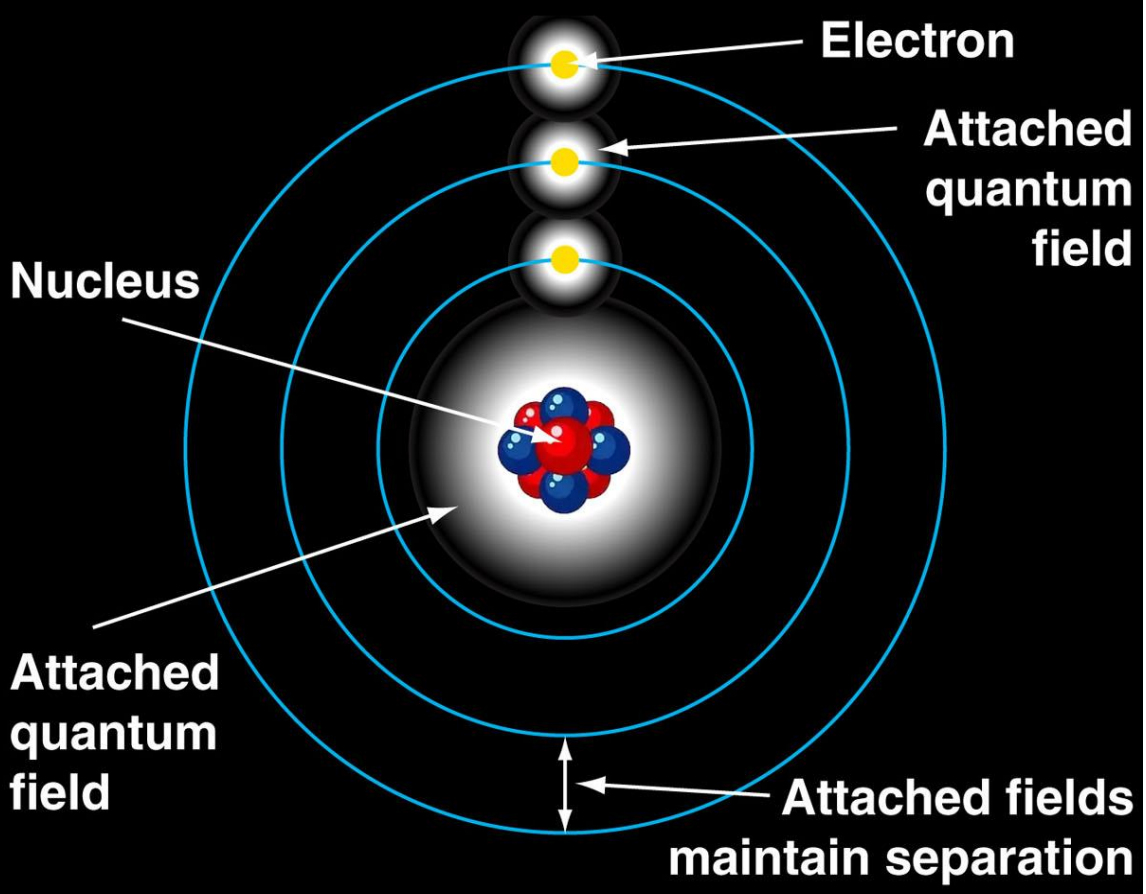
Explaining the Mechanics of the Strong Atomic Interaction



Catchments & Creeks

Version 1, 2025

Explaining the Mechanics of the Strong Atomic Interaction

Version 1, August 2025

Written and illustrated by: Grant Witheridge, *Catchments and Creeks*, Queensland, Australia.

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Cover image: The author's diagram displaying what is not a realistic atomic layout, but instead a diagram displaying aspects of how quantum forces can both fold an atom in a stable condition while also keeping the components separated.

About the author

Grant Witheridge is a retired civil engineer with both Bachelor and Masters degrees from the University of New South Wales. He has over 40 years experience in the fields of hydraulics, stormwater management, creek engineering, and as a lecturer in coastal engineering.

Grant brings to this discussion an understanding of fluid mechanics, and his belief that:

- the mechanics of the Universe must be founded on just a few simple principles/actions
- all forces originate from quantum forces, which are the building blocks of energy
- mystery and complexity exist only in the absence of knowledge.

Introduction

To the best of my knowledge (which is not extensive), the sciences have no been able to explain the mechanics of an atom in the same terms as the mechanics of orbiting celestial bodies; however, I believe that if we model the universe using a force-based model instead of the current energy-based model, then the explanation of the mechanics becomes obvious.

This document is just one paper in a series of papers that discusses how an analysis of quantum forces can be used to explain gravity, electromagnetism, and the weak and strong atomic forces.

Quantum forces can also explain why the force of gravity varies with the square of the distance of separation, why a magnetic field always moves to the right when passing through another magnetic field, why spaceships can be deflected off the Earth's atmosphere, the actions of our five human senses, the mechanics of mass inertia and momentum, what causes plants to spin, the movement of light, the mechanics of polaroid filters, the mechanics of the double slit experiment, and the mechanics of the triple-filter experiment.

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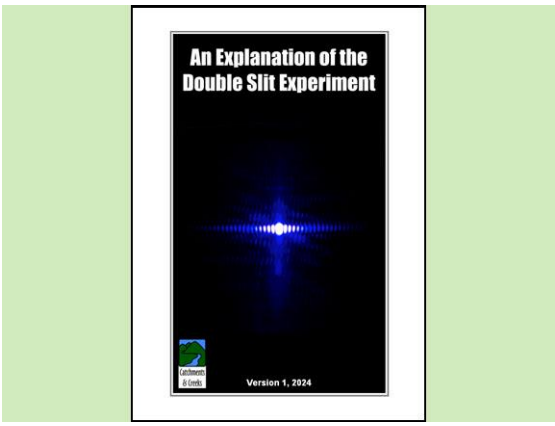
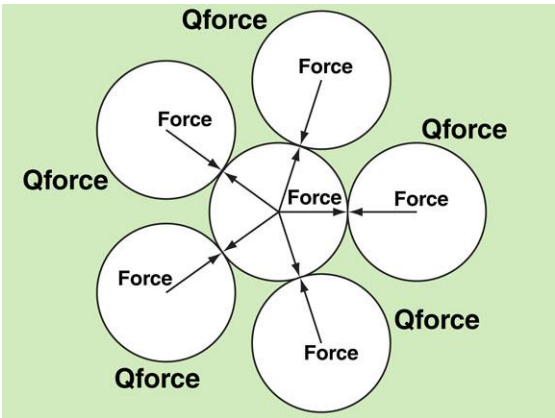
Introduction



Double Slit Experiment, Version 1



Quantum forces

WIKIPEDIA
The Free Encyclopedia

Fundamental interaction

In physics, the **fundamental interactions** or **fundamental forces** are the interactions that do not appear to be reducible to more basic interactions. There are four fundamental interactions known to exist:[1]

- gravity
- electromagnetism
- weak interaction
- strong interaction

The gravitational and electromagnetic interactions produce long-range forces whose effects can be seen directly in everyday life. The strong and weak interactions produce forces at minuscule, subatomic distances and govern nuclear interactions inside atoms.

Some scientists hypothesize that a fifth force might exist, but these hypotheses remain speculative.[2][3][4]

Each of the known fundamental interactions can be described mathematically as a *field*. The gravitational force is attributed to the curvature of spacetime, described by Einstein's general theory of relativity. The other three are discrete quantum fields, and their interactions are mediated by elementary particles described by the Standard Model of particle physics.[5]

Within the Standard Model, the strong interaction is carried by a particle called the gluon and is responsible for quarks binding together to form hadrons, such as protons and neutrons. As a

Wikipedia – Fundamental interactions

Weak interaction

The *weak interaction* or *weak nuclear force* is responsible for some nuclear phenomena such as beta decay. Electromagnetism and the weak force are now understood to be two aspects of a unified electroweak interaction — this discovery was the first step toward the unified theory known as the Standard Model. In the theory of the electroweak interaction, the carriers of the weak force are the massive gauge bosons called the W and Z bosons. The weak interaction is the only known interaction that does not conserve parity; it is left–right asymmetric. The weak interaction even violates CP symmetry but does conserve CPT.

Strong interaction

The *strong interaction*, or *strong nuclear force*, is the most complicated interaction, mainly because of the way it varies with distance. The nuclear force is powerfully attractive between nucleons at distances of about 1 femtometre (fm, or 10^{-15} metres), but it rapidly decreases to insignificance at distances beyond about 2.5 fm. At distances less than 0.7 fm, the nuclear force becomes repulsive. This repulsive component is responsible for the physical size of nuclei, since the nucleons can come no closer than the force allows.

After the nucleus was discovered in 1908, it was clear that a new force, today known as the nuclear force, was needed to overcome the electrostatic repulsion, a manifestation of electromagnetism, of the positively charged protons. Otherwise, the nucleus could not exist. Moreover, the force had to be strong enough to squeeze the protons into a volume whose diameter is about 10^{-15} m, much smaller than that of the entire atom. From the short range of this force, Hideki Yukawa predicted that it was associated with a massive force particle, whose mass is approximately 100 MeV.

The 1947 discovery of the pion ushered in the modern era of particle physics. Hundreds of hadrons were discovered from the 1940s to 1960s, and an extremely complicated theory of hadrons as strongly interacting particles was developed. Most notably:

Wikipedia – Strong atomic interaction

Introduction

- The quantum force model of the universe was introduced in *'An Explanation of the Double Slit Experiment'* (V1, 2024).
- This earlier publication suggested that all four of the fundamental interactions of the universe could be explained by the actions of quantum forces, those actions being:
  - gravity
  - electromagnetism
  - weak interaction, and the
  - strong interaction (focus of this paper).

The quantum force model of the universe

- The quantum force model of the universe is based on the following assumptions:
  - the Big Bang (or Big Expansion) was created by the expansion of highly concentrated quantum forces
  - quantum forces have no physical existence
  - 'space' exists as a continuum of uniformly distributed quantum forces, which some have termed as: 'aether'.

The weak interaction

- According to Wikipedia, *'the weak interaction or weak nuclear force is responsible for some nuclear phenomena such as beta decay.'*
- The carriers of weak interaction are reported to be the massive gauge bosons called the W and Z bosons.
- In the author's opinion, the weak atomic interaction represents the condition when 'attached' quantum forces are not stripped from, or pushed aside from, the matter that they are attached to.

The strong interaction

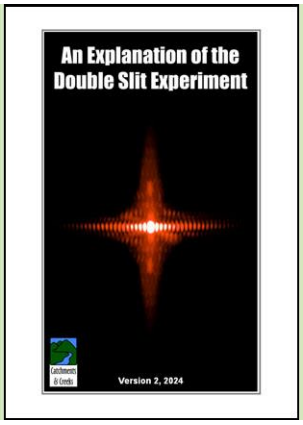
- According to Wikipedia, the strong interaction is notable because of the way it varies with distance.
- The nuclear force is powerfully attractive at distances of about 1 femtometre, but it rapidly decreases at 2.5 femtometre.
- At distances less than 0.7 femtometre, the nuclear force becomes repulsive.
- In the author's opinion, the strong atomic interaction can be explained by the activities of quantum forces around very small particles.

Why should you trust what I have to say?

Water engineer

Introduction

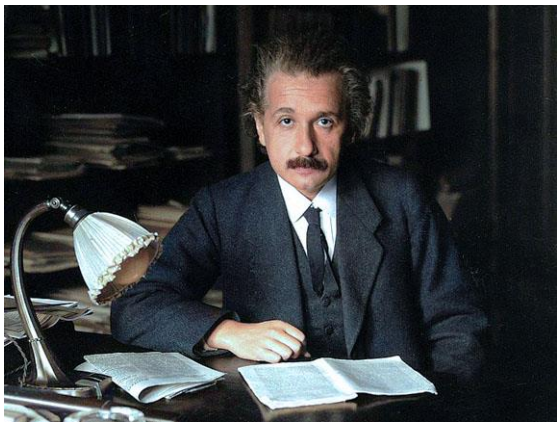
- Just to make things very clear, I am not a scientist, I am a retired civil engineer who specialised in the study of fluid mechanics.
- I have no formal training in atomic physics, but I tell myself that I understand basic physics.
- So why would anyone trust me to discuss the internal workings of an atom?
- Let me explain (below) . . .



Double Slit Experiment, Version 2

My knowledge of fluid mechanics

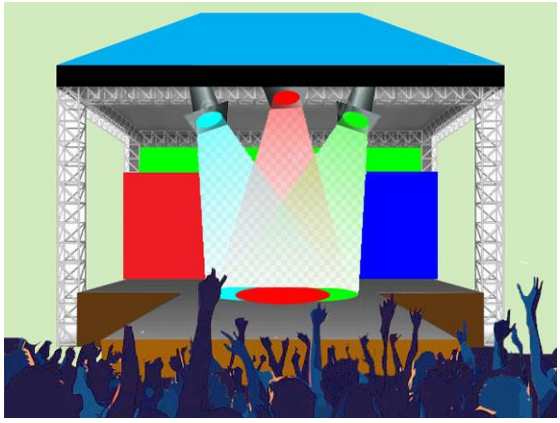
- It is my knowledge of fluid mechanics and wave mechanics that has allowed me to spot errors in Einstein's explanation of light.
- It is also my knowledge of fluid mechanics and wave mechanics that has allowed me to provide a rational explanation of the double slit experiment, and the triple filter experiment (see other documents).
- Oh, and when I say wave mechanics, I mean the engineering study of ocean waves.



Albert Einstein

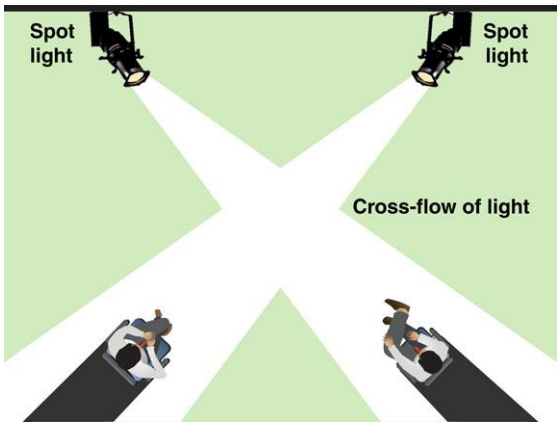
Einstein's explanation of light

- Einstein, like many scientists, describes a photon of light as being a massless particle, and a ray of light as being a form of electromagnetic radiation.
- Well, in my opinion, that is not totally true.
- The one thing that we should agree upon is that two items of atomic matter cannot pass through each other, but instead will do everything (beyond a nuclear explosion) to pass around each other, thus avoiding direct contact.
- Thus two electrons will avoid contact.
- Therefore, if photons were in fact massless particles, then two photons would avoid direct contact.
- Therefore, a ray of photons would not be able to pass, unaffected, through another ray of photons.
- So, why can spot lights at a concert hall pass through each other without any form of interference.
- Light moves as an energy wave, not as a particle wave, just like sound waves and ocean waves move as energy waves, not as particle waves.



Spot lights

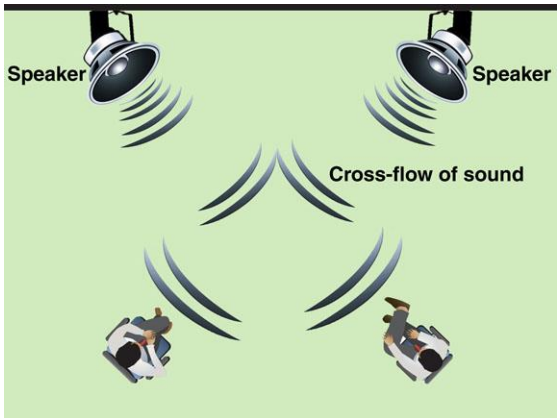
Energy waves



Spotlights

Energy waves

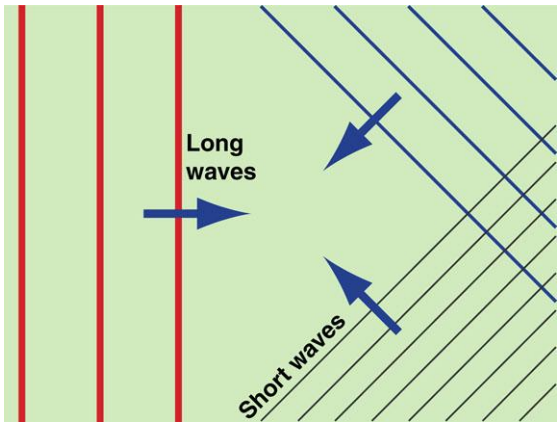
- An energy wave is an example of a compression wave.
- An energy wave transports only energy, not particles (i.e. there is no permanent movement of the physical matter).
- Examples of energy waves include:
  - deep water ocean waves
  - sound waves
  - gravitational waves
  - and light.



Cross flow of sound waves

Sound waves

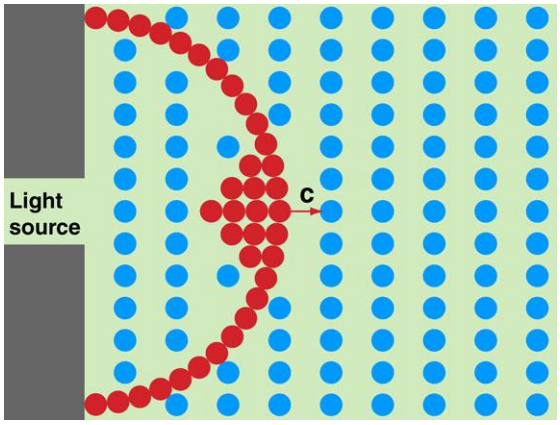
- If two sets of sound waves were to cross paths, then these two sets of waves would pass through each other with little loss of energy, or change in direction.
- This allows us to have a four-way conversation between four people within a tightly-packed social event.
- Even though energy waves do not experience a loss of energy or change in direction, energy waves can experience constructive and destructive interference of their energy.



Tree sets of ocean waves

Deep water ocean waves

- Deep water waves can travel great distances across an ocean.
- They are able to travel such distances because they are 'virtual' waves (i.e. energy waves, or non-particle waves).
- This means they can move through each other without a significant loss of energy, momentum, or change in direction.
- The seas may look 'choppy', but experienced sailors can recognise the long waves passing through any area.



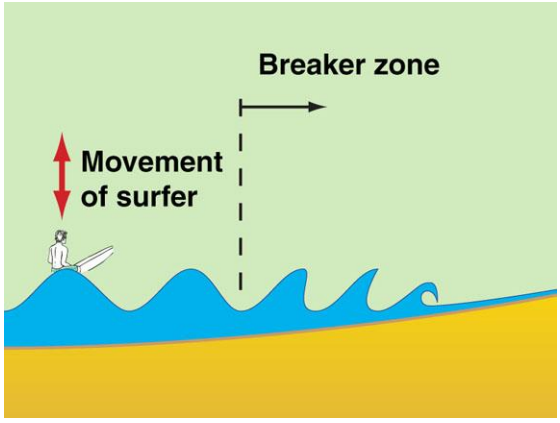
A photon shown as a shock wave

Photons of light

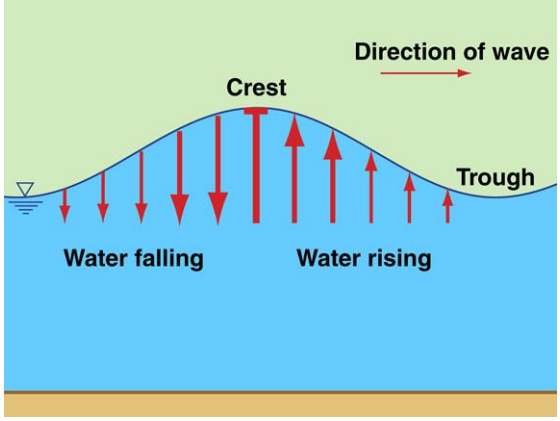
- A photon is currently believed to be a 'particle' because only a particle can move through a true vacuum, and it is currently believed that 'space' contains large regions of empty space.
- However, what I hope to demonstrate is that 'space' is not empty, but is in fact a continuum of quantum forces.
- I believe that a photon is a compression wave of quantum forces moving as an energy wave, which can experience constructive and destructive interference.

Particle waves

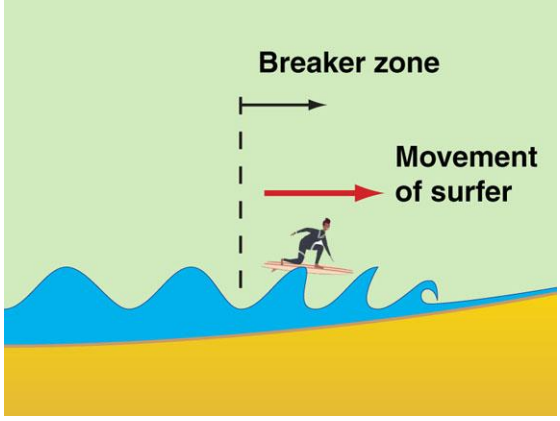
Surfing a coastal (broken) wave



Ocean waves (on the left)



Wave mechanics



Breaker (coastal) zone (on the right)

Particle waves

- A particle wave transports both energy and physical matter.
- Examples of particle waves include:
  - coastal (broken) waves
  - tsunami waves travelling over land
  - weather fronts.
- A particle wave cannot experience constructive or destructive interference.
- Consequently, two broken surf waves will 'crash' into each other, not pass through each other.

Deep water ocean waves

- A deep water ocean wave experiences only virtual horizontal movement, not physical horizontal movement, the same as the 'pointer' on your computer screen; it just appears to move.
- The term 'deep water' refers to the wave length relative to the water depth.
- The form of an ocean wave moves, and the energy moves, but not the water.
- Ocean waves can experience both constructive and destructive interference.

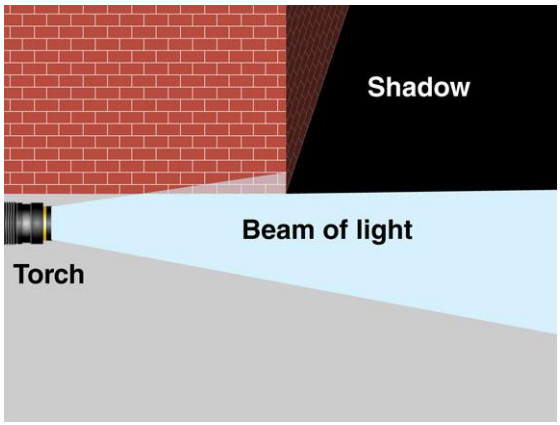
Ocean waves are transverse waves

- A transverse wave has its disturbance vectors moving perpendicular to the direction of propagation.
- Ocean waves are transverse waves.
- A surfer sitting on a surfboard beyond the breaker zone will only move up and down, but not towards the beach (unless there is an ocean current).
- However, light travels as a longitudinal compression wave, the same as sound waves.

Coastal waves are complex waves

- The movement and profile of a broken wave are defined by both the vertical and horizontal movement of the water particles.
- A broken wave is a particle wave that experiences physical movement.
- A broken wave cannot experience constructive or destructive interference.
- If light were to move as a particle wave, then it would not be able to demonstrate interference patterns.

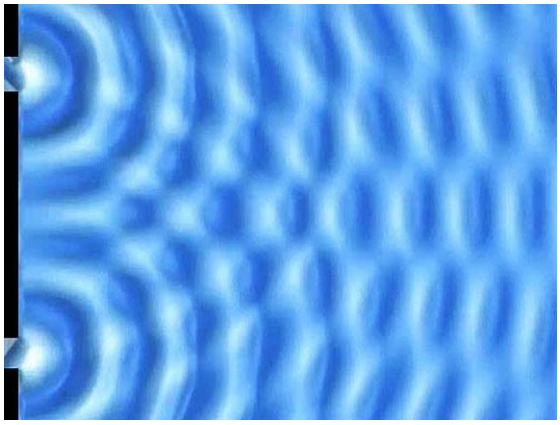
So, what did Einstein believe that was so wrong?



Minimal diffraction of light

A photon

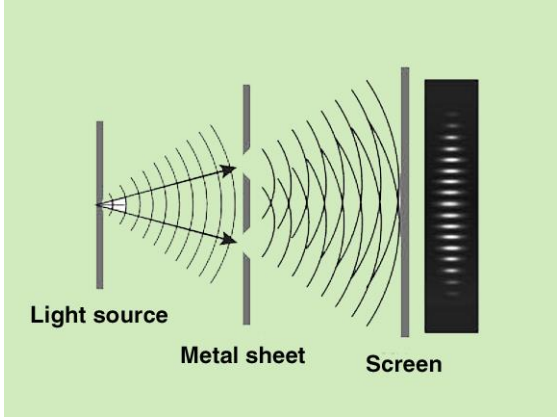
- Einstein believed that a photon was a massless particle partially because:
  - he believed that 'space' contained large regions of empty space (true vacuum)
  - he believed that only a physical particle could travel through a vacuum
  - he was aware of experiments showing that light displays the properties of a physical particle when it travels, just as limited diffraction.



Constructive and destructive interference

Constructive and destructive interference

- Constructive and destructive interference is a property that some waves experience when they 'meet'.
- The action is often displayed by someone generating two sets of 'deep water' waves on the surface of a pond.
- As the waves cross paths, the waves form a pattern of double crest & trough waves (constructive interference) interacting with zero amplitude waves (destructive interference).
- But these are all energy waves!



Double slit experiment

The meeting of particle waves

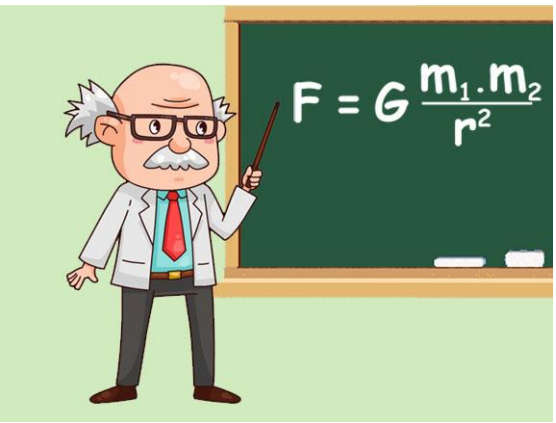
- As discussed on the previous page, if Einstein was correct in defining a photon as being a massless particle, then a ray of light would not be able to experience constructive or destructive interference.
- However, the double slit experiment demonstrates that photons, and rays of light, do experience constructive or destructive interference.
- Therefore Einstein must be wrong!

Einstein's falling man

Einstein's falling man theory

- Let us now consider Einstein's thought experiment about a falling man.
- Such a person is said (by Einstein) to be weightless because they feel weightless.
- In a car we feel the force of acceleration because the force is applied to the outside of our body.
- However, gravity is an internal force, which is applied equally to every atom in your body; consequently, a falling man would never feel the force of gravity.

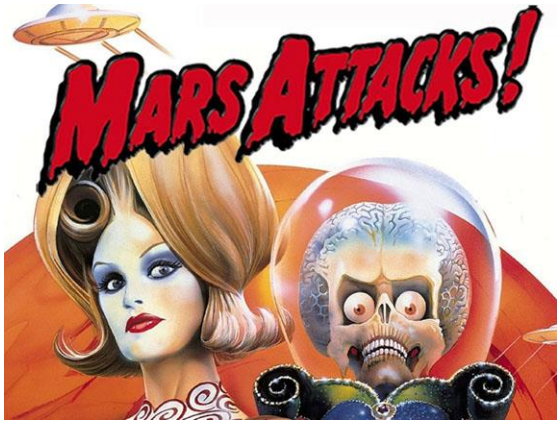
But, Einstein proved his work with mathematics!



Mathematics

The truth about mathematics

- But you say: Einstein proved his work mathematically!
- Well, I too love mathematics, but mathematics can be both a tool of great discovery, as well as a cloak of disguise hiding the truth from the audience.
- In my opinion, Einstein did not 'prove' his work with mathematics, he simply supported the concepts of his work with mathematics.
- Consider the following . . .



Mars Attacks (1996)

Investigating the cause of human propagation

- Aliens arrive on planet Earth and they wish to discover the cause of human propagation.
- One of the aliens observed that the birth rate in any city is proportional to the number of bananas sold in that city.
- The aliens considered the facts and concluded that: 'male humans use bananas to impregnate female humans'.
- They 'proved' this with mathematics!

Bananas

Further investigations

- Further investigations enlightened the aliens to additional facts:
  - young men buy and consume more bananas that older men
  - most bananas are purchased by women
  - the lower the cost of bananas, the more bananas are consumed
  - bananas come naturally with a protective sheath, which is removed before consumption.

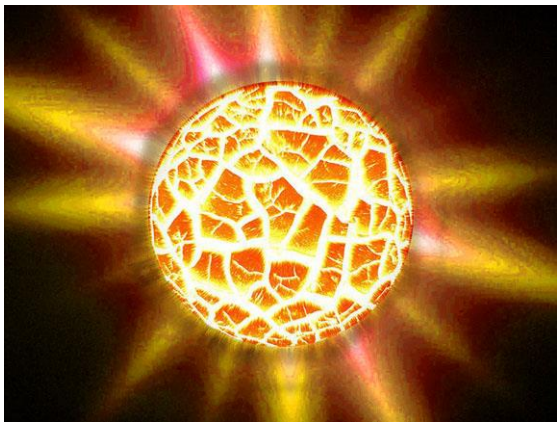
The universe

Energy model vs force model

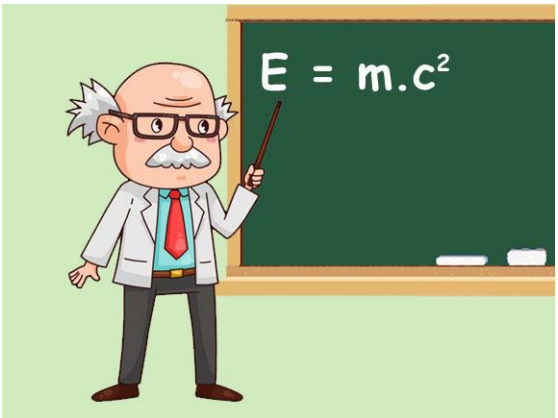
- The current energy-based model of the universe, and my proposed force-based model of the universe, are both anchored in the same basic science (physics).
- Energy acts through the application of forces, and forces act with the power of energy.
- If we move from an energy-based model to a force-based model, then nothing in science will actually change, except our explanation of the science.

1. An Introduction to a Force-based Model of the Universe

Introduction

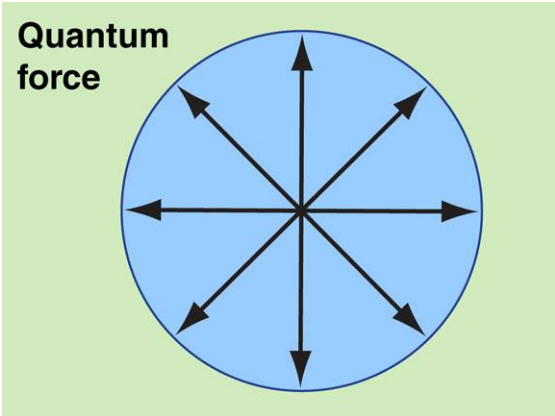


The Big Bang



Energy, mass and velocity

Thermal vision



Sphere of influence of a quantum force

Introduction

- The energy-based model of the universe has served us well for over 100 years.
- However, this model has failed to answer several questions about the physics of the universe.
- If, instead of imagining a universe filled with energy, we were to considered a universe filled with forces, then we would develop a force-based model.
- Both models can be 'correct' if applied correctly.

Energy vs forces

- We do not consider energy as being made of physical matter; instead, we think of physical matter as being a product of concentrated energy.
- This means matter can be converted back to pure energy, as described in Einstein's energy equation: $E = m.c^2$.
- Similarly, we do not think of a 'force' as being made from physical matter, rather that physical matter is one instrument through which a force can be applied.

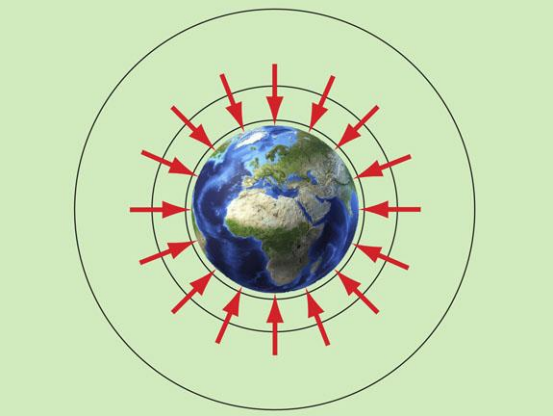
Is the existing energy-based model of the universe wrong?

- Neither the energy-based model, nor the force-based model, are fundamentally wrong; however, like all models, the model's outcomes can be wrong if the models are misused.
- Think of the two models as being like an infra-red telescope and a thermal scope; both are able to display the same science, but one model may present an image with better clarity in certain circumstances.

Does a 'force' have dimensions?

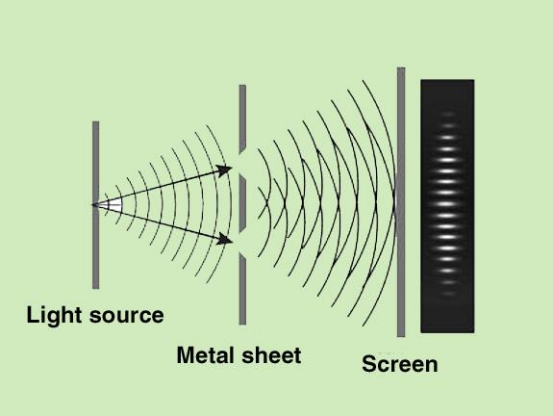
- A baseball has dimensions. A chair has dimensions. But what are the dimensions of a force?
- What are the dimensions of a unit of magnetic force?
- Maybe, a force does not have dimensions, which would mean that an infinite amount of force could exist without any dimensions, such as in a singularity.

A force-based model of the universe

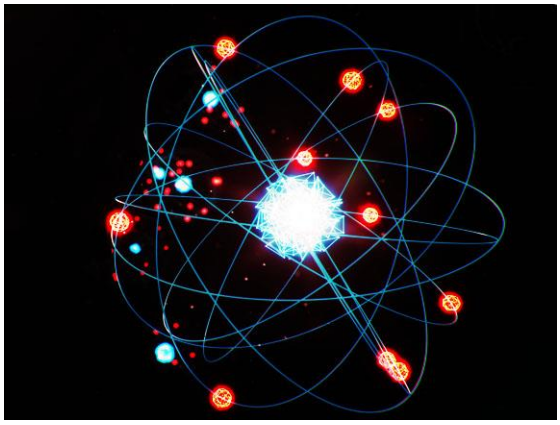


Gravity

Spinning Earth



Double slit experiment

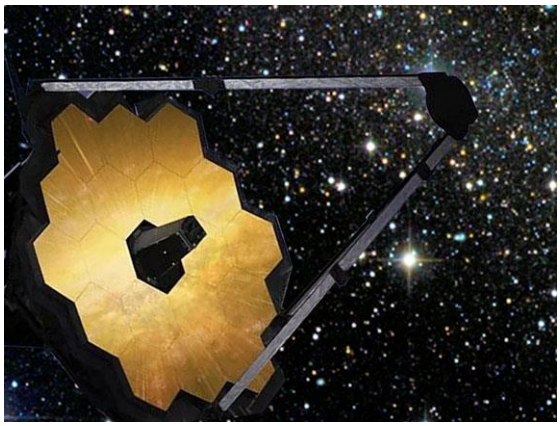


Atom

The benefits of a force-based model of the universe

- A force based model of the universe can provide us with a clear and logical explanation of the following scientific questions:
  - an explanation of gravity
  - why there is no such thing as a ‘pulling’ force, nor a ‘force at a distance’
  - an explanation of what a magnetic field is made of
  - an explanation of why a magnetic field always moves to the right (based on conventional flow) when passing through another magnetic field
  - an explanation of what allows certain elements to become magnetic
  - what causes stars, planets and moons (that have a magnetic field) to spin
  - what causes Earth’s magnetic field to deflect solar wings
  - what causes returning spaceships to be deflected of the Earth’s atmosphere
  - the properties of light
  - an explanation of the double slit experiment
  - an explanation of the triple filter experiment
  - what allows us to see stars clearly from any location
  - the reason why the force of gravity reduces with the square of the distance of separation
  - the reason why electrons can only exist at certain radiuses from the nucleus
  - the force that causes an electron to stay in orbit around a nucleus
  - the reason why the universe expanded primarily in two dimension, rather than in three dimensions
  - a possible reason for changes in the rate of expansion of the universe over time.
- Can the current energy-based model of the universe make the same claim?
- Note: Not all of the above explanations are discussed within this document.

Consider the following



James Webb telescope

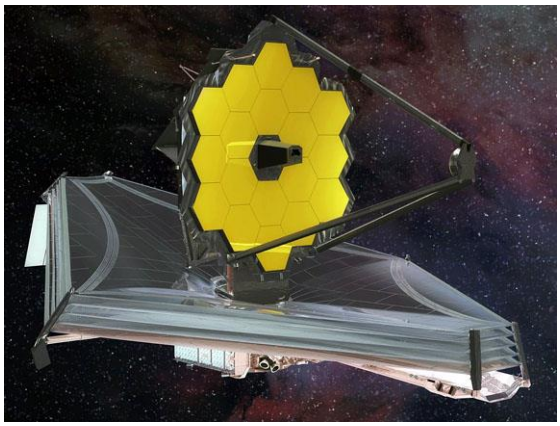
Introduction

- Let us consider the James Webb telescope—I am sure you have all seen the images captured by the telescope.
- No matter how close the telescope zooms into a star field, there is always more, and more, objects that we can find that are generating light.
- Billions and billions of stars and galaxies sending a 'ray' of light to a single location in the universe—the location of the James Webb telescope.

Star field

Light travelling through space

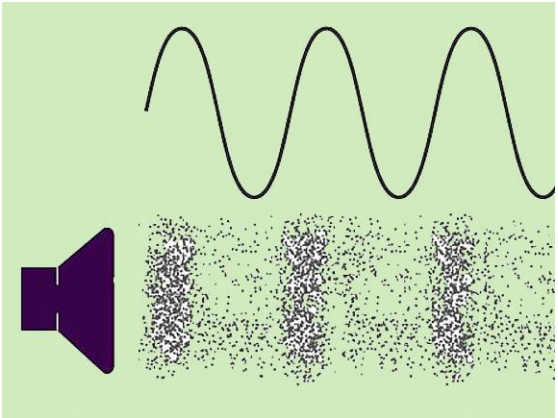
- Now consider that if a telescope can see billions of lights, then those sources of light must be sending a constant stream of photons to the telescope's location.
- AND, each of those rays of light must be travelling billions of light years without being deflected by other rays of light.
- YES, light may bend as it passes matter, and in theory (?), light could eventually loop around the universe, meaning that as we look deeper into space, we <u>could</u> be looking along a loop around the universe.



James Webb telescope

Stand anywhere is space

- Now consider the fact that it does not matter where the James Webb telescope is positioned in space, it will always 'see' those billions and billions of lights.
- This means that each ray of light will not only be travelling billions of light years through space, but will also be passing <u>through</u> billions of other rays of light before arriving at the James Webb telescope.
- If interference did occur, then all these star field images would be very blurred.



Sound waves

How do they do it?

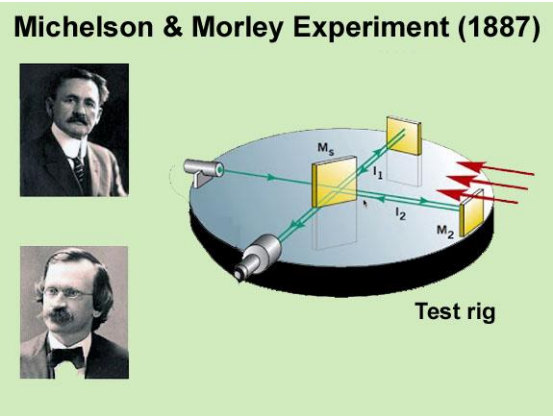
- How do billions and billions of massless photons pass through billions and billions of massless photons without experiencing any change of direction or loss of energy?
- They can do it because light does <u>not</u> travel as massless particles, but as an energy wave (or force message).
- Just like sound waves—there is no real forward movement of the media, there is just the movement of energy, while the media simply vibrates.

So, why did Einstein believe that light travelled as a massless photon?

'Empty' space

Introduction

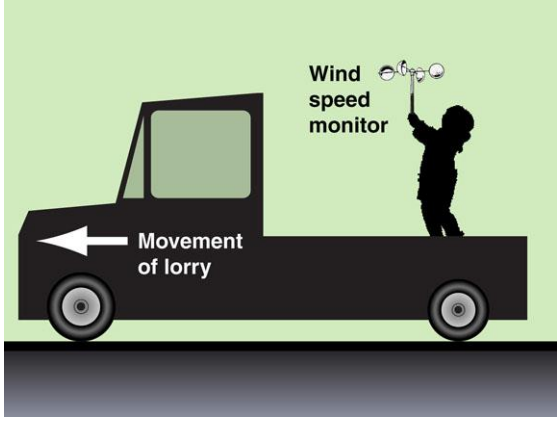
- For the past 100 years, science has held the position that space contains large regions of 'empty space'.
- Prior to this, many scientists believed that space was filled with a substance commonly referred to as aether (ether).
- The idea of an aether-filled space was dismissed in 1887 by two American physicists Albert Michelson and Edward Morley—but were they right in their conclusions?



Michelson–Morley experiment

Michelson–Morley experiment

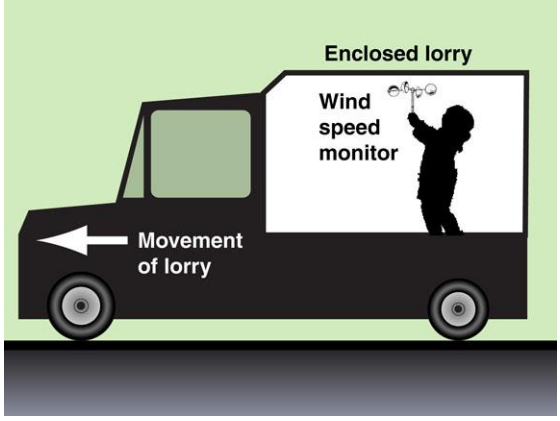
- The Michelson–Morley experiment looked for evidence that the speed of light was affected by the speed of the Earth as it travelled through space.
- Their experiment found no effect on the speed of light, and from this non-outcome they concluded that space was not filled with some type of matter.
- So, why do I think they got it all wrong?



Open lorry

Imagine testing the speed of a truck by measuring the air speed

- If a person stood in the back of an open lorry, while holding a wind speed monitor, then the air speed that they measured would provide an indication of the speed of the lorry.
- The measurement would not be perfect, but you get the idea.
- The lorry is moving through a media, and your wind speed monitor is moving through the same media.



Covered lorry

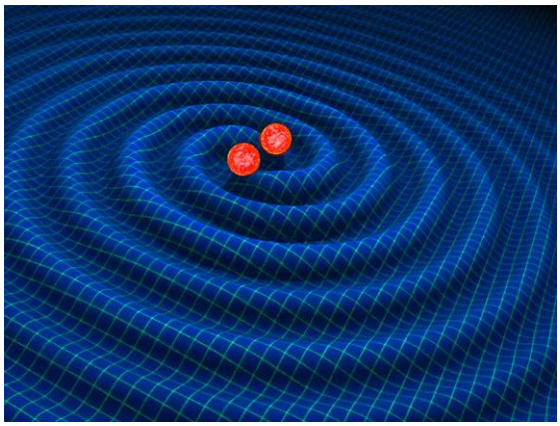
Now, perform the same test in an enclosed lorry

- However, if you repeated the test, but this time you were in an enclosed lorry, then the air would be travelling with the lorry, and your monitor would measure zero air speed.
- This is what I believe is happening in the Michelson–Morley experiment.
- The Earth travels in a cocoon of attached quantum forces (aether), just as electricity travels inside a cocoon of magnetic forces (also aether).

The movement of gravitational waves

The action of gravity

Ocean waves



Representation of gravitational waves

LIGO Livingston Observatory

Introduction

- We can argue about whether gravity is, or is not, a force; but, we should all agree that gravity causes a different action on free objects relative to fixed objects.
- If gravity is a force, then the action is on free objects, where as, if gravity is not a force, then the action is on fixed objects.
- Gravitational waves travel vast distances through space and cause minor variations in the local strength of gravity as they pass any given location.

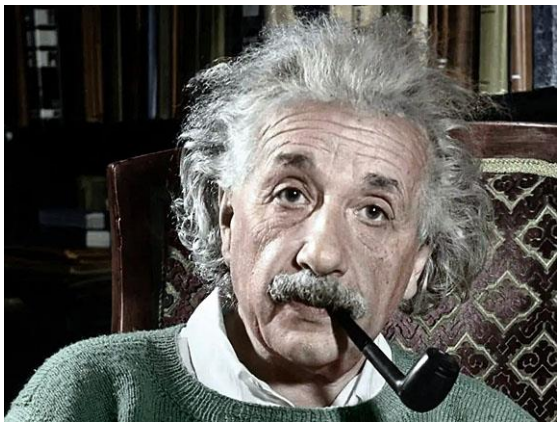
Ocean waves and tidal waves

- In order to understand the effects of gravitational waves on the local gravity, we can consider the effect of tides (tidal waves) on ocean waves.
- Ocean waves are mostly generated by wind friction, which causes a local rise and fall in the ocean's surface.
- Tidal waves are variations in the ocean's surface elevation generated by the proximity of celestial bodies, which move as long waves around the Earth's surface.
- If the 'action' is taken as the rise and fall of the ocean surface, then we can see that both ocean waves and tidal waves can independently cause such an action.
- Now, the local effects of oceans waves on water levels can be amplified or reduced by the effects of tidal waves.
- Similarly, the local effects of gravity on the acceleration of free objects can be amplified, or reduced, by the effects of gravitational waves acting on these same objects.
- The cause of gravity and gravitational waves may be different, but their actions are similar.

From gravitational waves

- The first direct observation of gravitational waves was made in 2015, when a signal was received by the LIGO gravitational wave detectors in Livingston, Louisiana, and in Hanford, Washington, USA.
- A gravitational wave is an energy wave, which means it cannot travel through a true vacuum—it needs a media.
- The detection of gravitational waves confirms (for some of us) the existence of a continuous media that fills space.

What this all means



Albert Einstein (1940s)

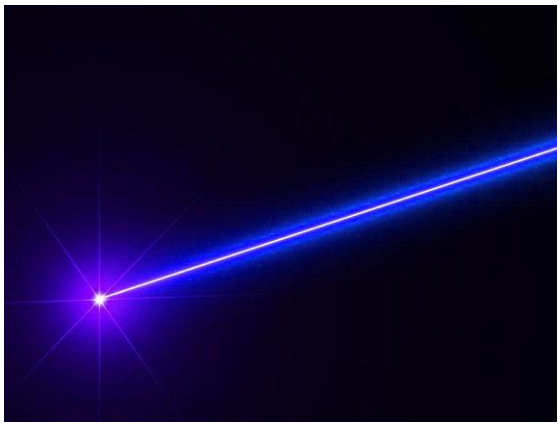
Introduction

- What this means is that we have Albert Einstein, with one of the greatest minds the world has even know, being a subject of his time.
- Einstein lived in the early 20th century.
- He was a mathematician and physicist; but, not a fluid mechanics expert.
- He did not have access to the scientific knowledge had we have today, and he lived at a time when the idea of a spaced filled with a substance was being questioned.

Space

Space is a continuum

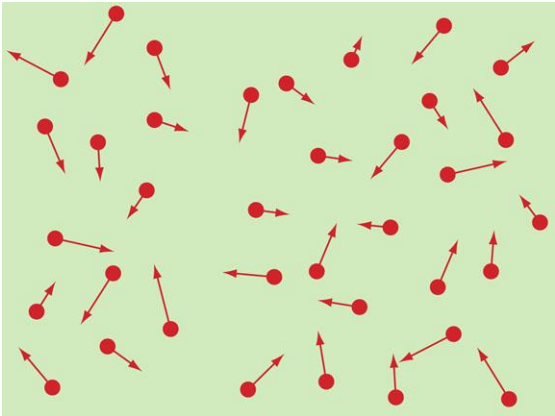
- There is enough evidence today to suggest that space is:
  - a continuum filled with an unknown substance (which some call 'aether')
  - the Big Bang consisted of a rapid expansion of this substance
  - the force that causes this expansion is also the force that causes gravity.
- The Big Bang was not an explosion, planets were not thrown into empty space, it expanded, and something needed to fill space that could expand.



Laser light

The properties of light

- If space contained large regions of 'empty space', then light would need to consist of an independent physical substance in order to pass through these voids.
- This supports the idea of a photon being a massless particle.
- However, if we can accept the idea of space being a continuum of an unknown substance, then that supports the idea of light being an energy wave, and the idea of gravitational waves.



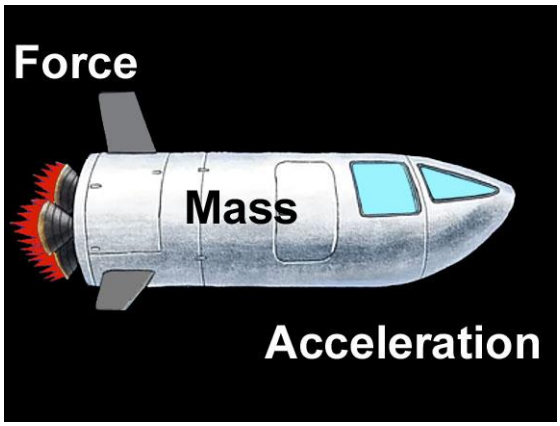
Forces shown here in a random pattern

A universe filled with energy or forces

- Our current understanding of the universe is based on the idea that at the time of the Big Bang, the universe consisted of only energy, space, and time.
- This concept can be termed an energy-based model of the universe.
- However, what would happen if we replaced the concept of an energy-based model with a force-based model.
- Energy performs work through the actions of forces, so a force-based model should be no different from an energy model.

2. Mass, Inertia and Momentum

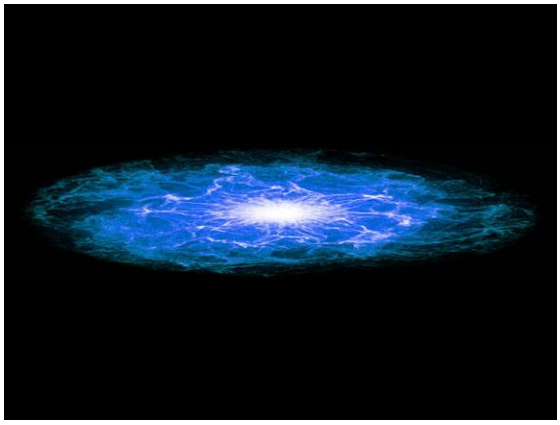
Introduction



Acceleration of a spaceship

Introduction

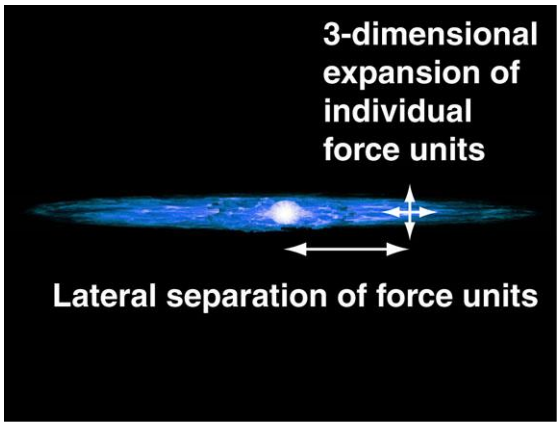
- The actions of inertia and momentum tell us that a force is required in order to change the speed or direction of an object of mass.
- Newton's second law of motion effectively states:
  - The vector (directional) force (F) required to cause an acceleration (a) of a body with mass (m) is equal to the product of the object's mass times its acceleration (i.e. F = m.a).



Representation of the Big Bang

Physical matter and quantum forces

- If we accept that physical matter is formed from compressed quantum forces.
- And we acknowledge that physical matter experiences the effects of mass and inertia, then we must accept that a signal quantum force (which forms matter) must also experience mass and inertia.
- This means that at the time of the Big Bang, the universe would have resisted the force of expansion, which meant that the expansion was not instantaneous.



Expansion of the universe

Expansion of the universe

- The expansion of the universe from a condition of singularity would have involved two forms of movement:
  - the three-dimensional expansion of the 'region of influence' of each quantum force, and
  - the two-dimensional expansion of the quantum forces relative to each other.
- Both of these forms of movement were not instantaneous, and therefore must have involved the effects of inertia.

Touching physical matter

The creation of matter

- If you have ever wondered how physical matter was created from 'nothing', then consider the following:
  - you only believe that matter exists because of what your five senses tell you (sight, sound, smell, taste & touch)
  - these five senses detect only forces
  - your brain then interprets these forces as being 'reality'.
- **So, forces, and only forces, are what tells you that physical matter exists.**

Quantum forces enable our five senses

How do I know matter exists?

Our five senses

- Our perception of physical matter is based on our five senses:
  - we see matter
  - we hear matter
  - we smell matter
  - we taste matter
  - we touch and move matter.
- These senses are a product of forces, which are ultimately generated by quantum forces, which have no physical existence, thus matter has no physical existence.

Human eye

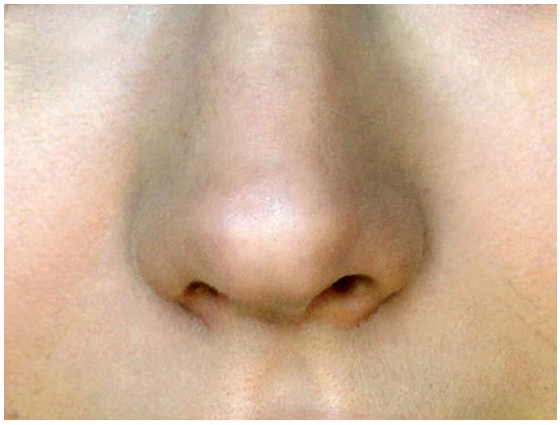
Light

- The sensation of light is **only** produced within the minds of living creatures.
- Light becomes visible to humans because the photons are capable of causing physical excitation within all molecules, which leads to changes in the chemistry within the visual molecule retinal of the eye.
- Light is just a form of energy.
- Therefore, the universe exists in total darkness.

Human ear

Sound

- The sensation of sound is **only** produced within the minds of living creatures.
- A falling tree produces only fluctuations in air pressure, which are detected by our ears, which sends an electrical signal to our brain, and only then is a sound created.
- There was no Big BANG, just a big expansion!
- Therefore, the universe exists in total silence.



Human nose

Smell

- The sensation of smell is **only** produced within the minds of living creatures.
- Gases with a chemical composition that can be registered by receptors within the nasal cavity, cause an electrical message to be sent to the brain, which creates the sensation of either a good or bad odour.
- The answer to the question: *Who made that smell?* is always, YOU!
- Therefore, the universe exists without a smell.

Quantum forces enable our five senses

Spices

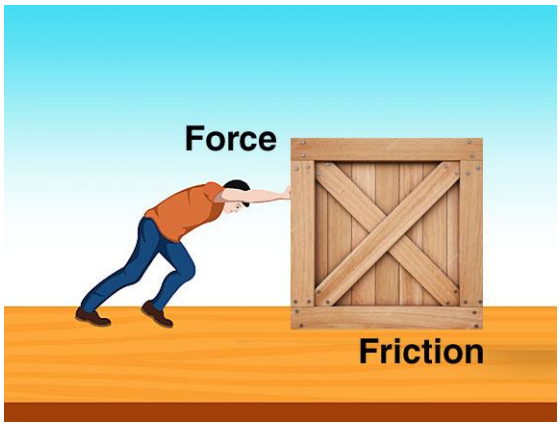
Taste

- The sensation of taste is **only** produced within the minds of living creatures.
- Taste is the perception produced, or stimulated, when a substance in the mouth reacts chemically with taste receptor cells located on taste buds in the oral cavity, mostly on the tongue.
- Humans can detect five taste modalities: sweetness, sourness, saltiness, bitterness, and savouriness.
- Therefore, the universe exists without taste (flavour).

Lava

Heat

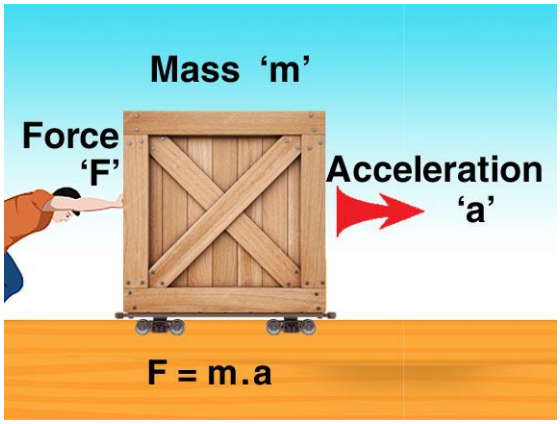
- Heat is a sensation that relates to the sensation of touch.
- Heat involves a transfer of energy, and sometimes a transfer of matter, which is just another form of energy.
- But ultimately, heat is made up solely of energy, which is made up of 'nothing' physical.
- The feeling of heat is created in the brain, while the action of heat is a product of energy acting through forces.



A repelling or pushing force

Touch

- Objects that we have traditionally been referred to as 'matter' cannot touch each other at a molecular level.
- It is said that molecular repulsion prevents any direct contact from occurring.
- This means that you have never actually touched any physical matter.
- The sensation of touch is generated by repelling forces, which can cause a deflection in the touched and/or touching surface, but it is the brain that registers this touch.

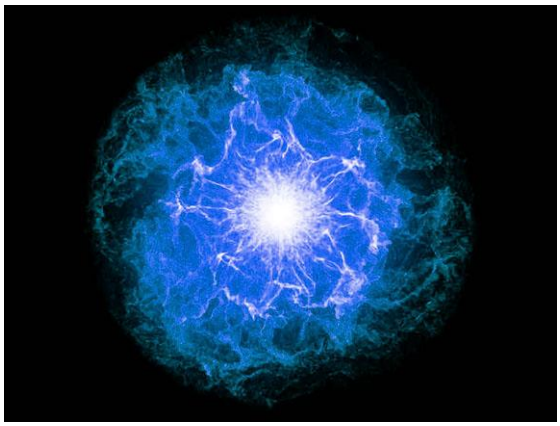


Force, mass and acceleration

Mass, inertia and momentum

- The effects of mass, inertia, and momentum are not created in the minds of humans, but instead exist in the reality of the universe.
- However, the effects of mass, inertia and momentum, are generated by quantum forces, just as the perception of physical matter is generated by quantum forces.
- But, what is so magical about all of this is the fact that the force that creates inertia is the same force that creates gravity.

Just a few more points of interest



Expanding universe

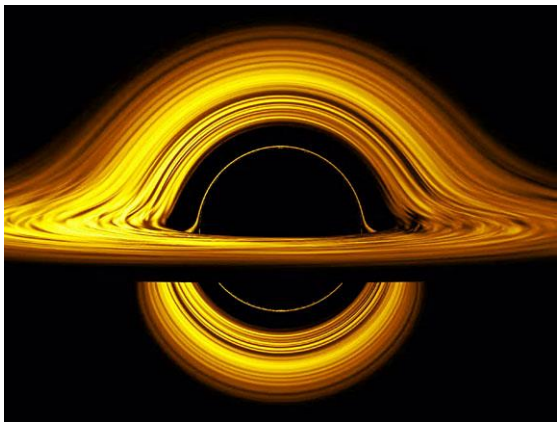
The force of expansion

- **Question:** What would happen if a quantum force did not experience the effects of inertia?
- **Answer:** The expansion of the universe would have been near-instantaneous because the speed of the expansion would have been limited to the speed of causality.
- However, we know that the speed of expansion was not infinite.

Earth

Matter vs concentrated quantum forces

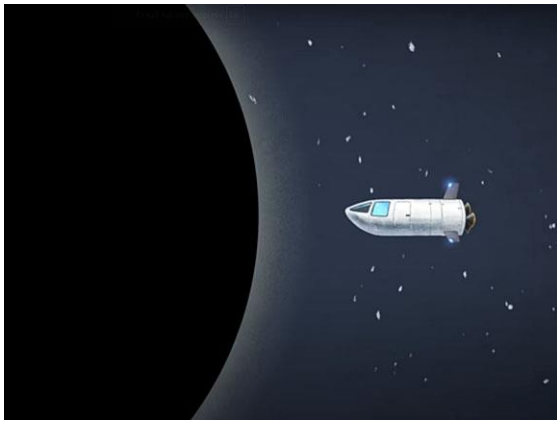
- I have stated that matter consists of a very high concentration of quantum forces.
- I have also stated that matter is surrounded by a concentration of attached quantum forces, which acts to make matter stable, and tries to make large bodies of matter take the shape of a sphere, if possible.
- However, I should add that this concentration of attached quantum force is significantly less than the concentration required to form matter.



Representation of a black hole

Black holes

- It is likely that black holes are of such a dense concentration of matter, and therefore, quantum forces, that the concentration of attached quantum forces that surrounds a black hole will begin to approach that of physical matter.
- Consequently, a black hole would effectively feed off the surrounding space, slowly adsorbing (not absorbing) the surrounding attached quantum forces as additional matter, which would prevent the release of 'light'.



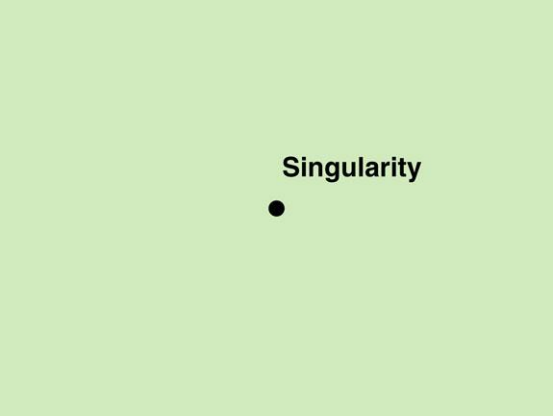
Approaching a black hole

Objects approaching a black hole

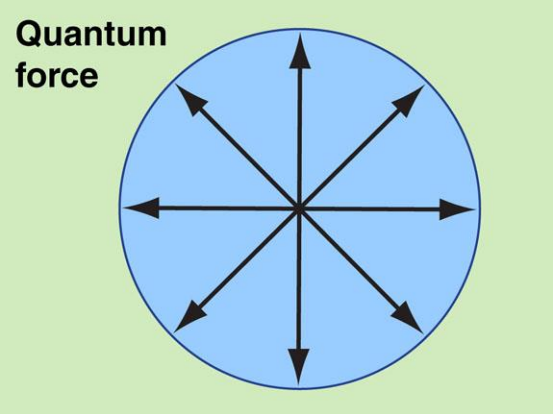
- I cannot understand why so many scientists talk about objects entering a black hole as if a black hole is some type of fluid.
- Approaching objects would crash into a black hole like they were crashing into the hardest and largest diamond they had ever met.
- The concentration of attached quantum forces would be so great that the speed of causality, and thus the speed of light, would approach zero.

3. A Brief Introduction to Quantum Forces

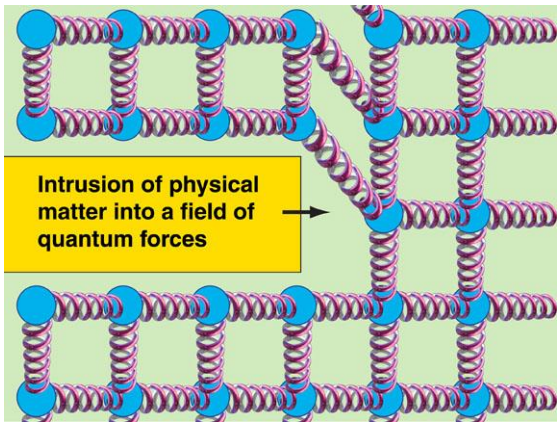
Introduction



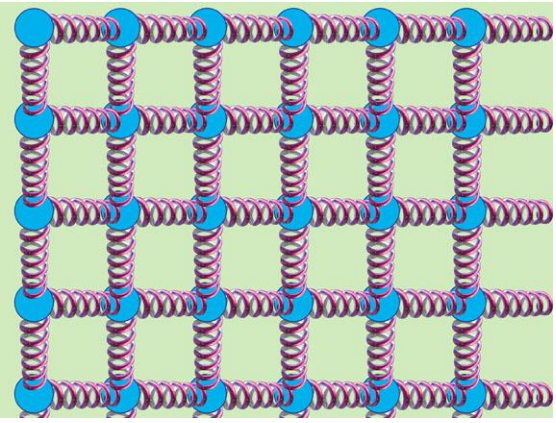
Singularity



Region of influence



Matter moving through quantum forces



Representation of a field of quantum forces

Introduction

- If we go back to the beginning, prior to the Big Bang, then we may think of the universe existed as a singularity, consisting of an almost infinite amount of dimensionless energy, or forces, existing at a single location.
- For now, I have chosen to call these forces: 'quantum forces'.
- The properties of a quantum force are assumed to be:
  - dimensionless in size, but each force has a region of influence, which expands as the universe expands
  - able to experience the effects of mass and inertia
  - quantum forces push against each other with a force that appears (?) to reduce as its region of influence expands, and
  - this pushing force varies with the inverse square of its distance of separation from physical matter.
- What held these forces in a singularity prior to the Big Bang was possibly the zero speed of causality that existed within the singularity.

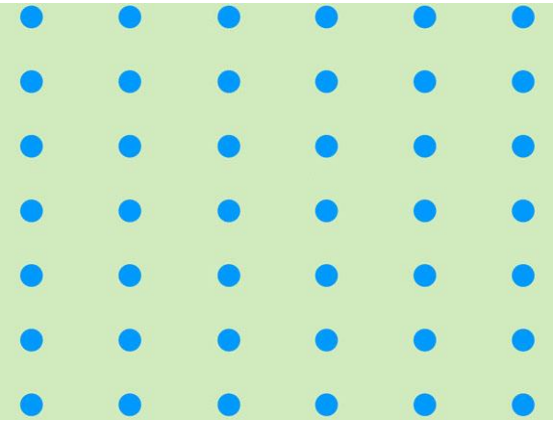
The existence of quantum forces as individual elements

- The quantum forces that fill space must consist of individual elements that can be separated.
- The separation of individual quantum forces is necessary for:
  - physical matter (e.g. a planet) to pass through a field of quantum forces, and
  - one field of quantum forces (e.g. a magnetic field) to pass through another field of quantum forces.

The various states of quantum forces

- Quantum forces are assumed to exist in three different states:
  - free
  - attached (including 'travelling')
  - concentrated.
- Physical matter is created through the concentration of quantum forces.
- Light exists as a transient form of concentrated quantum forces (i.e. a virtual particle) created by a compression wave.

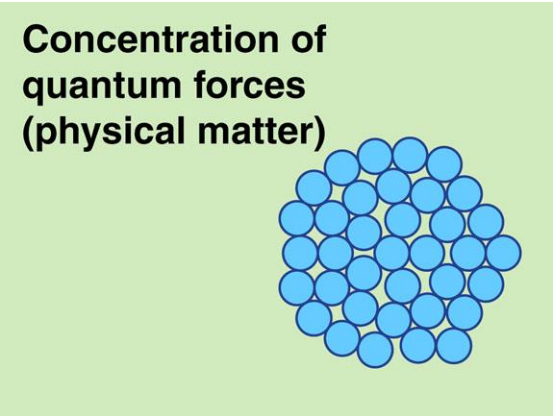
Different forms of quantum forces



Representation of free quantum forces

Free quantum forces

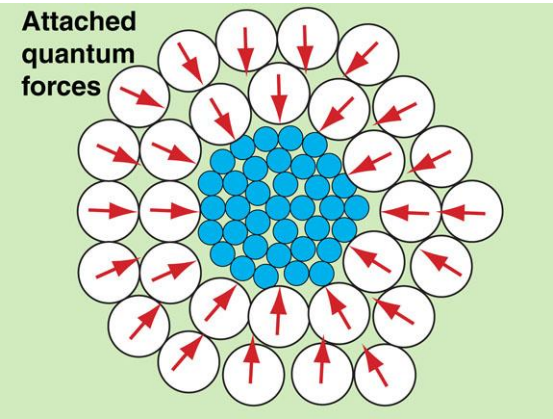
- Free quantum forces are the forces that make up the majority of space.
- The element we call 'aether' is formed from free quantum forces.
- Free quantum forces are mostly stationary, except for the ongoing expansion of the universe.
- Quantum forces also exist within physical matter—some attached to the matter, while others remaining free to move within the matter.



Concentration of quantum forces

A concentration of quantum forces

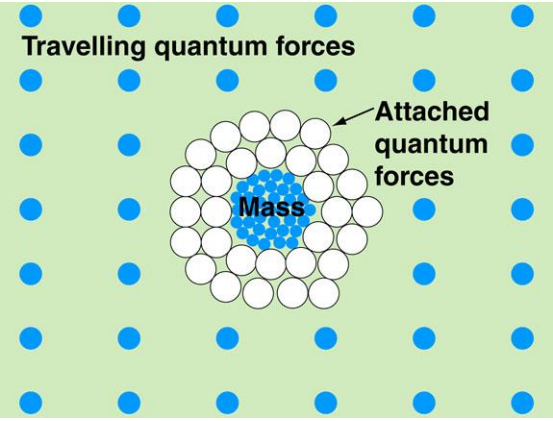
- Free quantum forces can be considered to exist at a background density that reduces as the universe expands.
- Concentrated quantum forces (i.e. matter) exist in a concentration much greater than the background density of free quantum forces.
- Concentrated quantum forces can exist as virtual particles (light), or physical particles (matter).



Quantum forces surrounding matter

Forces acting on matter

- Quantum forces, whether free or attached, surround any concentration of quantum forces (i.e. physical matter), thus causing the matter to be:
  - stable
  - spherical in shape (if possible)
  - compressed (i.e. concentrated)
  - and causing isolated objects of matter to move towards each other (i.e. a net force of attraction), thus increasing the size and density of any concentration.



Concentration in a field of free Qforces

Attached quantum forces

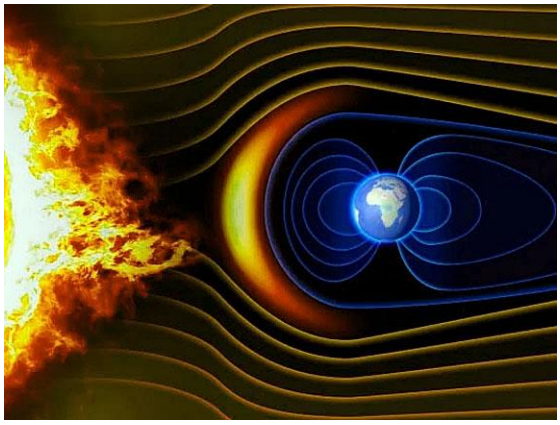
- Even though quantum forces push against physical matter, they are also being pushed by outer forces, which ultimately results in a net attraction force.
- Because of this force, some quantum forces can become firmly (but not permanently) attached to physical matter.
- If the matter moves, then these attached quantum forces will move, which in-turn will induce the movement of any travelling quantum forces that surround the attached quantum forces.

Different forms of quantum forces

Space

Free quantum forces (aether)

- Most quantum forces exist in a uniformly distributed gird that exists at a concentration that is constantly reducing as the universe expands.
- Aether is the substance that exists when quantum forces exist in this background concentration, which I, from time to time, refer to as a 'non-concentrated'.
- Magnetism is simply a moving form of aether, which has a concentration linked to the concentration of the physical matter that it is attached to.



Attached magnetic (quantum) field

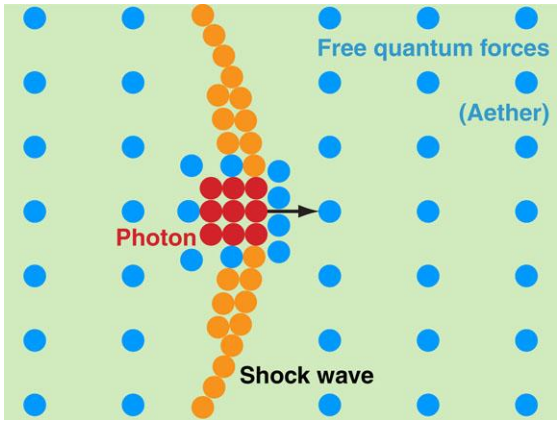
Attached quantum forces

- Even though quantum forces repel each other, this repelling action causes some quantum forces to concentrate around matter as attached quantum forces.
- The Earth has a massive volume of attached quantum forces, some firmly attached to matter, some free to move, but travel (travelling quantum forces).
- The Earth's magnetic field is made-up of those quantum forces that are sometimes attached to the electrons that make-up the Earth's magnetic core.

Earth: a concentration of forces

Concentrated quantum forces

- In the current energy-based model of the universe, matter is considered to be a concentration of energy.
- In the force-based model of the universe, matter is considered to be made-up of concentrated quantum forces.
- All matter, including all electrons, are surrounded by attached quantum forces.
- When electrons move (i.e. electricity) their attached quantum forces also move, thus creating the attached magnetic field.

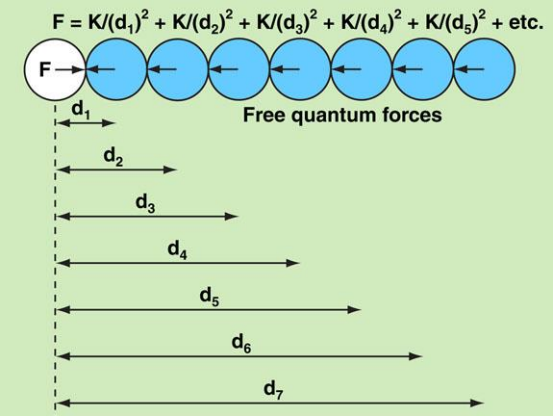


A photon of light

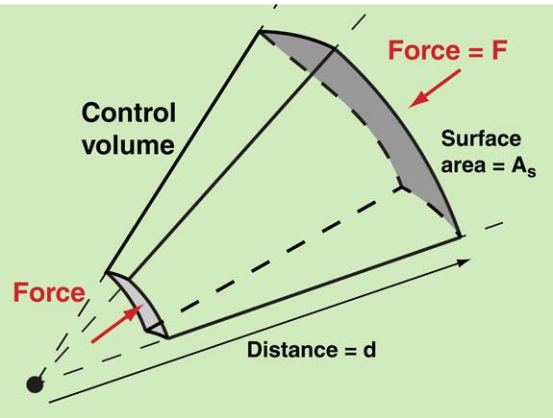
Transient concentrations of quantum forces

- When a compression wave passes through aether, a portion of the aether temporarily becomes concentrated above background levels, and then relaxes.
- Just like sound waves move as a transient concentration of air particles, light travels as a transient concentration of aether.
- It is believed (by the author) that the lateral spread of this concentration of aether is what generates the different colours that travel with white light.

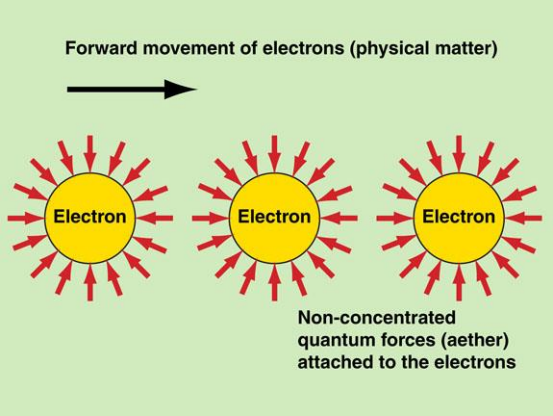
Attached quantum forces



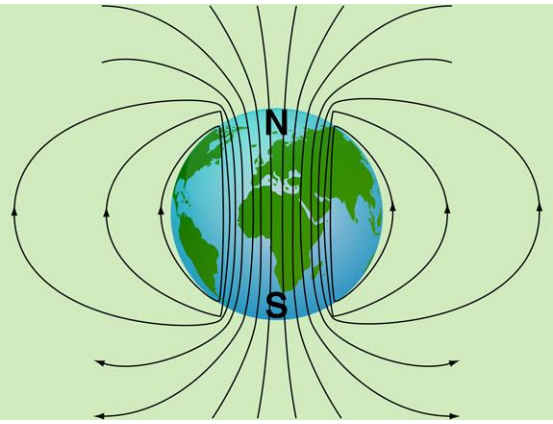
Interaction between quantum forces



Forces acting on a segment of a sphere



Quantum forces attached to electrons



Quasi-free quantum forces

The effects of distance

- As previously mentioned, quantum forces have just one task, or action, that being to repel all other quantum forces.
- The magnitude of the force exerted by one quantum force on an adjacent quantum forces depends on:
  - the sum of the mass of quantum forces, in a given direction, divided by the square of the distance of each quantum force from the principal quantum force
  - in other words, the force increases with the concentration of quantum forces.

Forces acting on a central object

- In a force-based system, if we:
  - consider the forces acting on a control volume where there is no force applied to the sides, then we find that the force per unit area acting at each end must be inversely proportional to the square of the distance from the centre in order to the total force (F) to be constant
  - this is because the surface area of a sphere increases with the square of its radius (surface area = $4\pi r^2$).

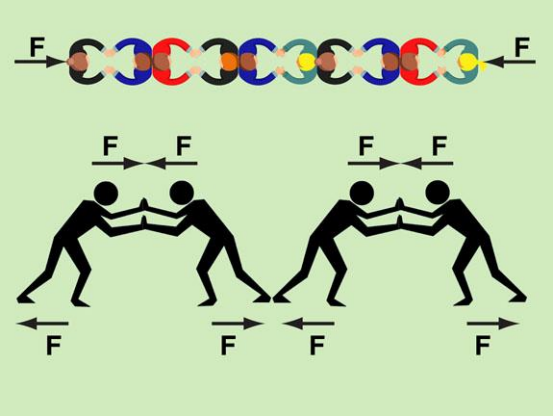
Quantum forces attached to electrons

- The region of influence of a quantum force is significantly smaller than an electron.
- Quantum forces will push inwardly upon electrons because electrons are formed from a concentration of quantum forces (just like a planet).
- Thus, electrons will always be surrounded by a ring of attached quantum forces, which will likely influence the spacing a electron shells for any given background pressure.

Quantum forces attached to Earth

- Quantum forces are attached to every element of a planet, including every electron and nucleus—they are what makes every free-forming objects want to take the shape of a sphere.
- Within any planet, there will be quantum forces that can move freely through the planet while staying within the planet, and those that travel with the planet while also travelling in loops in and out of the planet, such as in the Earth's magnetic field.

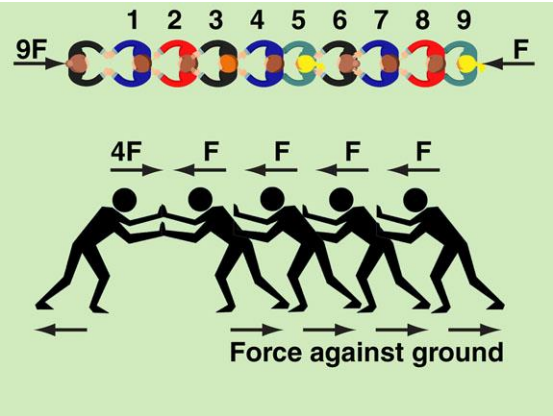
Quantum forces act as point forces, not like pressure



Simulating pressure force

The action of pressure

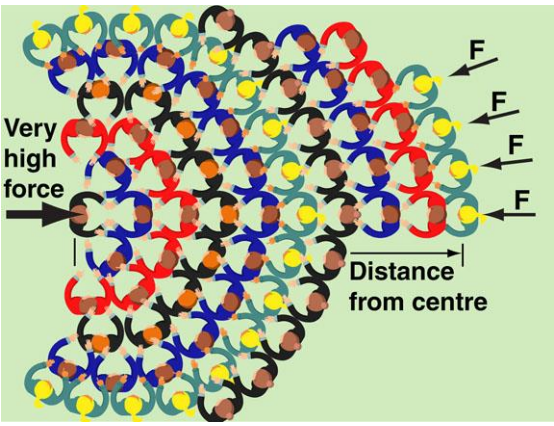
- It would seem logical to think of the forces exerted by quantum forces as acting like a fluid in a pressure container, but quantum forces don't act like pressure, they act like a collection of point forces.
- The following discussion is not perfect, but I hope that it will give you a bit of an idea.
- The action of pressure is like a crowd of people standing back-to-back, pushing each other such that the net force is balanced between any two people.



Simulating quantum force

The action of forces

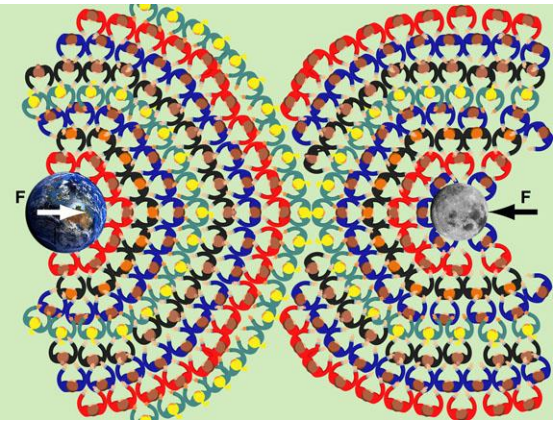
- However, the quantum forces that fill space work in a different way—if a concentration occurs (i.e. matter), then:
  - a concentration of attached quantum forces surrounds the matter
  - they push against each other as well as pushing against the matter
  - as much as they push outwards, they are pushed inwards with a greater force.



Simulating gravitational forces

Forces on a central object

- The surface area of a sphere varies with the square of its radius (area = $4\pi r^2$).
- When quantum forces surround a planet, the surface area of the net force pushing towards the plant increases with the square of the distance from the planet.
- This means that the force acting on each quantum force decreases with the square of the distance, which causes the region of influence of each quantum force to increase with its distance from the planet (not shown in my diagrams).

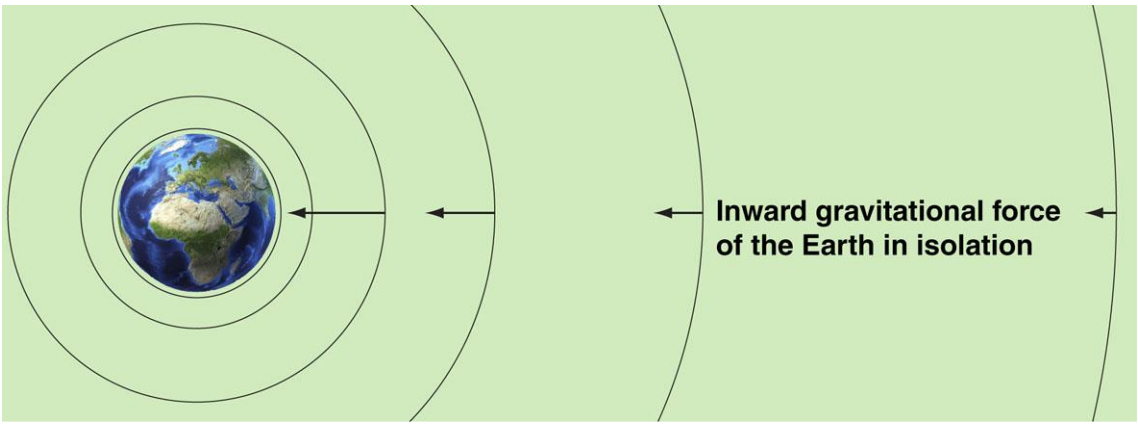


Simulating planetary 'attraction'

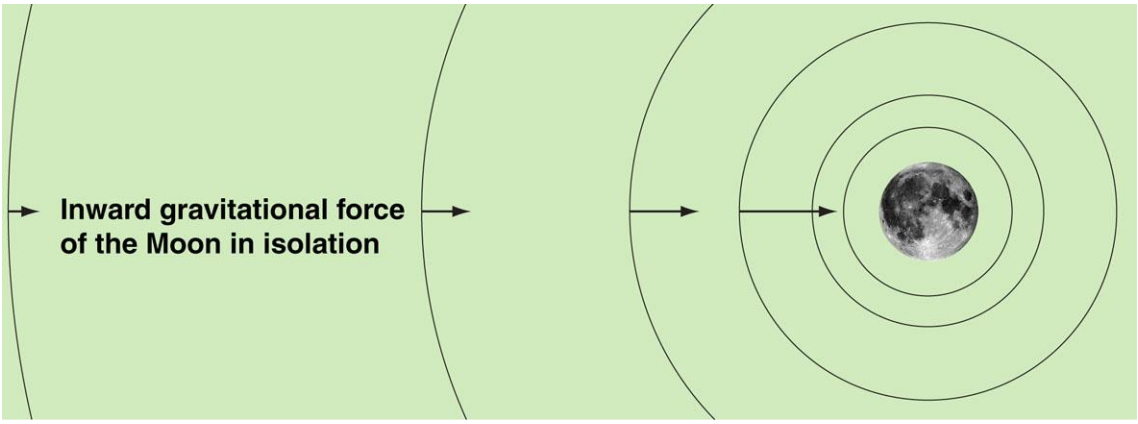
Action of forces on two objects

- The forces that surround any star, planet or moon, extend across space for vast distances, but not indefinitely.
- When two celestial bodies are close to each other, the sphere of influence of the quantum forces that surround each moon or planet will overlap each other, and the attracting forces will superimpose.
- Ultimately this action causes a net force to push these two objects towards each other, which we call 'gravity'.

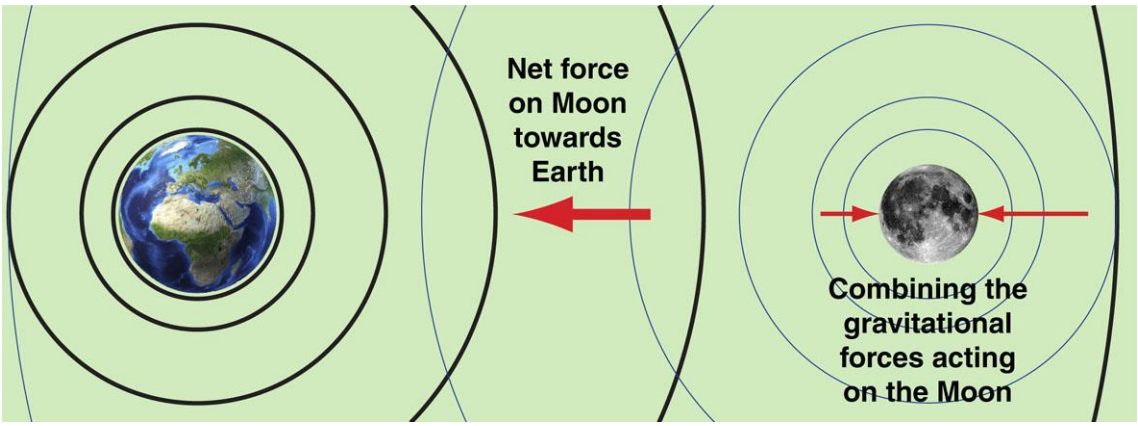
Gravitational forces acting on the Earth and Moon



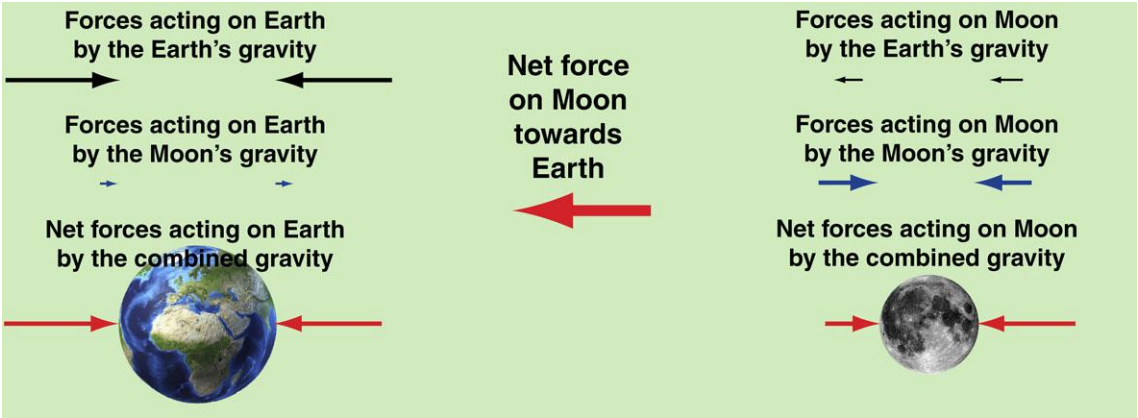
Inward compressing force on the <u>Earth</u>



Inward compressing force on the <u>Moon</u>

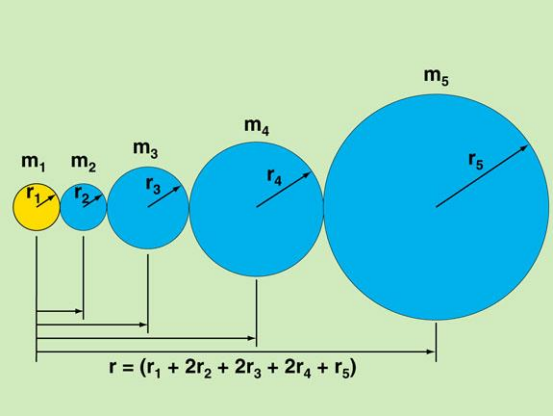


Combined forces acting on the Earth and Moon



Combined gravitational forces acting on the Earth and Moon

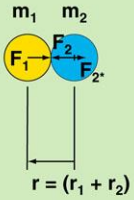
Creating the force of attraction and repulsion



Electron and attached quantum forces

$$F_1 = F_2 - F_{2*} + F_3 - F_{3*} + F_4 - F_{4*} + F_5 - F_{5*} + \text{etc}$$

$$F_2 = \frac{G.m_1.m_2}{(r_1 + r_2)^2}$$



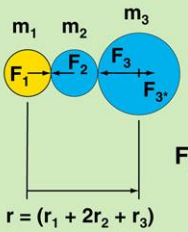
$$F_{2*} = \sum \frac{(G.m_2.m_n)}{(r_2 + 2r_3 + 2r_4 + 2r_5 \ldots)^2}$$

F_{2*} = sum of forces of attraction to outer quantum forces

Forces acting on mass-2

$$F_1 = F_2 - F_{2*} + F_3 - F_{3*} + F_4 - F_{4*} + F_5 - F_{5*} + \text{etc}$$

$$F_3 = \frac{G.m_1.m_3}{(r_1 + 2r_2 + r_3)^2} + \frac{G.m_2.m_3}{(r_2 + r_3)^2}$$

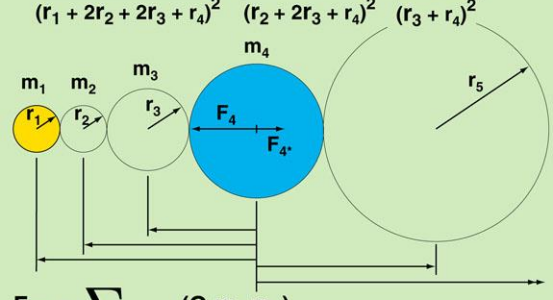


We could assume $m_2 = m_3$

$$F_{3*} = \sum \frac{(G.m_3.m_n)}{(r_3 + 2r_4 + 2r_5 + 2r_6 \ldots)^2}$$

Forces acting on mass-3

$$F_4 = \frac{G.m_1.m_4}{(r_1 + 2r_2 + 2r_3 + r_4)^2} + \frac{G.m_2.m_4}{(r_2 + 2r_3 + r_4)^2} + \frac{G.m_3.m_4}{(r_3 + r_4)^2}$$



$$F_{4*} = \sum \frac{(G.m_4.m_n)}{(r_4 + 2r_5 + 2r_6 + 2r_7 \ldots)^2}$$

Forces acting on mass-4

Introduction

- On this page I will describe the type of mathematics that demonstrates how the attached quantum forces ultimately generates a net force of attraction.
- This is NOT the correct mathematics, because in this example I have assumed that the effective size of the quantum force increases in proportion to distance, which is not correct (I believe).
- The correct analysis requires consideration of the mechanics in three dimensions—too hard for me!

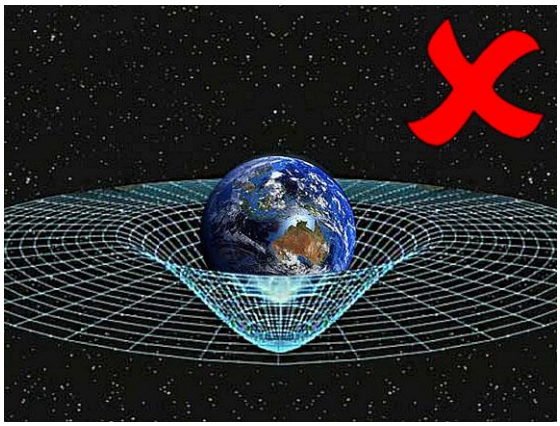
Forces acting on primary mass (m_1) and first secondary mass (m_2)

- There is a repelling force that exists between the primary mass (m_1) and the first attached quantum force (m_2).
- The primary mass can be anything from an electron to a planet, or a black hole.
- Key to this analysis is the relative size of the primary mass (r_1) compared to the attached quantum forces (r_2, r_3, r_4, etc.).
- For an electron; $r_1 > r_2$.
- For a nucleus; $r_1 >>> r_2$.
- The repelling force (F_2) that exists between the primary mass (m_1) and the first attached quantum force (m_2) is governed only by masses m_1 and m_2.
- The repelling force (F_{2*}) that exists between the first attached quantum force (m_2). and the outer attached quantum forces involves mass m_2 and all the masses outside m_2.
- This same analysis is repeated for all the attached quantum forces until the outer most attached quantum force has an inward repelling force equal to the background repelling force of free aether.

The effect of particle size

- For a mass the size of our Sun, the attached quantum forces will extend beyond Pluto before the attached quantum force 'pressure' equals the background aether, after which, the net force converts to the repelling force of aether.
- For a primary mass the size of an electron, the distance from the electron before the net force converts from attraction to repelling in microscopic, which means electrons repel each other, rather than attract each other.

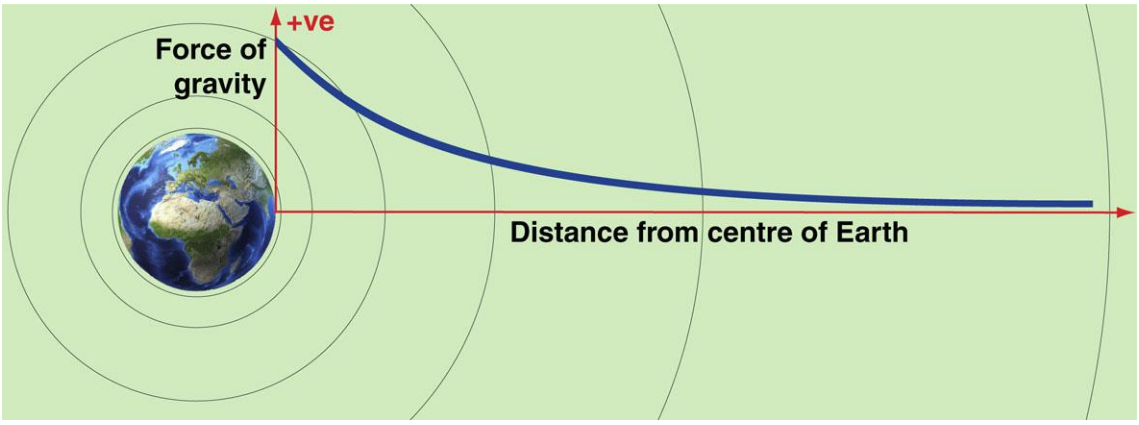
Creating the force of attraction and repulsion



'Spacetime' does not exist

The force of gravity adjacent the Earth

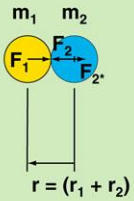
- Sorry Einstein, but gravity is not an action resulting from curved spacetime.
- 'Time' doesn't even exist in reality; it is just a human invention used as a measuring tool.
- Gravity, like everything in the universe, is a product of quantum forces, and the result of how these forces manage to turn a fundamental repelling force into a net force of attraction when applied in three dimensions around a central concentration of quantum forces (Wow!).



Variation in the force of gravity with distance from Earth

$$F_1 = F_2 - F_{2*} + F_3 - F_{3*} + F_4 - F_{4*} + F_5 - F_{5*} + \text{etc}$$

$$F_2 = \frac{G.m_1.m_2}{(r_1 + r_2)^2}$$



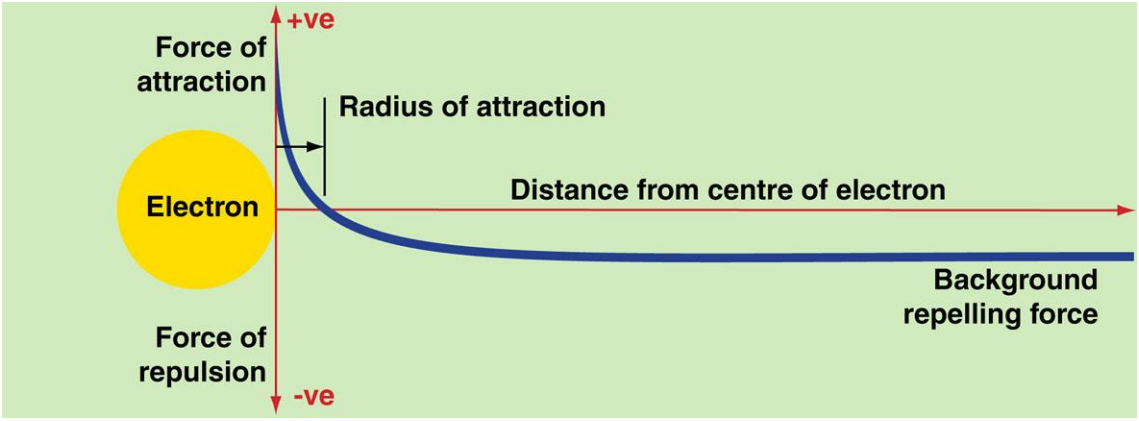
$$F_{2*} = \sum \frac{(G.m_2.m_n)}{(r_2 + 2r_3 + 2r_4 + 2r_5 \ldots)^2}$$

F_{2*} = sum of forces of attraction to outer quantum forces

The relative size of mass and Q-force

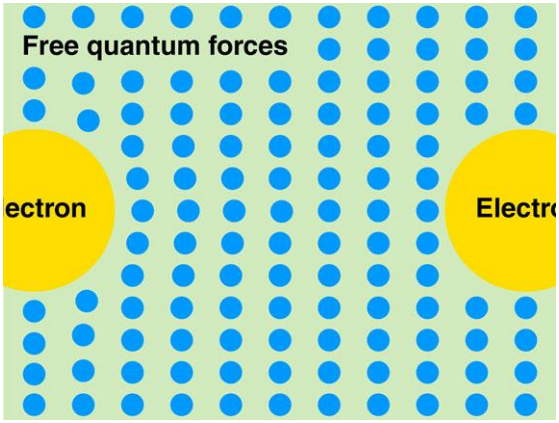
The force of gravity adjacent an electron

- The net force of attraction reduces with the square of the distance of separation.
- As the distance of separation increases, the net force reduces until it can no longer overcome the background force of repulsion shared by all free quantum forces, after which this repulsion force dominates.
- The distance to this attraction–repulsion inflection varies with the relative size of the primary mass relative to the size of the adjacent quantum force (another Wow!).



Variation in the force of gravity with distance from an electron

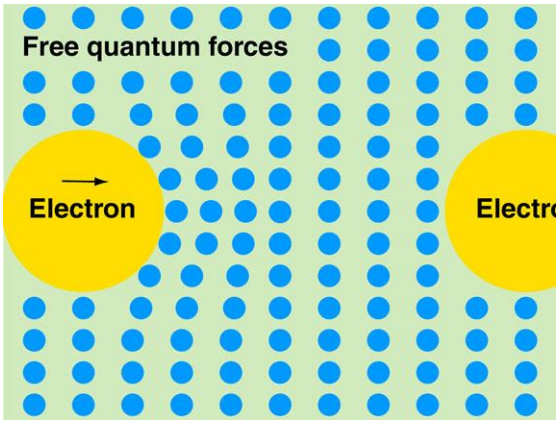
Interaction between quantum forces and electrons



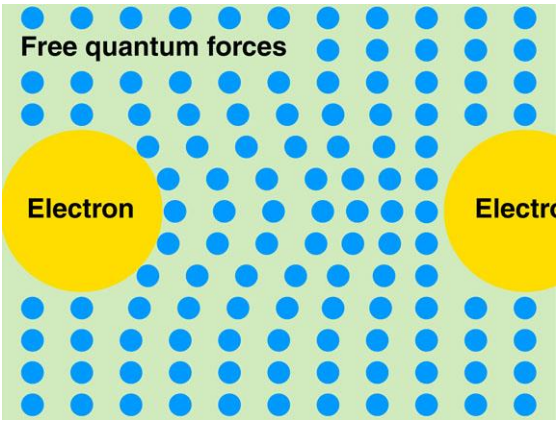
Stage 1

Discussion

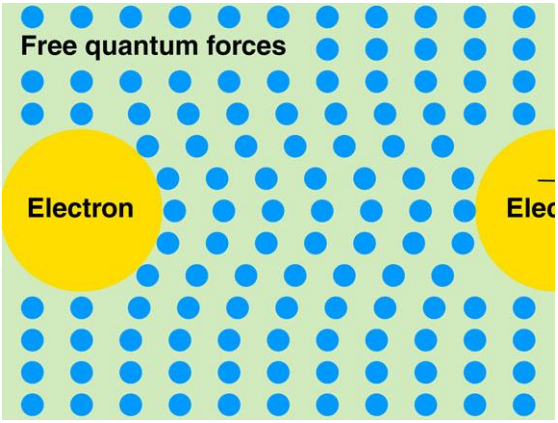
- When an electron moves, it will cause the direct movement of its attached quantum forces, which in-turn will induce movement in the surrounding free quantum forces.
- The force message of this movement will flow through a field of forces at the speed of causality.
- These diagrams show how the movement of one electron can create compression waves in the aether, which can cause the movement of other electrons.



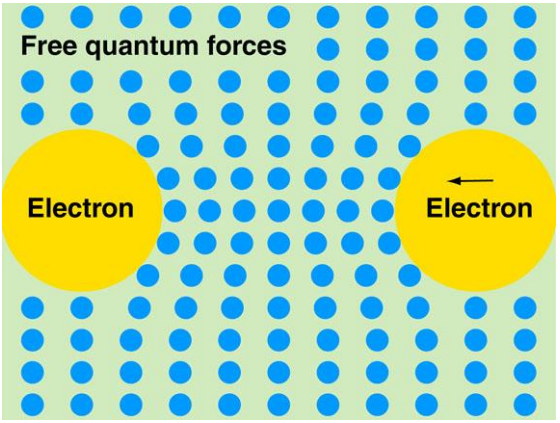
Stage 2 (movement to the right)



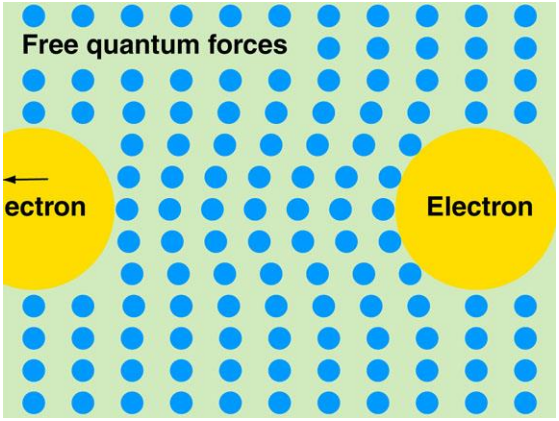
Stage 3 (movement to the right)



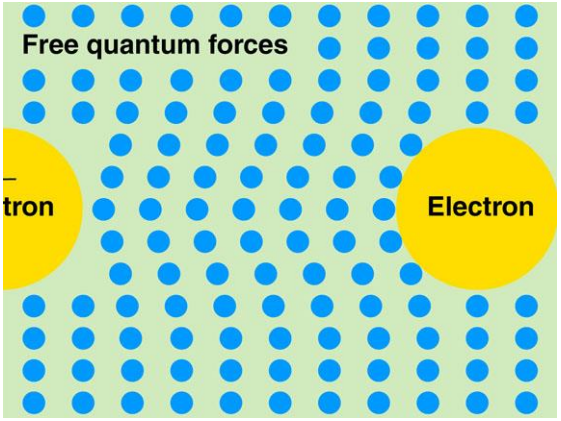
Stage 4 (movement to the right)



Stage 5 (movement to the left)



Stage 6 (movement to the left)



Stage 7 (movement to the left)

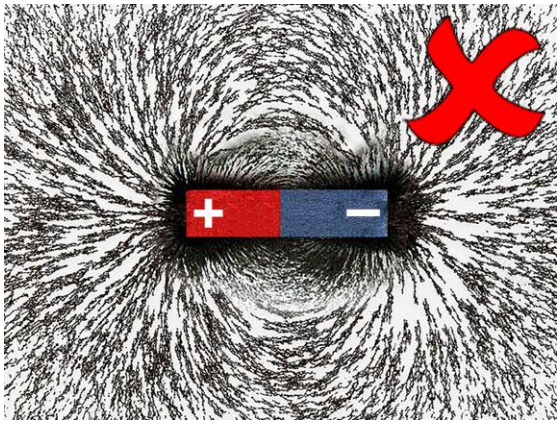
4. The Mechanics of the Strong Atomic Interaction

An important note to the reader

Speaking with limited knowledge

Introduction

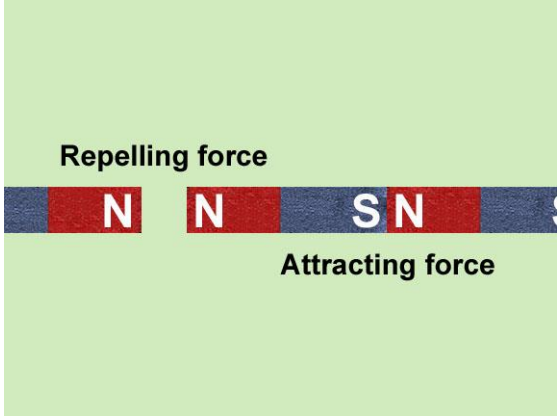
- At this point in the discussion I would like to point out that chemistry is not my thing!
- Consequently, the following discussion may not be totally correct!
- While I found physics to be a very logical science, I found chemistry to be a very illogical science.
- Chemistry is a science where there is an exception to almost every rule.
- In my uneducated opinion, if a 'rule' has an exception, then it is not a rule.



No positive or negative effects

No more positive and negative charges

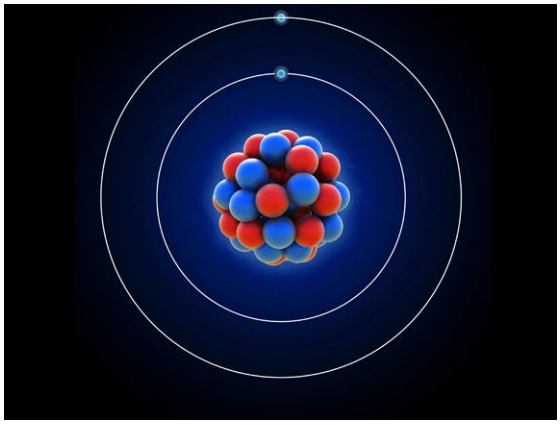
- In order to discuss atomic activity we need to remove all reference to positive (+) and negative (-) charges.
- Surprise, surprise, atomic activity has **nothing** to do with charged particles.
- The concept of charged particles was **invented** as a means of describing the forces that hold electrons in orbit around a nucleus, which was developed when no other logical explanation existed.



The 'assumed' magnetic forces

An invented force

- Both magnetism and electromagnetism are assumed to be fundamental interactions because these forces could not be explained in terms of the other known fundamental interactions.
- This interaction assumes both 'repelling' actions and 'attracting' actions.
- However, both of these actions can be explained by quantum forces, which utilise only repelling forces, but do so in a manner that occasionally gives the appearance of an attracting force.

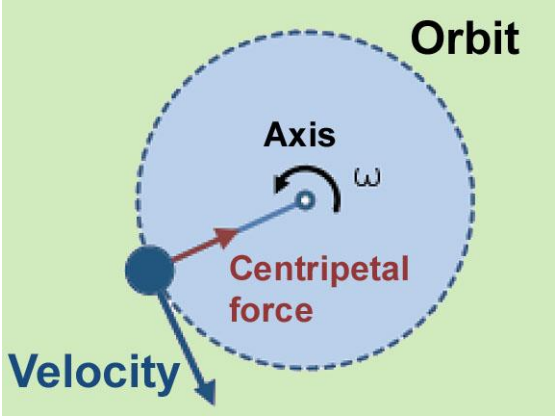


Atom

An atom is <u>not</u> held together by magnetic forces

- The forces that attract an electron to a nucleus, that repel an electron from another electron, that determine the spacing of electron shells, subshells and orbitals, are in fact the same forces that hold moons in orbit around planets, and planets in orbits around stars.
- All of these forces originate from quantum forces.
- The key is understanding how these forces change with particle size.

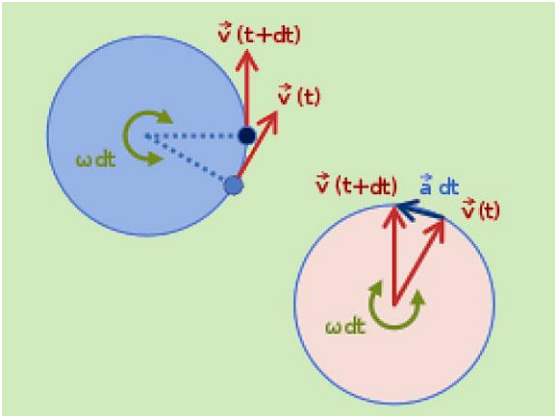
Centripetal forces



Centripetal force

Introduction

- In physics we learn about centripetal force, and the mathematical relationship between a central axis and an orbiting object, whether joined by a physical chord, or an externally applied force.
- The direction of this force always being orthogonal to the motion, and towards the central axis.

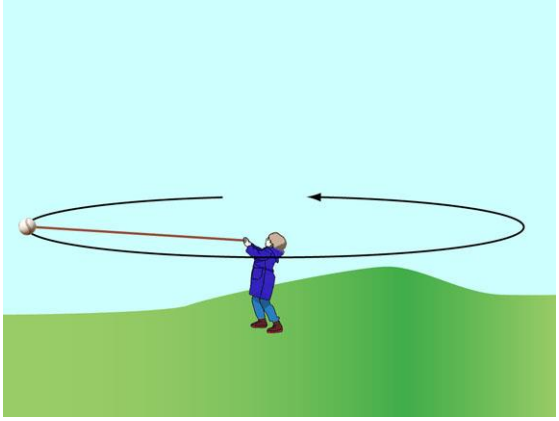


Velocity vectors

Traditional analysis

- Traditionally, physics has described this motion in terms of:
  - the centripetal force, F
  - the objects mass, m
  - the radius of curvature, r
  - the tangential speed, v
- Such that:

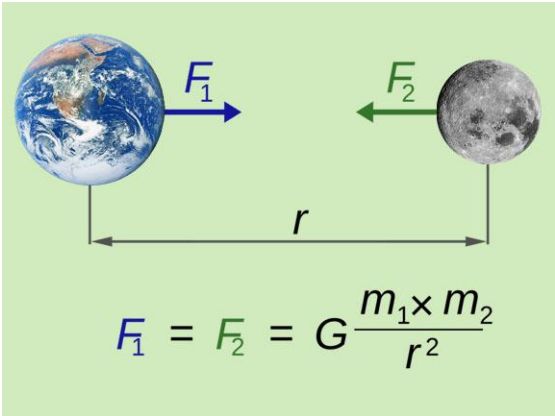
$$F = (m.v^2)/r$$



Centripetal action

The speed of causality

- When a ball is held by a string, we can say that the response to the ball's change of direction, in terms of the string's tension and angle of attach, is instantaneous.
- However, if the motion is induced by an external force generated by the reactions of the media through which it moves, then:
  - these reactions would experience a delay, which would be linked to the speed of the force message
  - the force would always lag behind the motion.



Gravitational attracting

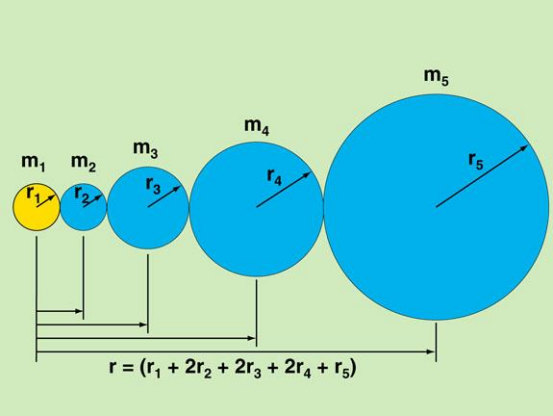
Celestial bodies

- The force equation we use for celestial bodies is:

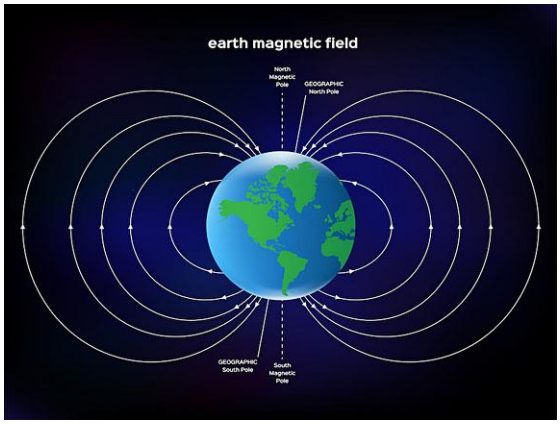
$$F = (G.m_1.m_2)/r^2$$

- This equation suggests that an 'attracting' force extends indefinitely; however, eventually this attaching force will fall below the background repelling force of aether.
- Sorry Einstein, but gravity is not an action resulting from curved spacetime, and gravity is most definitely a **force**.

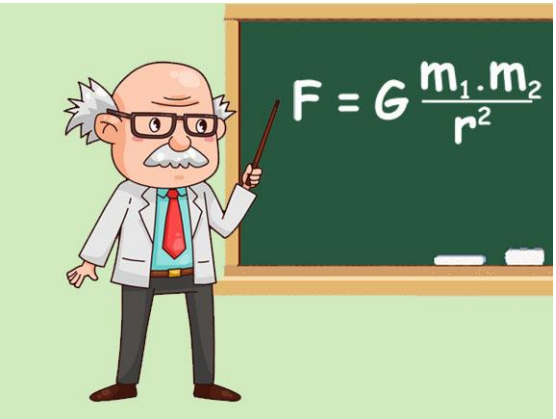
Mechanics of attached quantum forces



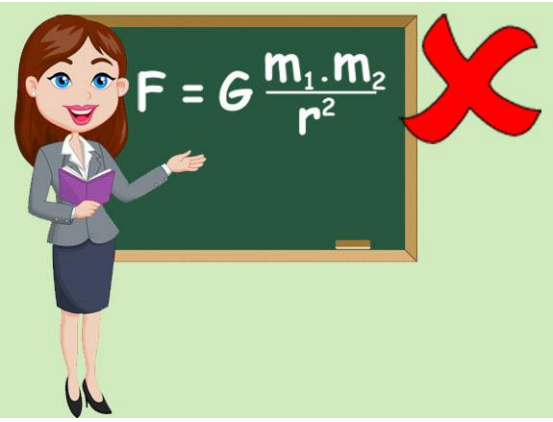
Electron and attached quantum forces



Magnetic flow of quantum forces



Gravitational equation



This may not be the final equation!

Introduction

- As introduced in a previous chapter, quantum forces can exist in various conditions.
- Free quantum forces exist as a background concentration, which is constantly being reduced as the universe expands.
- Attached quantum forces exist at various concentrations, and are held onto, and travel with, physical matter.
- Travelling quantum forces have at some stage been captured by, and therefore travel with, physical matter, but currently move 'freely' within the physical matter, which accounts for most of the quantum forces travelling with the Earth.
- Magnetic fields consist of travelling quantum forces that are loosely attached to a magnet or electromagnet.
- Concentrated quantum forces are the building blocks of all physical matter.
- Even though an electron is very small, it too is made-up of a concentration of quantum forces that are themselves surrounded by attached quantum forces.

The strength of attached quantum forces

- The gravitational force existing between a primary particle and any attached quantum force is inversely proportional to the square of the distance of separation.
- The force equation being the same of the gravitational force equation:

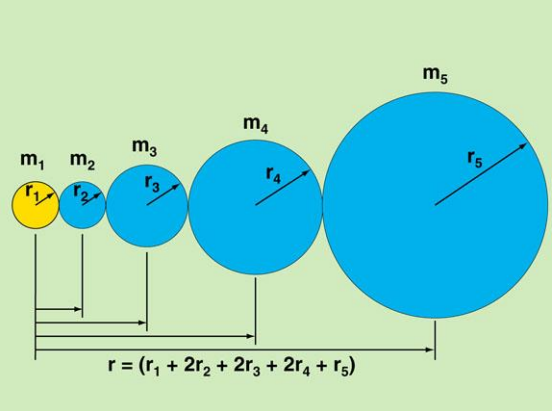
$$F = (G.m_1.m_2)/r^2$$

- This equation suggests that an attracting force extends indefinitely; however, this force will eventually fall below the background repelling force at the effective radius of attached quantum forces (R).

The strength of electron attachment to a nucleus

- In this document I am insisting that the force of attraction between physical matter and the attached quantum forces is determined by the same gravitational equation that applies to celestial bodies.
- However, there are **many** factors that modify these forces when we consider the net force of attraction between two forms of atomic matter, such as an electron and its nucleus, which can result in a very different relationship between 'force' and 'radius'.

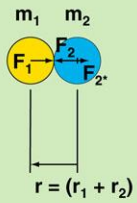
Repeat of a page from the previous chapter



Electron and attached quantum forces

$$F_1 = F_2 - F_{2*} + F_3 - F_{3*} + F_4 - F_{4*} + F_5 - F_{5*} + \text{etc}$$

$$F_2 = \frac{G.m_1.m_2}{(r_1 + r_2)^2}$$



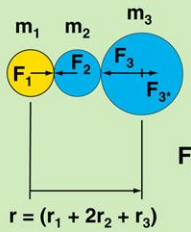
$$F_{2*} = \sum \frac{(G.m_2.m_n)}{(r_2 + 2r_3 + 2r_4 + 2r_5 \ldots)^2}$$

F_{2*} = sum of forces of attraction to outer quantum forces

Forces acting on mass-2

$$F_1 = F_2 - F_{2*} + F_3 - F_{3*} + F_4 - F_{4*} + F_5 - F_{5*} + \text{etc}$$

$$F_3 = \frac{G.m_1.m_3}{(r_1 + 2r_2 + r_3)^2} + \frac{G.m_2.m_3}{(r_2 + r_3)^2}$$

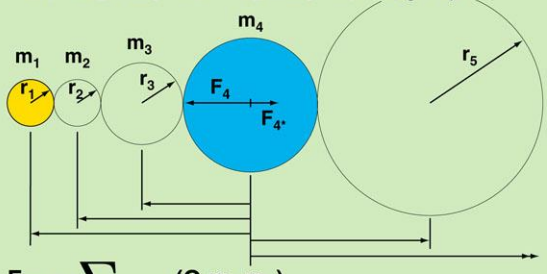


We could assume $m_2 = m_3$

$$F_{3*} = \sum \frac{(G.m_3.m_n)}{(r_3 + 2r_4 + 2r_5 + 2r_6 \ldots)^2}$$

Forces acting on mass-3

$$F_4 = \frac{G.m_1.m_4}{(r_1 + 2r_2 + 2r_3 + r_4)^2} + \frac{G.m_2.m_4}{(r_2 + 2r_3 + r_4)^2} + \frac{G.m_3.m_4}{(r_3 + r_4)^2}$$



$$F_{4*} = \sum \frac{(G.m_4.m_n)}{(r_4 + 2r_5 + 2r_6 + 2r_7 \ldots)^2}$$

Forces acting on mass-4

Introduction

- On this page I will describe the type of mathematics associated with the accumulative force that can be generated by attached quantum forces.
- This is NOT the correct mathematics, because in this example I have assumed that the effective size of the quantum force increases uniformly with distance, which is not a correct.
- The correct analysis requires consideration of the mechanics in three dimensions, which is too much for me!

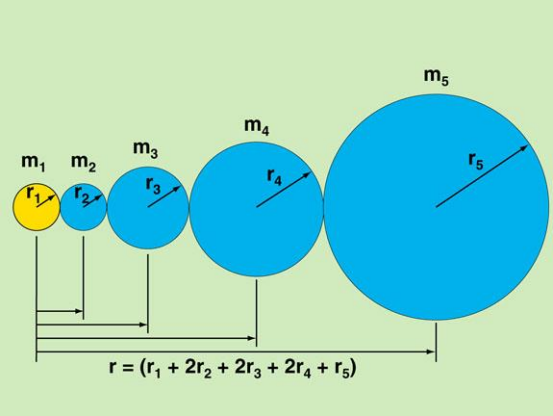
Forces acting on primary mass (m_1) and first secondary mass (m_2)

- There is a repelling force that exists between the primary mass (m_1) and the first attached quantum force (m_2).
- The primary mass can be anything from an electron to a planet, or even a black hole.
- The key to this analysis is the relative size of the primary mass (r_1) to that of the attached quantum forces (r_2, r_3, r_4, etc.).
- For an electron; $r_1 > r_2$.
- For a nucleus; $r_1 >>> r_2$.
- The repelling force (F_2) that exists between the primary mass (m_1) and the first attached quantum force (m_2) is governed only by masses m_1 and m_2.
- The repelling force (F_{2*}) that exists between the first attached quantum force (m_2). and the outer attached quantum forces involves mass m_2 and all the masses outside m_2.
- This same analysis is repeated for all the attached quantum forces until the outer most 'attached' quantum force has an inward repelling force equal to the background repelling force of free aether.

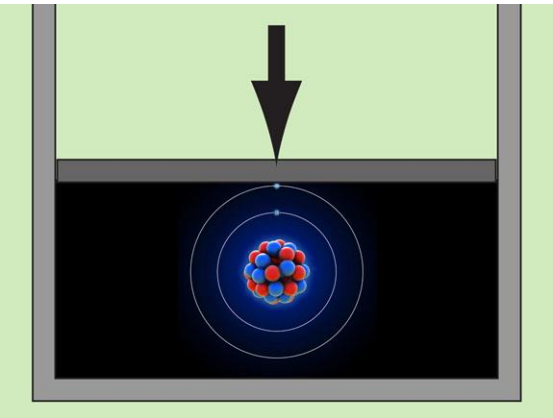
The effect of particle size

- For a mass the size of our Sun, the attached quantum forces will extend beyond Pluto before the attached quantum force 'pressure' equals background aether (i.e. the radius of attraction is very large).
- However, for a primary mass the size of an electron, the radius of attraction is very small (i.e. the distance from the electron to the point where the net force converts from an attraction force to a repelling force), which means electrons repel each other, rather than attract.

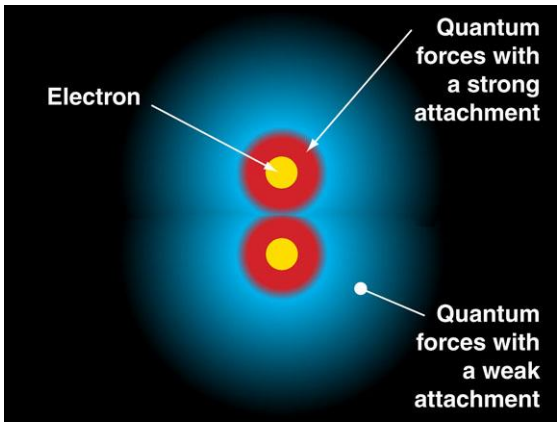
An explanation of the strong atomic interaction



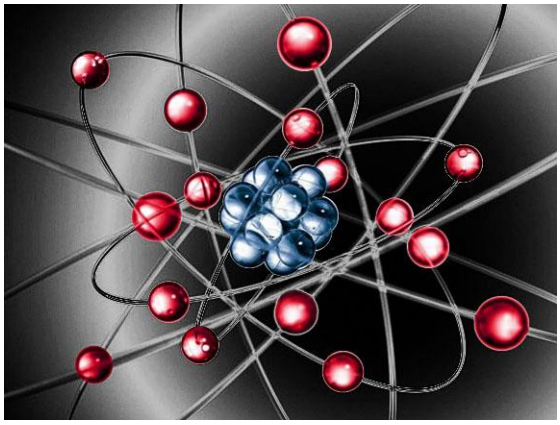
Quantum forces attached to an electron



Compressing a gas



Electrons pushed closer together



Complex atom

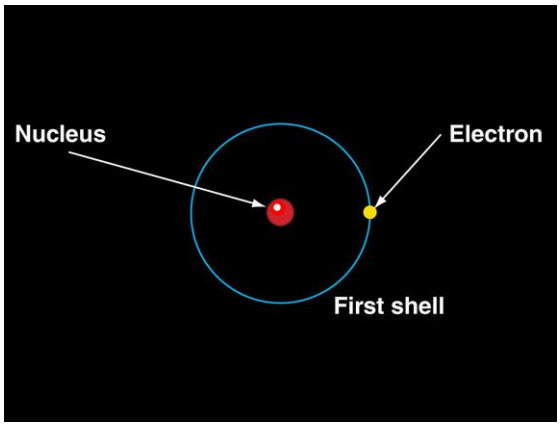
Atoms

- At an atomic level we have the workings of both the strong and weak interaction.
- The key to understanding these forces is to realise that as the diameter of the primary mass (m_1) gets smaller relative to the secondary mass (m_2), the inward force applied by the quantum force increases for a given primary mass.
- In other words, at an atomic level, size matters!
- In this case, the primary mass is either an electron or a nucleus, and the secondary mass is the attached quantum force.
- Consequently, when a very small electron is surrounded by attached quantum forces, the resulting force of attraction is significantly different from the forces that surround a much larger nucleus.
- Electrons have a much stronger attachment of quantum forces, but they also have a significantly smaller radius of attraction, beyond which the force reverses into a repelling force.
- For an nucleons (Wikipedia):
  - the nuclear force is powerfully attractive between nucleons at distances of about 1 femtometre, but it rapidly decreases to insignificance at distances beyond about 2.5 femtometres.
- As a gas is placed under pressure, the electrons are force closer and closer to the nucleus, which increases the effective attractive force between the electron and its nucleus, which:
  - reduces the size of the attached quantum forces relative to the electron, which in turn
  - reduces the attachment of the quantum forces to the electron.

Size and stability of atoms

- The nucleus of atoms varies in size according to the type of element.
- As the nucleus increases in size, the maximum radius of attraction increases significantly.
- If temperatures or a collision cause an electron to bounce free of this radius of attraction, then that particular electron is released from that particular atom.

Expanding the atom from element to element



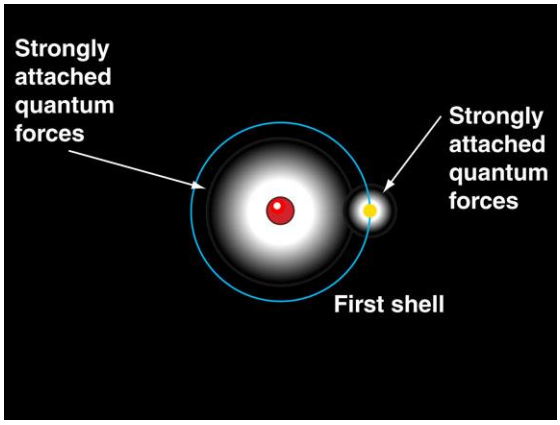
Hydrogen atom

Hydrogen atom

- The hydrogen atom is the simplest of all the elements with just one proton and one electron, and an atomic number: N = 1.
- We can let the initial radius of orbit be:

$$r = R_H$$

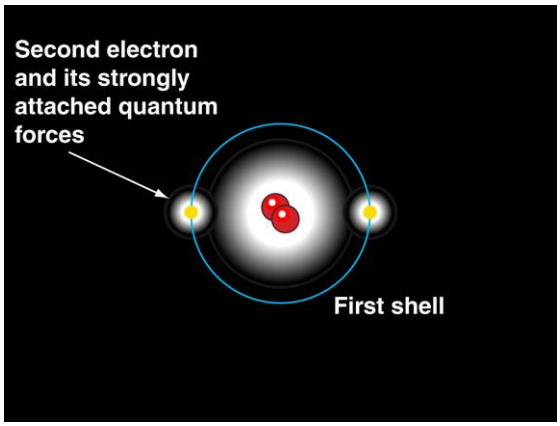
- If an electron fails to maintain its orbit it will be pushed into the nucleus.
- Once an electron approaches a nucleus, the increase in 'local' mass will alter the properties of its attached quantum forces and the electron will lose its repulsion force.



Hydrogen atom

Spacing of the first electron shell

- Even though the effective attraction radius of the nucleus extends well beyond the first electron shell, the velocity of the electron allows it to maintain its orbit.
- Both the electron and nucleus are surrounded by attached quantum forces, and it is assumed that for any given background pressure of the quantum forces (P_F), there is a certain radius of attached quantum forces that determines the radius of the electron's orbit, R_H.

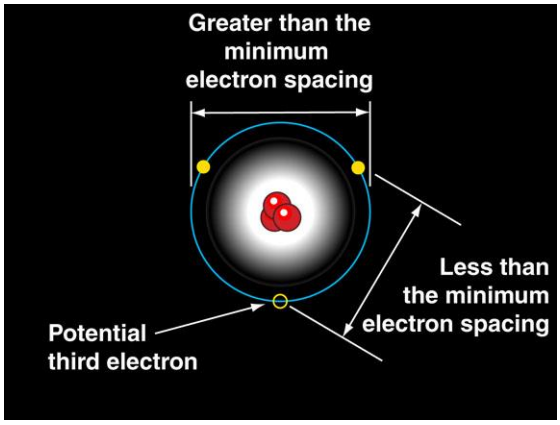


Helium atom

Helium atom

- The next element up the periodic table is the helium atom.
- As the atomic number (N) of the atom increases, there will be an increase in the gravitational attraction of the electrons to the nucleus.
- Therefore, as the atomic number increases, the radius of this first shell (r_1) reduces; similarly, as the background pressure increases, the radius also reduces:

$$r_1 = R_H.(f(N, P_F))$$

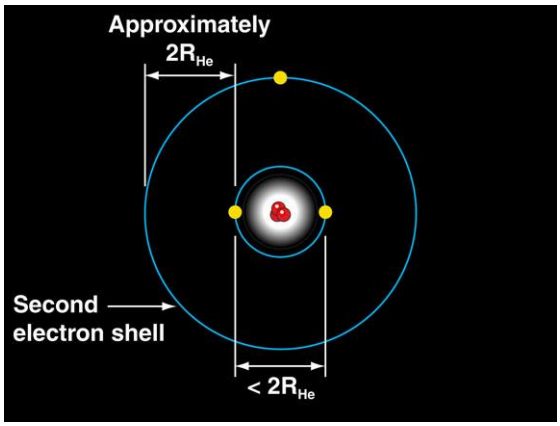


Spacing if the 1st shell held 3 electrons

A third electron will not fit

- The next element up the periodic table is the lithium atom, with three protons and three electrons.
- The third electron sits in a second shell because the first shell can only accommodate two electrons.
- This is important because it gives us an indication of the safe repelling distance of two electrons for a given background pressure of the quantum forces, which turns out to be just less than $2R_{He}$.

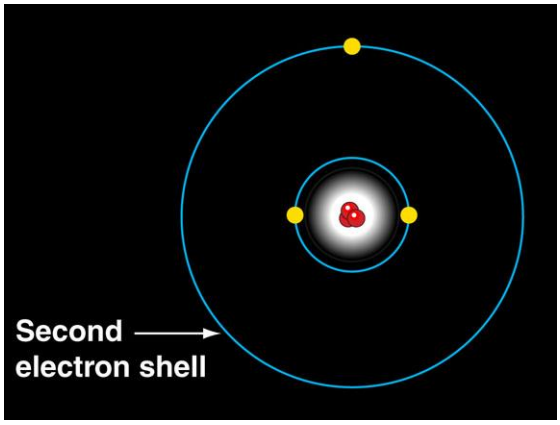
Expanding the atom from element to element



Lithium atom

Lithium atom

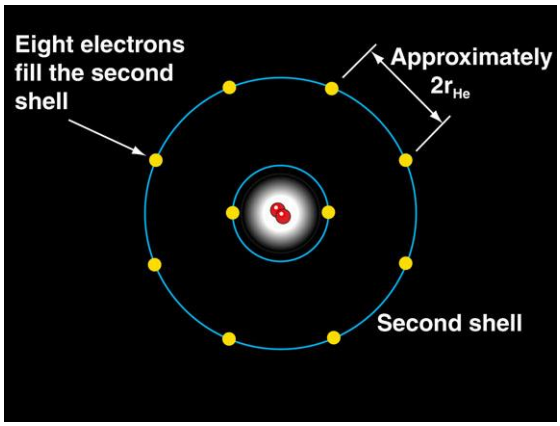
- The lithium atom's third electron must position itself on a new outer shell that needs to be approximately $2r_{He}$ larger in radius from that of the inner shell.
- However, the inclusion of an additional photon, neutron and electron causes an increase in the gravitational force, which:
  - reduces the radius of the inner shell, and
  - reduces the size of the quantum forces attached to the two inner electrons.



Lithium atom

The impact of adding this third electron

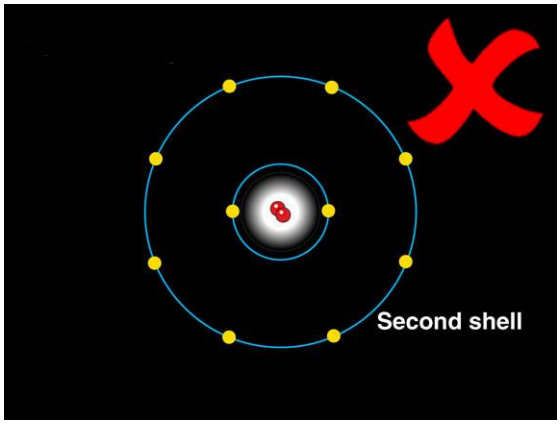
- Adding a third electron results in the following outcomes:
  - the nucleus increases in size with an added proton and neutron
  - the radius of the first shell reduces due to the increases attraction force, which could displace some attached quantum forces
  - the quantum forces attached to the electrons in the first shell will reduce in size.



Neon atom

Neon

- The second shell is reported to hold up to eight electrons.
- Therefore, the radius of the second shell would need to be about $2.6(R_{He})$ in order to hold eight electrons at the desired separation.
- However, due to the increased gravitational force caused by the larger nucleus, the radius of the first shell will again be reduced.
- But, would eight electrons really want to sit in a two-dimensional outer shell?

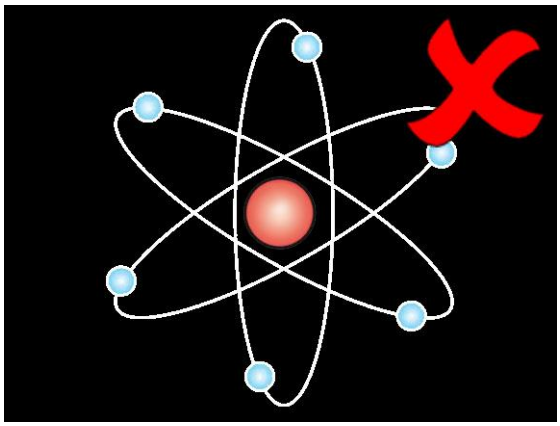


Questionable electron arrangement

Subshells and orbitals

- If the eight electron stayed in this single 'ring', then that would make the atom act like a near-flat, two-dimensional disk.
- All it would take would be one diagonal electron-to-electron collision from an adjacent atom, and this 'flat' shell would be pushed into a three-dimensional shell with the eight electrons:
  - still maintaining their desired spacing from each other, and
  - still orbiting the nucleus.

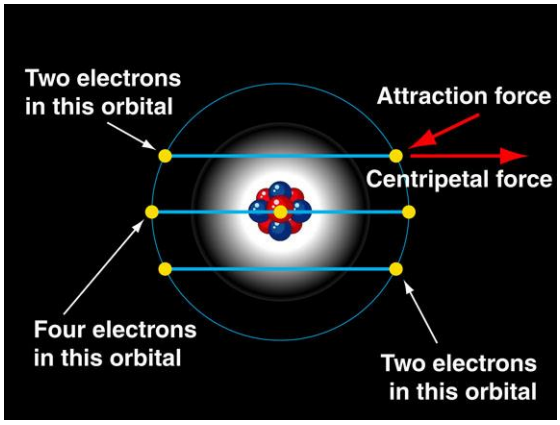
Expanding the atom from element to element



The wrong type of orbital

The wrong type of orbit pattern

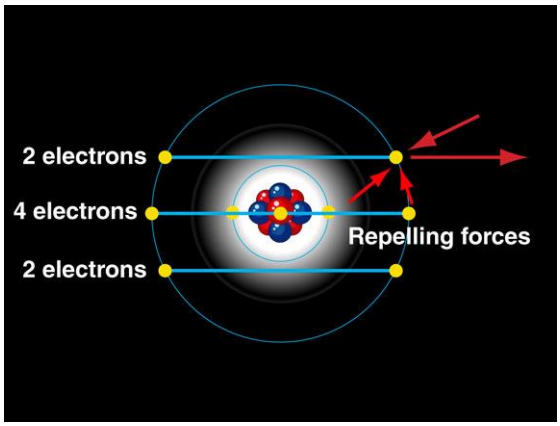
- Many diagrams display atoms in a three-dimensional form, but with the electrons potentially crossing paths, which would not happen.



Proposed orbitals

Orbital patterns

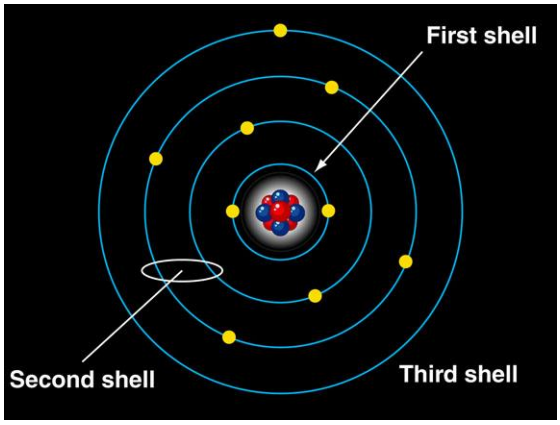
- If we tilt the previous diagrams 90-degrees we can see this second shell of eight electrons existing as three separate orbitals (rings).
- The problem is that the centripetal force is parallel with the plane of rotation, while the attraction force is directed towards the centre of the nucleus.
- Consequently there would 'appear' to be an imbalance in the forces acting on the electron; but, there is a third force (continued below).



Neon atom

Neon atom

- Unlike satellites orbiting the Earth, electrons orbiting a nucleus have a third force acting on them, that being the force of repulsion shared between all electrons.
- This third force balances the upper and lower orbitals containing two electrons each.
- Consequently, a neon atom can have a stable arrangement of four electrons in a central orbit, and four electrons shared between two outer orbitals, with all eight electrons existing in the second shell.

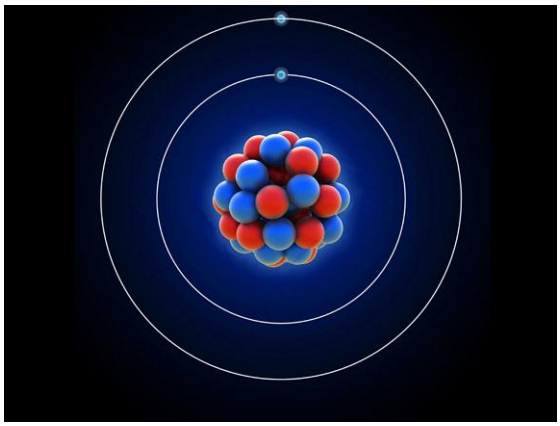


Sodium atom

Sodium atom

- The sodium atom introduces a third shell, which needs to be larger in radius than the second shell.
- The inclusion of an additional photon, neutron and electron once again causes an increase in the gravitational force, which:
  - reduces the radius of the inner shells
  - reduces the size of the quantum forces attached to the inner electrons.

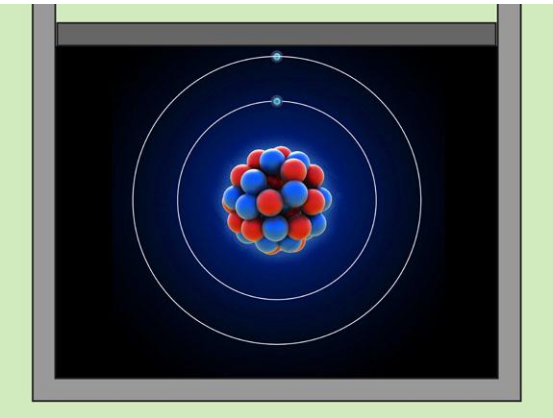
Compressing gases



An atom in space

Introduction

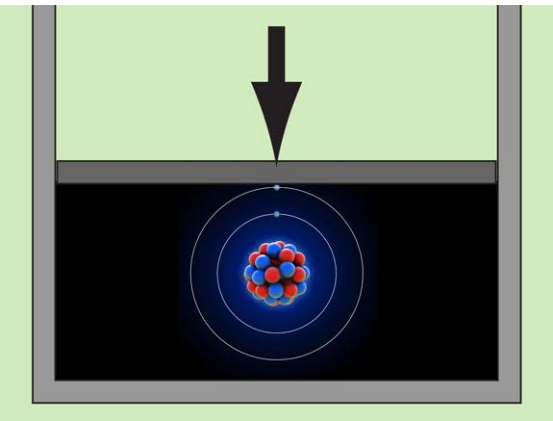
- We can think of electrons resting in shells that are a specific radius, or distance of separation, from the nucleus or other shells, but there is no set shell radius, or distance of separation.
- Electrons can position themselves at almost any radius—it all depends on the local background pressure.
- In space, the background pressure is determined by the expansion of the universe.



Representation of an air molecule

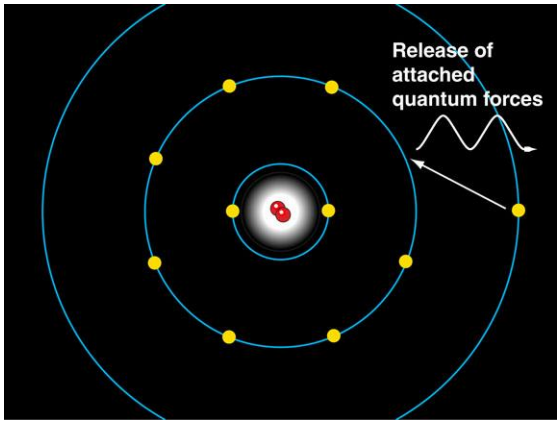
A gas locked in a container

- There is no specific temperature vs volume relationship.
- It is true that the temperature of a gas will rise if the gas is compressed, but the container can be cooled back to its original temperature leaving you with a new temperature vs volume relationship.
- Compressing a gas does two things, it reduces the radius of the electron shells, and it temporarily increases the likelihood of electron collisions.



Cooling or heating a compressed gas

- Increasing the temperature of a gas increases the speed of the electrons, which means the electrons will try to move to a larger radius, which causes an increase in the pressure within the container—this is a increase in the local background pressure.
- Cooling a gas slows the electrons, reduces the desired radius of orbit, and reduces the local background pressure.



The release of electromagnetic radiation

The release of electromagnetic radiation

- When an electron is forced to move to a lower shell, it can cause a certain ‘volume’ of attached quantum forces to be ‘pushed’ away from the electron, and possibly even the nucleus.
- This sudden release of quantum forces can be seen as a magnetic flow, or a release of electromagnetic radiation.

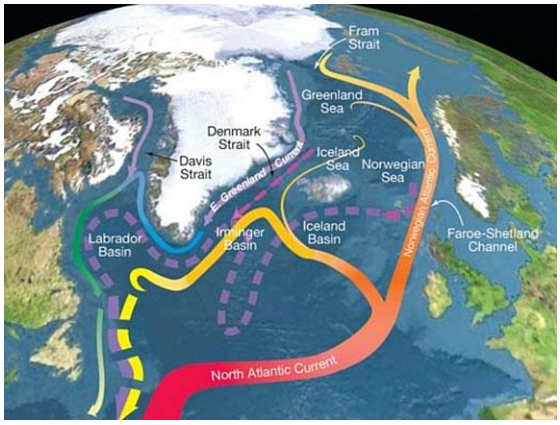
5. The Energy Needs of Circulation and Mixing

Introduction

Internal wave within a stratified fluid

Introduction

- The properties of atoms plays a major role in the mechanics of fluid mixing and circulation.
- Fluids of different densities don't like to mix, and this fluid property plays a role in the Earth remaining as a livable planet with favourable weather conditions.
- Unfortunately, poor mixing also plays a role in how certain 'bad' smells can so easily spread across a class room.



Poorly mixed ocean currents

Good circulation

- In coastal engineering we are taught that our oceans are well-circulated, but poorly-mixed.
- A good deal of the warmth felt by Europeans is due to the North Atlantic Current that carries warm water from the tropics upwards into the North Atlantic.
- In the absence of good mixing, ocean currents are able to carry warmth around our planet, while also carrying cold waters along the coast of some countries.

Good milk circulation, but poor mixing

Good mixing

- The circulation of fluids is a low energy activity, while the mixing of fluids is a high energy activity.
- When milk is poured into coffee or tea, it will initially experiences good circulation, but poor mixing.
- The milk only 'marbles' the brown liquid.
- Only when energy is introduced in the form of 'stirring' does good mixing occur, which finally achieves an even colour.

Water supply treatment plant

Adding chemicals to water

- Chlorination is a process that is applied to most drinking water systems in order to purify (disinfect) the water.
- This process involves adding chemicals to the water, but this process requires both good mixing (in order to achieve the chemical reaction) and good circulation (in order to achieve 100% contact with the water).
- Because the mixing process requires high energy inputs, the chemicals are often injected as high velocity.

The mechanics of density stratification

Poor mixing of a sediment plume (Qld)

Slow-mixing sediment plume

Poorly-mixed stratified smoke

Torrens Lake fountain (SA)

Questions:

- Why is it that two fluids of different densities do not want to mix?
- Why is it that a bad smell can spread through a room with the greatest of ease, and air layers of different density (or temperatures) experience minimal mixing unless energy is introduced?
- Why is it that you can selectively withdraw water of a given density from a dam without interfering with the immediate upper and lower layers of water?

Answers:

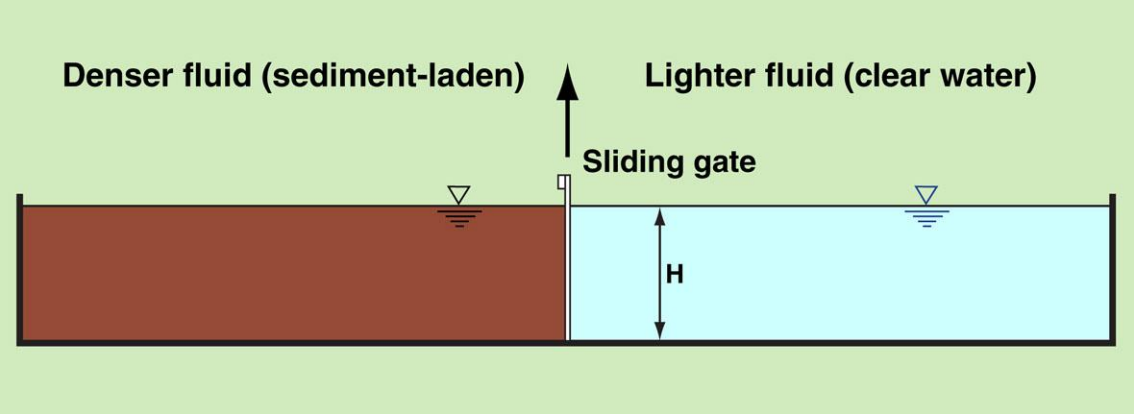
- The speed of causality changes with a change in density, thus atomic activity changes with density.
- A slowing of atomic activity means the velocity of electrons will slow, so the electron's radius of orbit will reduce.
- If two atoms from different density waters collide, then these electrons will initially have different speeds, which causes an exchange of momentum between the two electrons.
- One electron gets faster, the other gets slower, but if the faster electron does not gain enough energy to jump to a higher energy shell (orbit), then it will return to its original orbit condition, and its original density.
- If the other electron does not get slow enough to change its energy shell, then it will maintain its density; in addition the collision will send it in amongst molecules of its 'own' density layer.
- Unlike metals, it is the mobility of liquid molecules that reinforces the stratification process.
- A greater energy input is required in order to achieve a change in density, and thus the mixing of fluids.
- In ocean waters, it is tidal actions, and the turbulence that tidal exchanges causes, that introduces enough energy to cause mixing.
- In dams, it often take the circulation effects of an aeration system, or a lake fountain, that introduces the energy that is required to achieve good mixing, and avoid liquid stratification.

Lock exchange test – A demonstration of poor mixing

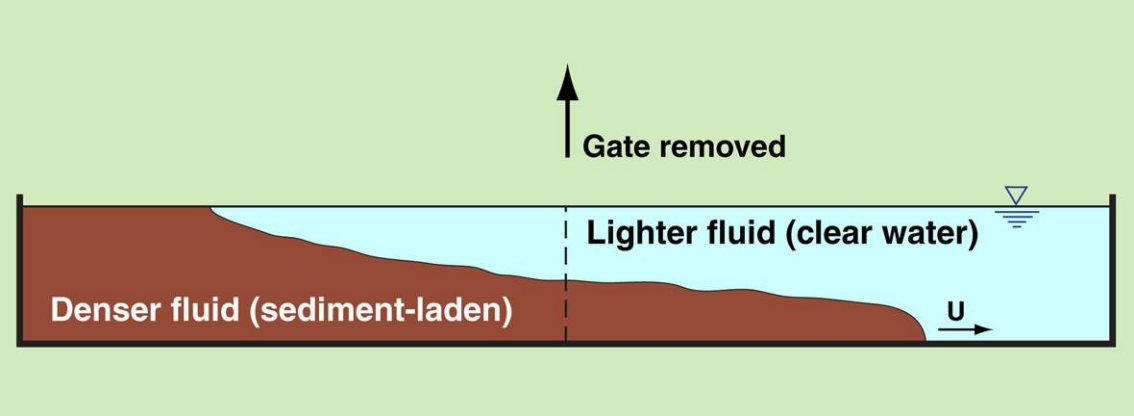
Lock exchange test prior to gate removal

Examples of poor 'mixing' in waters

- A lock exchange test can be used to measure the density difference between two fluids that have only a slight variation in their densities.
- The test relies on the fact that waters of different densities will flow as a 'wedge' over and under each other with minimal mixing.
- A 'salt water wedge' can form when fresh floodwater discharges into an ocean; or when shipping locks cause the interaction of fresh and saline water.



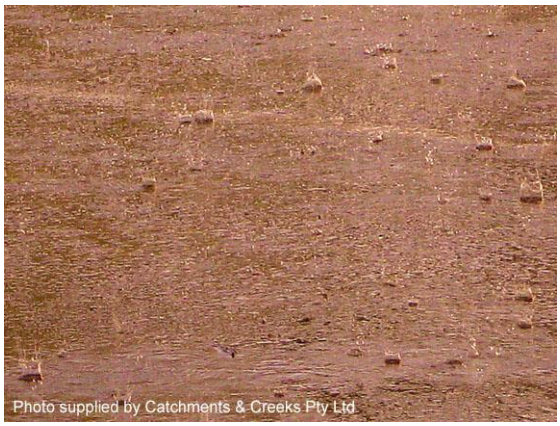
Lock exchange tank prior to removal of the dividing gate



Movement of the two fluids after removal of the dividing gate

Lock exchange tank used to measure density difference of wastewater floc

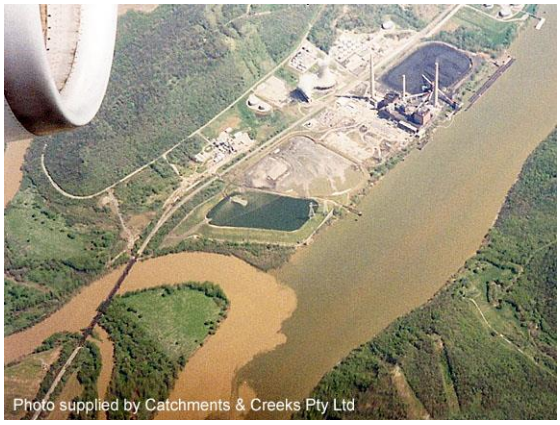
The complex journey of turbid floodwater



Raindrop impact erosion

Raindrop impact erosion

- There are several different forms of water-induced soil erosion.
- Of all of these forms of erosion, it is raindrop impact erosion that is usually responsible for the 'brown' colour of stormwater runoff, and therefore, brown floodwater.
- Raindrops hit the earth with enough energy to explode clay particles out of heavily compacted soils (unless those soils are cover with vegetation or mulch).



Sediment-laden river flow (USA)

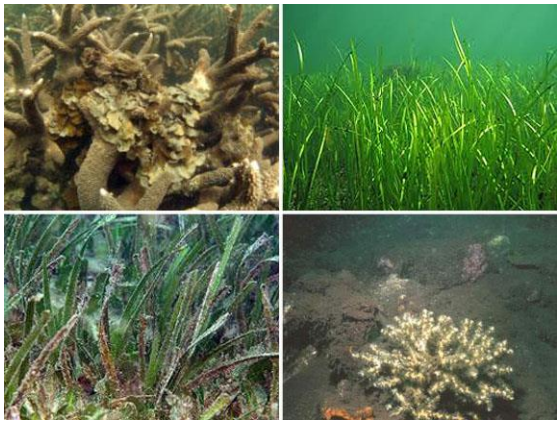
Well-mixed sediment-laden freshwater rivers

- The degree of turbidity (i.e. suspended clay) within a river's floodwater is usually an indication of:
  - the percentage of arid land in the catchment, or
  - the degree of construction and farming practices.
- If the suspended clay particles are dispersive (i.e. high sodium) then clay will not settle under simple gravity.

Floodwater released into the Pacific

The release of sediment-laden floodwater in oceans and estuaries

- Sediment-laden floodwaters can be released from rivers into oceans and estuaries where the lighter brown freshwater floats above the heavier saltwater.
- This action causes the sediment-laden water to spread evenly over vast areas of marine waters, sometimes turning the surface of entire saltwater estuary 'brown' when viewed from above, while clear saltwater remain below the floodwater.



Sediment deposition on the ocean floor

The salt-induced settlement of dispersive sediments onto the ocean floor

- Over the following days and weeks, tidal action introduces enough energy into the water column to cause mixing, which allows the saltwater to remove the dispersive characteristics of the turbid freshwater, and cause the sediment to settle like a thin, dirty, blanket over the seabed, and all the seagrass and coral.
- Animals that rely of the seagrass, such as dugong, can find life every difficult while these seagrasses take time to recover.