

The  
Wonderful  
World of The  
Quantum  
Physics

## COPYRIGHT

The total or partial reproduction of this book without authorization of the author is also prohibited, otherwise it will be penalized as required by law.

GUAYAQUIL 2010- 2021

Attached the ISBN and Bar Code for:

The Wonderful World of Quantum Physics:

ISBN-10: ISBN-9978-45-641-4

ISBN-13: ISBN-978-9978-45-641-5

NATIONAL REGISTRATION OF COPYRIGHT

No. 025512

I dedicate this Work to my loved ones and to all these great groups of readers and lovers of modern Physics.

I thank my beloved Sons Daniel and Wilson Hidalgo Morales.

To my parents Irma Suarez de Hidalgo and Pedro Hidalgo M.

I thank my brothers and nephews in general.

And a special thanks to the groups of readers who love modern physics.

Thank you.

This Book is protected by copyright and intellectual rights.

This book is a creation of H&M Libros Editorial, whose author is the theoretical physicist, Wilson Vitelio Hidalgo Suarez.

H&M LIBROS EDITORIAL ®

## CHAPTER INDEX

1-Fermions and bosons

2 - Relationship of Matter and Energy

3- The Duality of Particle and Wave

4 - The Standard model of particles

5- Protons are not composed of three

Quark

6- Important investigations

7- Cooper's pair

8- The Bose-Einstein condensate

9- The super atom

10- The wonder of quantum entanglement

11- The energy at the zero point

12- The expansion of the universe and energy

Dark

13- The flat world and the three-dimensional world

14- Possible density of the rope

15- Property of the Rope

16- The relationship of the electric field with gravitational effects

17- Acceleration of the gravity of the planets integrating and unifying

electric fields

18- Gravity and electromagnetism are related to each other.

19- Theories of flat bars

20- microscopic structures of flat bars

21 - The quantum charge of flat bars

22 - The current atomic model

23 - The dimensionless atom

24 - The variation of the mass of a quantum bar

25 - Error in the standard model

26 - The duality of light

27 - Radius of curvature of the spatial fabric  
originated by massive bodies.

## PREFACE

The Wonderful World of Quantum Physics is a very detailed work

about the phenomena of quantum physics and modern and current astrophysics.

I deal with very important topics in modern physics, such as the duality of a particle, since subatomic particles have double

nature that is wave and corpuscular.

Here in this book we will deal with topics, such as the Bose-

Einstein, is a wonderful subject where matter behaves in a

very strange way that takes us out of common sense, the same happens

with quantum entanglement, a very important topic in physics

modern and that is being analyzed in great detail, since



predicts that an electron for example can be at the same time in

various places or at any probable point in space.

WE HOPE this book to be helpful in understanding quantum mechanics and string theory.

This work is expected to serve and be understood by high school students.

## INTRODUCTION

It deals with quantum information, a topic that is being tested in

advanced physics laboratories and is already being applied in

develop the quantum computer, where instead of the byts are the

qubits in the information, the advantage is that it would be a computer much

faster and the information will be almost instantaneous.

We will deal with the Standard model, which explains that a proton is

made up of three quarks, two Up quark and one Donw quark.

The neutron is made up of three quarks, two Donw quark, and one Up quark.

They will talk about the new discovery of the standard model, which

predicts that a proton is not constituted by three quarks, but by a huge agglomerate of quark and gluons.

In this Work we will find very important topics, such as energy

dark and its nature.

How would galaxies expand in relation to the pressure of energy

dark.

This and much more very important topics will be found in this

wonderful work.

I hope that this popular science and scientific literary book is understood

per high school student.

Simple and detailed reading is expected. I want the reader to know

feel satisfied with this work of scientific literature, which are compilations of more research works on the salient of humanity.

#### READING ENRICHES KNOWLEDGE.

In the world of the atom and its components, everything appears in heaps

(quantum = how much = heap). Mass, energy, moment, etc.

it appears in heaps: nothing in this world is smooth and continuous. Mechanics

is the old term for the Science of motion, so Mechanics

Quantum is the branch of Science dedicated to describing the movement of

things in the subatomic world. Mott defines it as the branch of

Physics that describes the behavior of electrons in atoms, in molecules and in solids or also as the branch of the

Mathematical physics that allows calculating the properties of atoms.

However, it is more than that: Quantum Mechanics provides the

fundamental support of all modern Science; its equations

describe the behavior of objects at the atomic scale,

providing the only explanation of the world of the miniscule.

Without their equations, scientists would not have been able to design power plants or

nuclear bombs, build lasers, explain why the sun stays

hot, Chemistry would still be in a dark age and there would be no

molecular biology, understanding DNA, genetic engineering, etc.

The biggest problem we have when dealing with  
Mechanics

Quantum proceeds from our unconscious  
assumption that things are

will behave the same way in the quantum world  
as they do

in the normal world of our experience

There is no reason to expect that when we  
contemplate objects

very small or very fast objects, they behave the  
same

the way objects we are familiar with do. The

Quantum Physics represents one of the  
conquests

fundamentals of Science, much more

meaningful and direct, from the point of view

practical, that the Theory of Relativity

In your world, the usual laws of Physics stop working:

events become governed by probabilities. The

Relativity and Quantum Mechanics constitute the basic theories of the

Modern physics; regardless of the Göttingen group, Dirac

discovered that the equations of Quantum Mechanics have the same

mathematical structure than the equations of classical mechanics, and that

This is a particular case of Quantum corresponding to large

quantum numbers or to give the value 0 to Plank's constant.

Quantum Mechanics is like a building that rises within the great

building of Physics, of entire Science. Its construction starts with the

great idea from a founder, Max Plank, and  
contribution in great way

Albert Einstein, Bohr, a revolutionary, De Broglie,  
parents,

Schroedinger and Heisenberg, a great  
mathematician, Dirac.

## THE FERMIONS AND BOSONS

What is our universe made of? This question has  
accompanied the

man since its origins, because knowing our  
intimate essence,

revealing who we are is one of the great enigmas  
that we still

we strive to solve.

In our journey within ourselves, we have  
discovered that

we are living organisms, groupings of cells that are  
composed



of molecules, which in turn are made up of atoms.

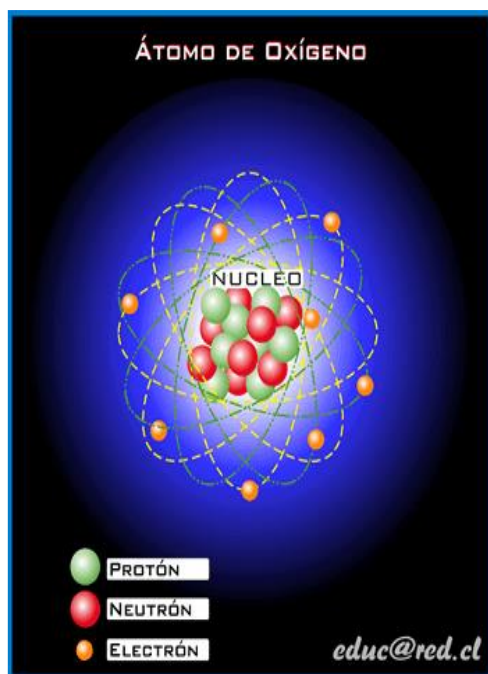
And we have

learned that these atoms are made up of a

nucleus (which contains

protons and neutrons) surrounded by a cloud of electrons.

This is what we learn in schools and colleges: the basic building blocks of our universe are protons, neutrons, and electrons.



But from time to time, we hear news in the press that speak of new

discoveries in particle physics, which reveal the existence of

an authentic fauna of strange particles with shocking names, which

we do not know where they fit into the model we have studied.

We will try to explain very briefly how they are all organized

those particles, and which ones seem to be the bricks for now

fundamental. The physical theory that explains this puzzle and how

particles interact is the Standard Model. According to this theory there are

two types of elementary particles: fermions and bosons. He

model explains the forces between two particles (fermions) as

result of an exchange of mediating particles (bosons).

Three Generations of Matter (Fermions)			
	I	II	III
mass→	2.4 MeV	1.37 GeV	171.2 GeV
charge→	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$
spin→	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
name→	<b>u</b> up	<b>c</b> charm	<b>t</b> top
Quarks	<b>d</b> down	<b>s</b> strange	<b>b</b> bottom
	4.2 MeV	134 MeV	8.2 GeV
	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
Leptons	<b><math>\nu_e</math></b> electron neutrino	<b><math>\nu_\mu</math></b> muon neutrino	<b><math>\nu_\tau</math></b> tau neutrino
	$\leq 2.2$ eV	$\leq 0.17$ MeV	$\leq 15.5$ MeV
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	<b>e</b> electron	<b><math>\mu</math></b> muon	<b><math>\tau</math></b> tau
	0.511 MeV	105.7 MeV	1.777 GeV
	-1	-1	-1
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$

They are associated with the idea that we have of matter. Obey the

Fermi-Dirac statistics. They comply with the Pauli exclusion principle

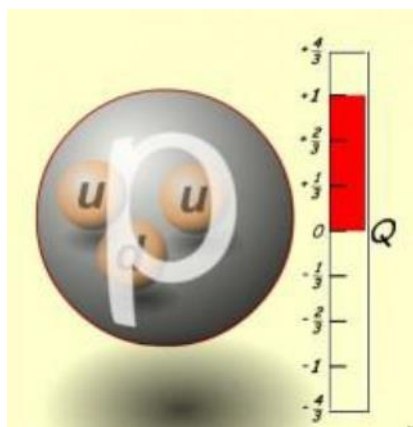
(two fermions cannot occupy the same quantum state at the same time).

They have semi-integer spin. Each fermion has its own anti-fermion.

There are 12 different fermions: 6 are quarks and 6 are leptons.

Fermions are grouped into three families or three generations: each

consisting of a pair of quarks and a pair of leptons.



Quarks are carriers of color charge and therefore interact with

the so-called strong force. They also have electrical charge and weak isospin,

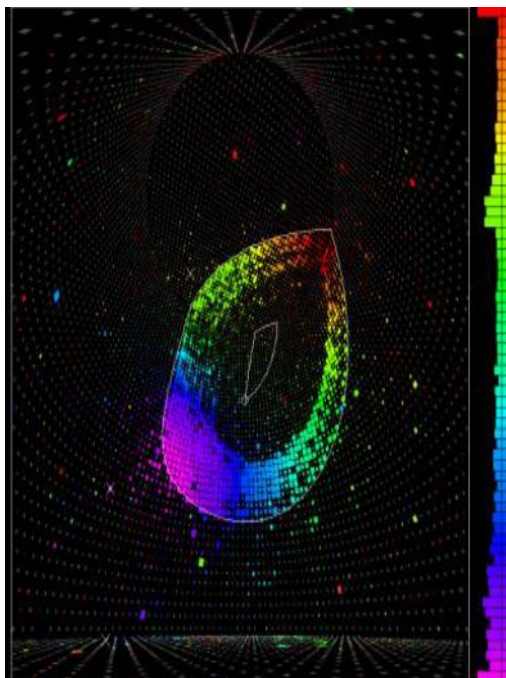
so they also interact with the electromagnetic force and the

weak force. There are 6 types of quarks. The strong force confines them in such a way that they are always grouped together, forming compounds with no color charge: hadrons. These can be made up of 3 quarks (and are then called baryons) or

by a pair of quark and antiquark (the mesons, which are actually

bosons). Our well-known protons and neutrons are a type of

baryons, and are therefore composed of 3 quarks



Leptons have no color charge, so they do not interact with the

strong force. To this group belong the electron, the muon and the tau,

in addition to the neutrinos that each one has associated, the neutrino

electronic, muonic and tauonic.

The electron, the muon and the tau have an electric charge and interact with the

electromagnetic force and weak force. Neutrinos have no charge

electrical, so they only interact with the weak force, one of the

reasons why they are difficult to detect.



0	0	1	$\gamma$	photon
0	0	1	g	gluon
81.2 GeV	0	1	Z	weak force
80.4 GeV	$\pm 1$	1	W	weak force

Bosons (Forces)

They obey the Bose-Einstein statistic. They have a whole spin and no

they follow the Pauli exclusion principle. Five of them are elemental:

the 4 gauge bosons (which are force carriers) and the Higgs boson.

Others are compound bosons like mesons.

Among the gauge bosons we find photons (carriers of the electromagnetic force), gluons (carriers of the strong force) and the  $W^+$ ,  $W^-$  and  $Z$  bosons (carriers of the weak force).

In addition, the existence of the Higgs boson (zero spin) is theorized,

which is an elementary particle that would explain the origin of the mass of the elementary particles.

The Higgs boson was discovered by the accelerator Hadrons (LHC) from CERN in June 2012.

Hadron, lepton, muon, baryon, fermion.... What a mess!. Do not be discouraged

with such varied fauna, I just wanted to introduce you to its main

components, so you can identify them in their groups when you hear

of them and get an idea of their properties and how they interact.

You will hear many more weird names called with Greek letters

(lambda, sigma, delta ...), do not be alarmed, most likely they will be types of hadrons.



Domain Unregistered.  
To view, register at:  
[bit.ly/imageshack-domain](https://bit.ly/imageshack-domain)

Stick with this: From what we know so far, the bricks

fundamental elements of our universe are quarks, leptons and

force-bearing bosons.

And now with more confidence, discover this world so varied, a dance

cosmic of creation and destruction, of interaction, always in

movement, a real challenge to our imagination!

## THE RELATIONSHIP OF MATTER AND ENERGY

It is a no-brainer for anyone with a minimal understanding of the theory of

Einstein's relativity, which states that matter and energy are

equivalents. Matter is highly condensed energy that can

be released, as the atomic bomb sadly showed. He

path of science has more or less traveled the following route: from the

matter came to the atom, from the atom to the subatomic particles, from

subatomic particles to energetic "wave packets",

unimaginably hot that later exploded (big bang) giving rise

to our universe. Nothing prevents that background energy from

other points emerged, also gestating other singularities and other

parallel universes or in another dimension.

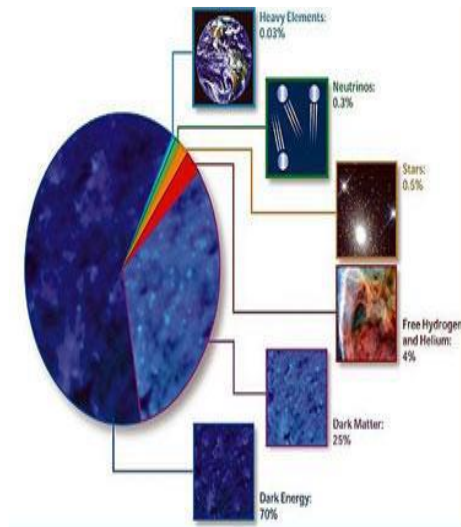
With the appearance of the universe, spacetime simultaneously broke in.

Time is the movement of fluctuation of energies  
and of

the expansion of matter. Space is not the static  
void within

which everything happens, but that continuously  
open process that allows

let energy networks and beings manifest.



According to recent estimates, summarized in this NASA graphic

about 70% of the energy content of the Universe consists of dark energy, the presence of which is inferred from its effect on the expansion

of the Universe but about whose ultimate nature only little is known.



Baryons are protons, neutrons, and other subatomic particles that make up ordinary matter like hydrogen, helium, and the heavier elements. The baryonic matter is what stars are made of, planets, moons, and even interstellar gas and dust from which new stars are born.

It should be made clear that hidden baryonic matter should not be confused with dark matter. The latter is a mysterious and exotic form of matter that is detected only by its gravitational attraction.

Using the astronomical satellites Hubble and FUSE, Shull and Charles Danforth searched for hidden baryonic matter

using, as if they were lighthouses, the light of quasars (the luminous centers of galaxies with active black holes) to probe the somewhat similar structure to a spider web,

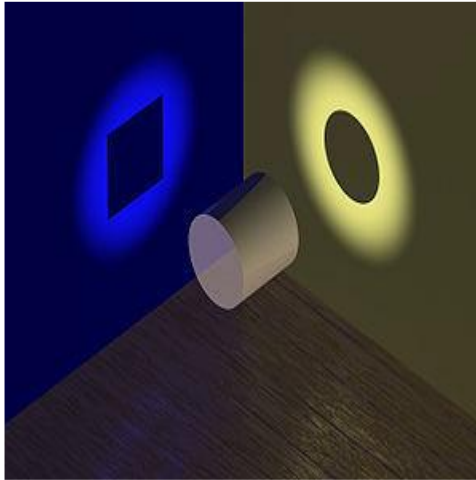
that populates the seemingly invisible space between the galaxies. That poll was like using a flashlight to explore a place through the fog.

Hundreds of filaments of the cosmic web have been observed.

The team also found that a significant percentage of baryons reside in the voids between the filaments.

Within these voids, there could be dwarf galaxies or scattered matter that could accumulate with the passage of time to become stars and galaxies within billions of years.

## PARTICLE AND WAVE DUALITY



Illustrative image of the wave-particle duality, in which you can see

how the same phenomenon can have two different perceptions.

Wave-corpuscle duality, also called wave-particle duality,