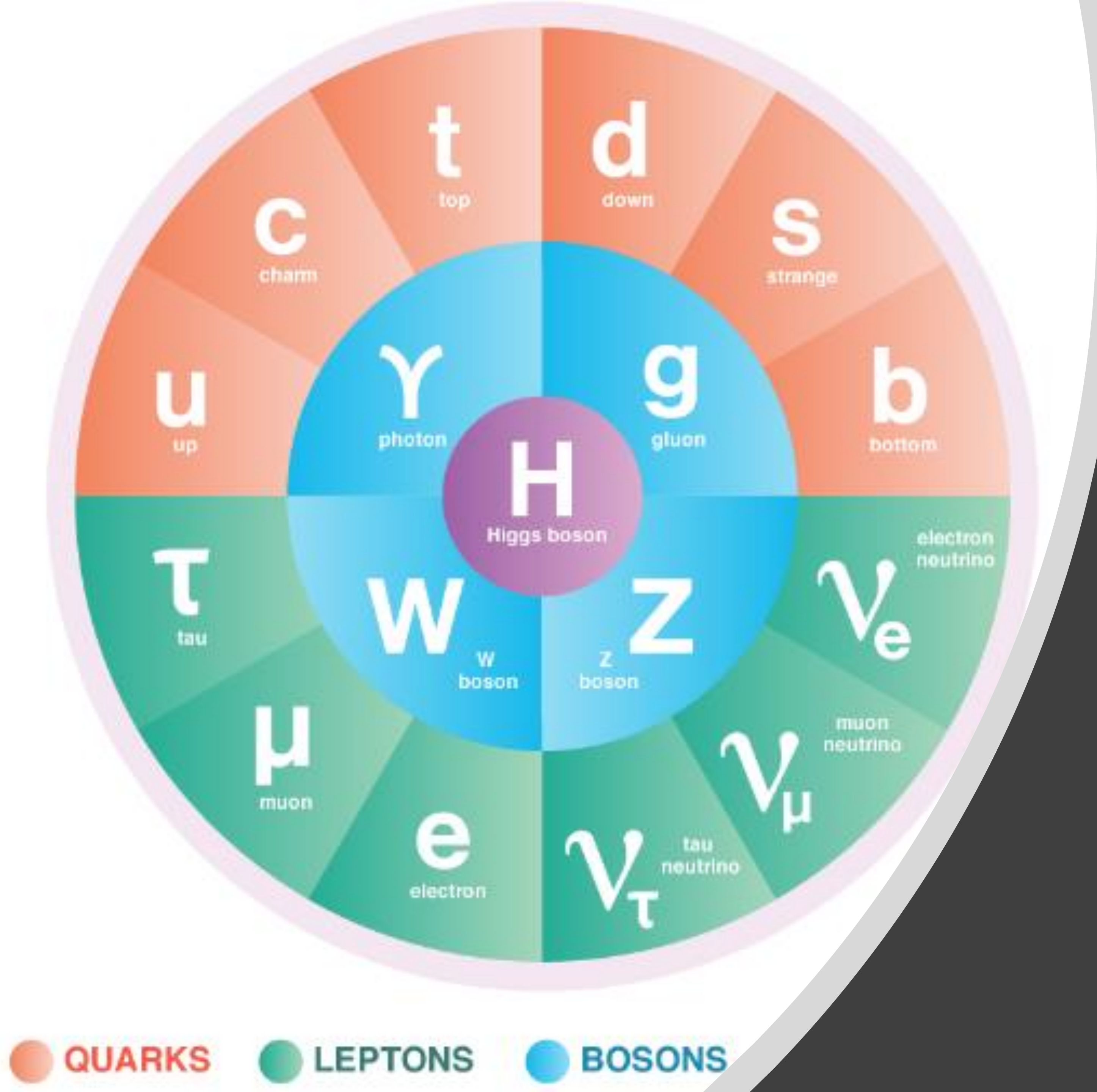


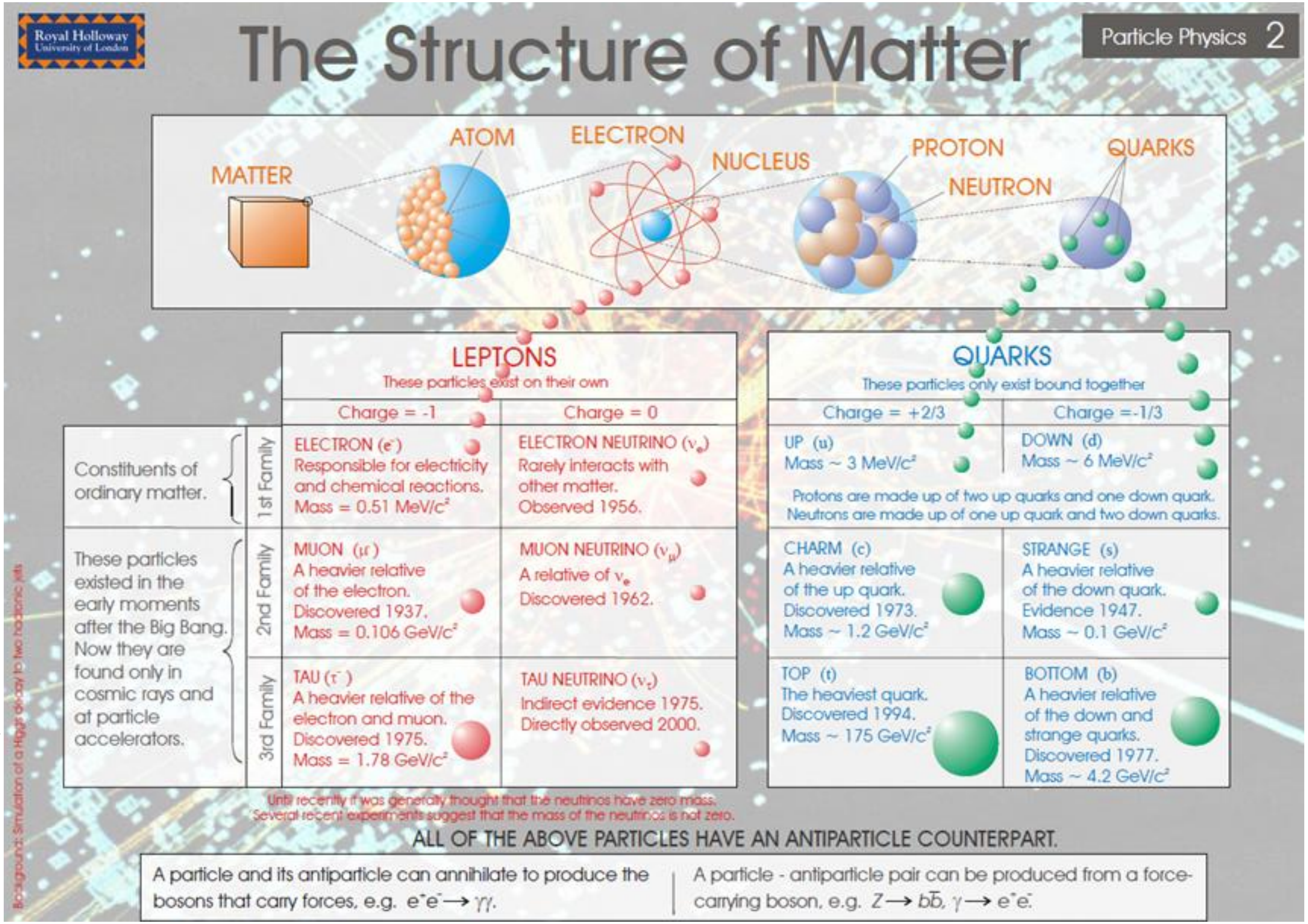
The Standard Model

In cupcakes!

Let’s eat our way through this topic!

- Thanks to Sally Weatherly for the original cupcake idea!

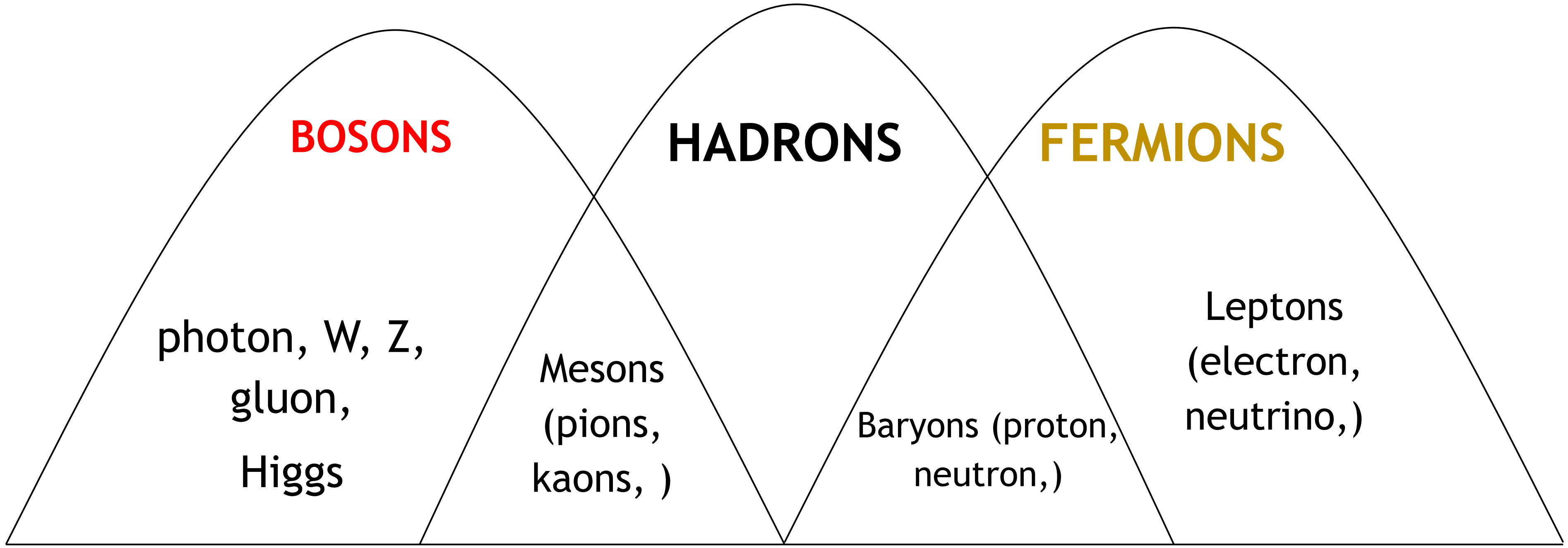
The standard model represents our best understanding of the fundamental nature of matter. It proposes 12 fundamental matter particles, fermions, organised in three generations. The first generation includes the electron, the neutrino and the two quarks that make up protons and neutrons, i.e. the normal matter of our universe. The other generations are only found in high-energy collisions in particle accelerators or in naturally occurring cosmic rays. Each has a charge of a fraction of the charge on an electron (1.60×10^{-19} C).



Let’s Tweet! :in 140 characters or less

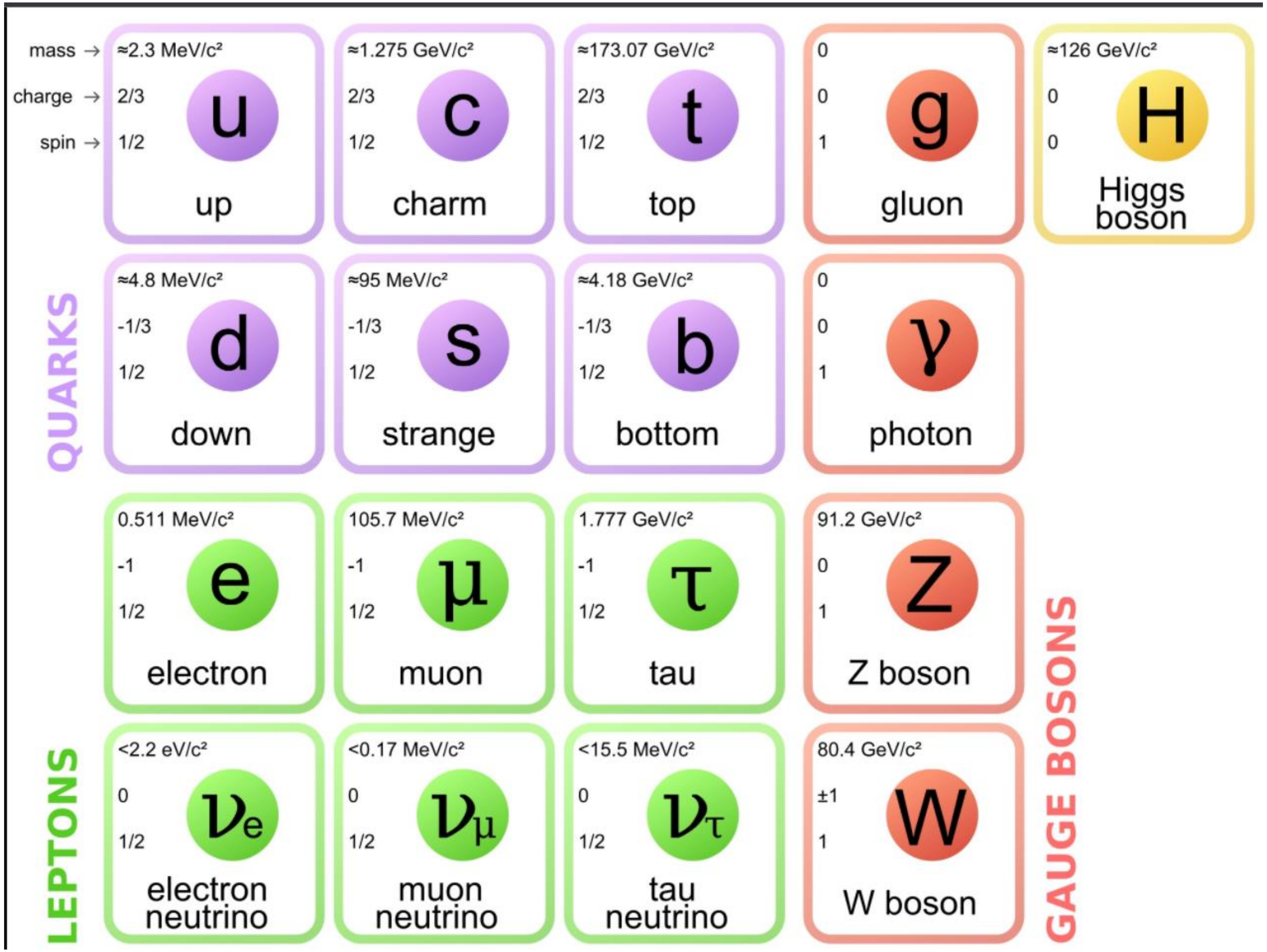
#HADRON	#MUON
#BARYON	#ANNIHALATE
#MESON	#BOSON
#POSITRON	#LEPTON
#STANDARD MODEL	#4 FUNDAMENTAL FORCES
#NEUTRINO	#STRONG FORCE
#QUARK	#WEAK FORCE
#GLUON	#GRAVITATIONAL FORCE
#COLOUR	#ANTIMATTER
#SPIN	#FERMION
#EXCHANGE PARTICLE	
#ELECTROMAGNETIC FORCE	

Classification of particles



For example, a proton is both a fermion (a matter particle) and a hadron (a particle made up of quarks), Bosons are called the Exchange particles.

The Particle Zoo



Code to our Quarks

Skittle	Colour	Corresponding Quark
	Yellow	Up
	Red	Down
	Green	Strange
	Yellow with s facing up	Anti-Up
	Red with s facing up	Anti-Down
	Green with s facing up	Anti-Strange

You will be given a cupcake and the particle you are to build
Collect the Skittles you need and build your particle. (wash hands and lift the skittles with covid safe tweezers!)
Place it on the "dining table" for us to all identify, add your name underneath but not the name of your particle
Go and identify each person's particle and fill in the table. If you built the wrong particle I eat your cupcake!

A Delicious Way to Classify Particles copy the table

2 or 3 “quarks”?	Baryon or Meson?	Quark Composition	Name of particle	Baryon Number	Charge
3	Baryon	uud	proton	1	+(2/3)+2/3)-(1/3) = 1

Mesons

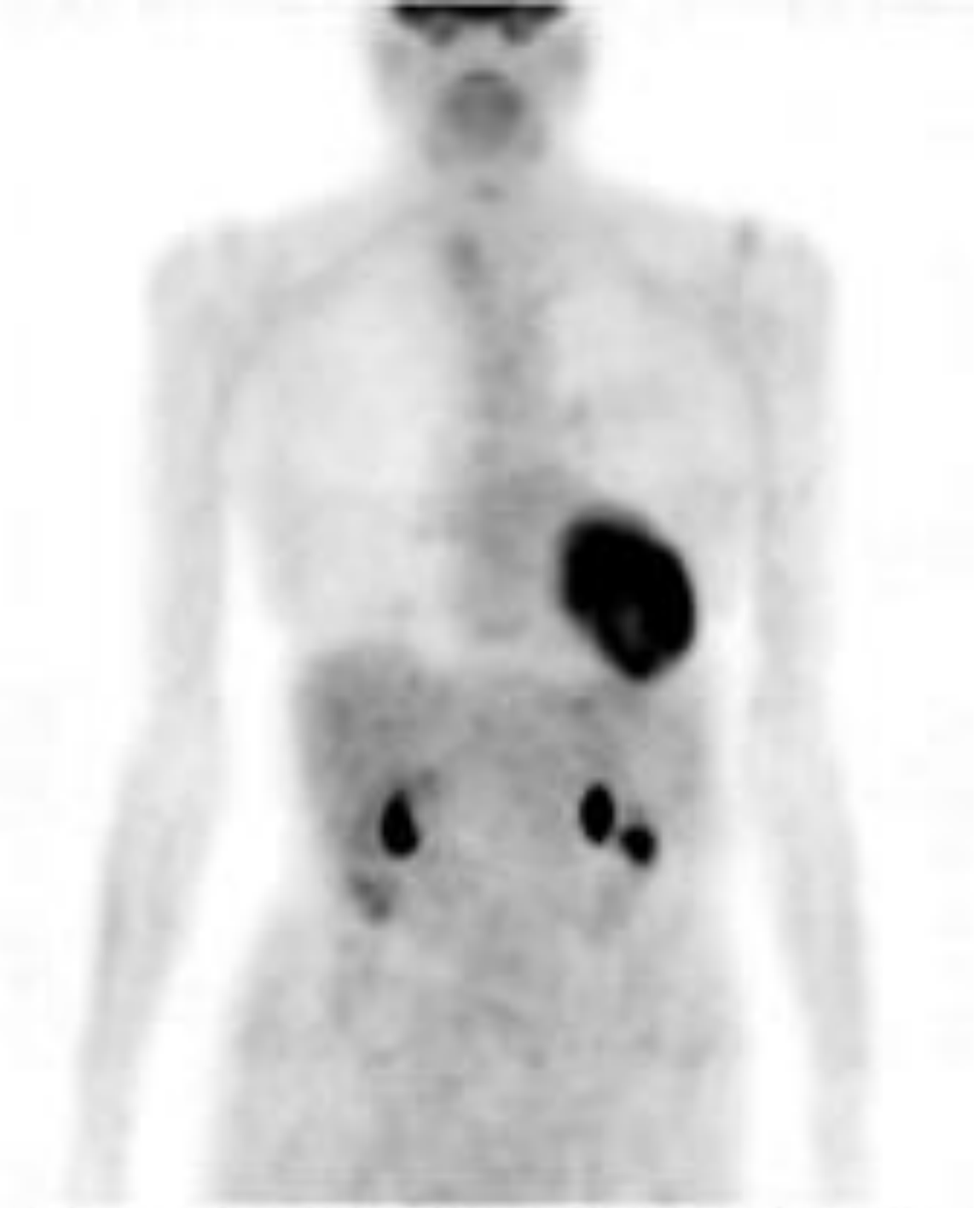
Meson	Symbol	Baryon No. (B)	Charge (Q)	Strangeness (S)	Quark Structure
kay-plus	K^+	0	+1	1	$u\bar{s}$
kay-zero	K^0	0	0	1	$d\bar{s}$
kay-minus	K^-	0	-1	1	$s\bar{u}$
phi	ϕ^0	0	0	0	$s\bar{s}$
pi-plus	π^+	0	+1	0	$u\bar{d}$
pi-zero	π^0	0	0	0	$u\bar{u}$ or $d\bar{d}$
pi-minus	π^-	0	-1	0	$d\bar{u}$

Each meson has a corresponding anti-meson, with opposite charge and quark structure.

Baryons

Baryon	Symbol	Baryon No. (B)	Charge (Q)	Strangeness (S)	Quark Structure
neutron	n^0	1	0	0	udd
proton	p^+	1	+1	0	uud
delta-plus	Δ^+	1	+1	0	uud
delta-zero	Δ^0	1	0	0	udd
delta-minus	Δ^-	1	-1	0	ddd
lambda	Λ	1	0	-1	uds
sigma-plus	Σ^+	1	+1	-1	uus
sigma-zero	Σ^0	1	0	-1	uds
sigma-minus	Σ^-	1	-1	-1	dds

Each baryon has a corresponding anti-baryon, with opposite charge and quark structure.



ET scan of patient with lung cancer

Research Task- The PET Scanner

1. **A PET scanner works using the phenomenon of particle and anti-particle annihilation.** Produce a short presentation including the following points:

- A labelled diagram of the PET Scanner
- An explanation of how it works: specifically how it incorporates particle and anti-particle annihilation;
- Why the device is useful and what is it used for;
- A real life example of where you may find this device.

2. Choose an appropriate form of presentation to place on TEAMS eg

- A digital presentation (e.g. Powerpoint, Keynote, Prezi, etc)
- An information booklet
- A mind map
- A short video