystery Particles



If the protons and neutrons in this picture were 10 cm across, then the quarks and electrons would be less than 0.1 mm in size and the entire atom would be about 10 km across.

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What is this ring made of ?



What does the Periodic Table tell us about atoms?

H																		He
Li	Be											B	C	N	O	F	Ne	
Na	Mg											Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub							
			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

Sub-atomic particles:

nucleus

proton

quark,
electron

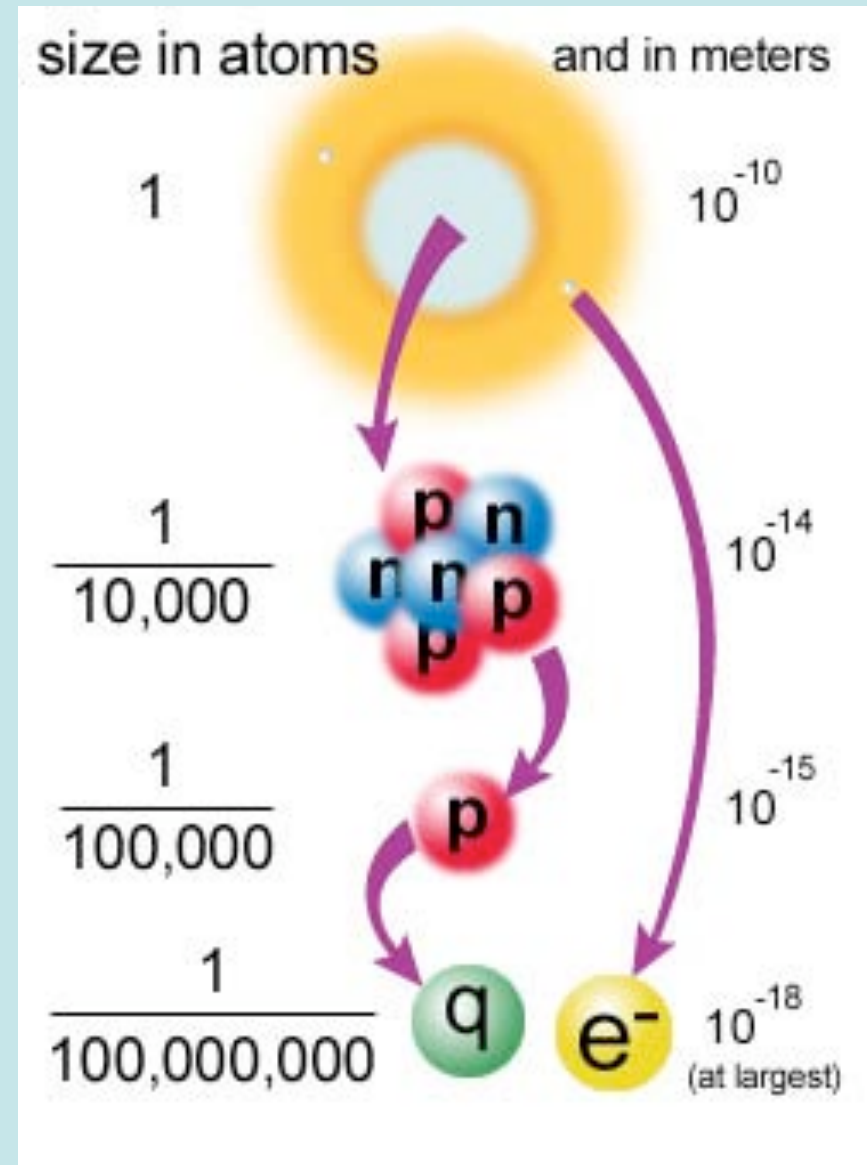


Table of sub-atomic mystery particles

Leptons spin = 1/2			Quarks spin = 1/2		
Flavor	Mass GeV/c ²	Electric charge	Flavor	Approx. Mass GeV/c ²	Electric charge
ν_e electron neutrino	$<1 \times 10^{-8}$	0	u up	0.003	2/3
e electron	0.000511	-1	d down	0.006	-1/3
ν_μ muon neutrino	<0.0002	0	C charm	1.3	2/3
μ muon	0.106	-1	S strange	0.1	-1/3
ν_τ tau neutrino	<0.02	0	t top	175	2/3
τ tau	1.7771	-1	b bottom	4.3	-1/3

Why are there so many different
kinds of particles?

What do the differences teach us?

Mystery particle #1: Top quark (t)



Mystery particle #2: Neutrino (ν)

Cosmic Gall

Neutrinos, they are very small

They have no charge and little mass

And scarcely interact at all

...

John Updike (updated)

Sub-atomic particles matter!

- History: alchemy, atomic weapons
- Astronomy: sunshine, “metals”, cosmology
- Medicine: PET, MRI, chemotherapy
- Household: smoke detectors, radon
- Computers: the World-Wide Web
- Archaeology & Earth Sciences: dating

