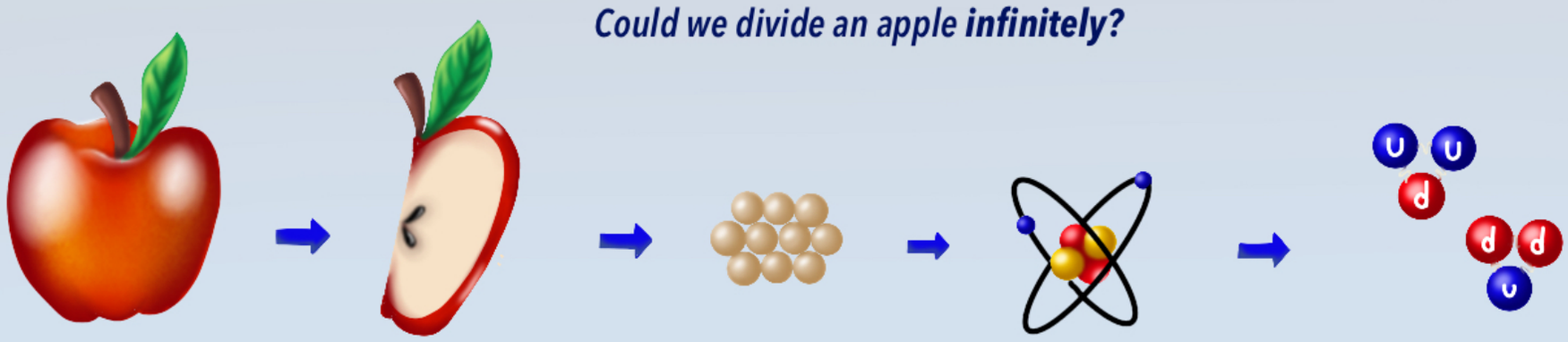
What are we made of?

1

We have always asked ourselves: ***What are things made of?***



Could we divide an apple ***infinitely?***

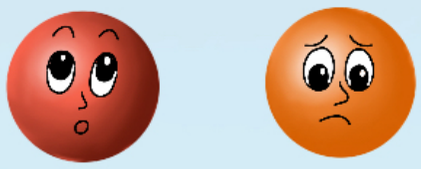
Which is the smallest component of our world?

In which point we cannot divide it more?

2

Many experiments and investigations have answered us this question. There's something ***smaller*** *than molecules, atoms, neutrons and protons. Currently the particles that we know as* ***indivisibles*** *are the* ***fermions***

Quarks:



Up **Down**

They form ***neutrons*** *and* ***protons.***

Leptons:

Electron **Electron Neutrino**

That are ***lonely particles.***

3

There are other fundamental particles, the ***second*** *and* ***third generation fermions****. They are:*

	Quarks:		Leptons:	
II	Charm	Strange	Muon	Mu Neutrino
III	Top	Bottom	Tau	Tau Neutrino

They are quite similar to the first generation fermions, but they're ***heavier*** *and not commonly seen in nature.*

4

If the ***fundamental forces*** *wouldn't exist these particles would be lost, they wouldn't interact with each other. These forces are:*

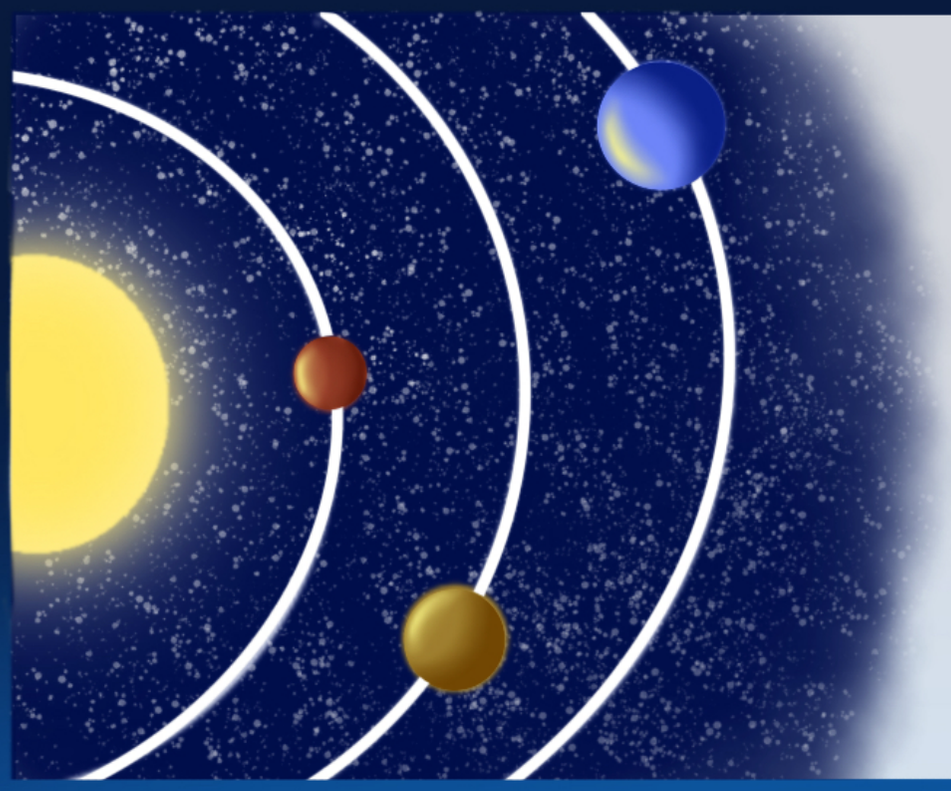
Electromagnetic, *that acts on charged particles.* ***Weak,*** *that is responsible of the radioactive decay of atoms.* ***Strong,*** *that binds together neutrons and protons to form atom nuclei and* ***gravitational*** *that makes massive bodies interact.*

5

There are particles that are the ***mediators*** *of these forces, they are responsible for the interactions. It's like fermions were* ***throwing balls*** *to each other.*

Electromagnetic Force	Photon
Strong Force	Gluon
Weak Force	W and Z bosons

These 'balls' or mediator particles are called ***bosons.***



6

What about gravity? *On small scales gravity is by far the weakest of all forces, but on big scales, like* ***planetary and cosmological scales****, gravity dominates over all forces, nevertheless, by now we have not yet discovered a mediator particle for gravity, this particle would be a* ***graviton.***

7

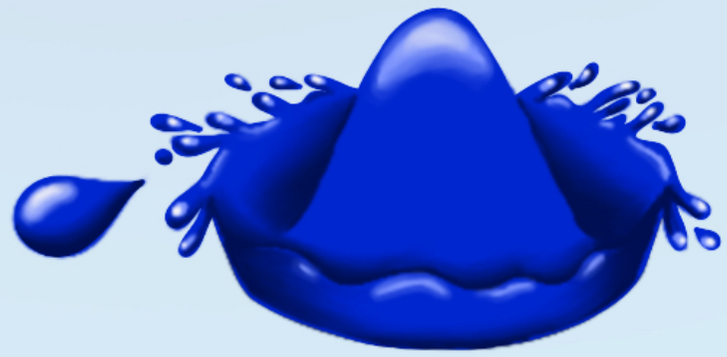
We haven't mentioned yet a very famous particle, the ***Higgs Boson,*** *which was predicted theoretically in* ***1964*** *and discovered in the LHC at* ***CERN*** *in* ***2012.***

But, ***what is the Higgs Boson?***

8

There is a ***field,*** *something like the sea, that* ***gives mass*** *to all particles. We cannot see this field until we* ***perturbate*** *it.*

It's like when you hit the sea water, ***droplets*** *come out.*



These field is called the ***Higgs Field****, and when you hit it the* ***Higgs Boson*** *come out.*

9

The particles and forces that we've mentioned (except gravity) form the ***standard model of particle physics****. It's goal is to explain and catalogue our universe, its components and interactions in a* ***single theoretical framework,*** *and to have indivisible parts that interact through* ***fundamental forces.***

10

However, the standard model cannot explain the behavior of everything in the ***universe.*** *There are a lot things that* ***remain a mystery,*** *there are places where the physics laws could be different from the ones we know. For example,* ***dark matter*** *makes up* ***80%*** *of the universe's matter, we know it exists because of the rotational velocities of galaxies and the gravitational lenses that it produces, but we don't know what is it made off and we haven't seen it because* ***it doesn't emit light.***

Jessica Velásquez Múnera, José David Ruiz Álvarez.

Instituto de Física
Grupo de Fenomenología e Interacciones Fundamentales

UNIVERSIDAD DE ANTIOQUIA
1803
Facultad de Ciencias Exactas y Naturales