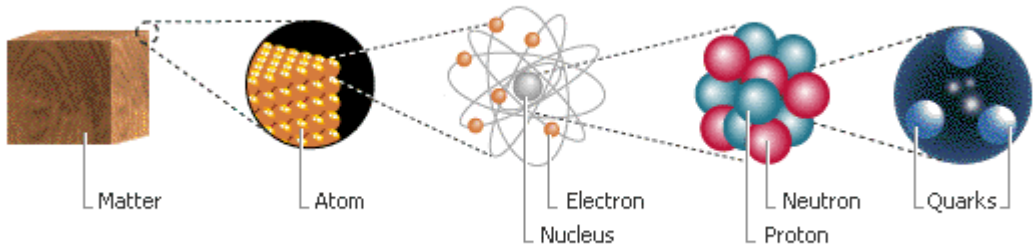
Atoms, Electrons & Electromagnetic Force

This paper provides basic scientific information, including well-known Physics definitions of the make-up of Atoms and the intrinsic part Electrons play in an atom's structure. It allows you to appreciate how electrons behave as both particles and waves, and involve an Electromagnetic force - all in your body's atomic cellular structure.

It then highlights how, when two electron waves meet each other, they merge creating a different wave pattern and that this "interference" can be adverse. This shows how the subtle electromagnetic forces holding together the very atoms of humans can be affected by encountering Electromagnetic Field (EMF) radiation waves from other sources.

You will no doubt accept that humans are made up substantially of cells and that cells are made up of atoms. Let's start by looking at accepted scientific information about atoms and develop from there.

Structure of Matter



Modern physics has revealed successively deeper layers of structure in ordinary matter.

Matter - composed, on a tiny scale, of particles called *atoms*.

Atoms - made up of minuscule *nuclei* surrounded by a cloud of particles called *electrons*.

Nuclei - composed of particles called *protons* and *neutrons*.

Protons and **neutrons** - made up of even smaller particles called *quarks*.

Quarks - believed to be fundamental and can't be broken up into smaller particles.

Electrons - tiny, negatively charged particles forming orbitals of negative ***electric charge***.

Atoms

Atom, a tiny basic building block of matter. All the material on Earth, including human cells, is composed of various combinations of atoms. Atoms are the smallest particles of a chemical element that still exhibit all the chemical properties unique to that element. A row of 100 million atoms would be only about a centimetre long.

When two or more atoms combine, they form a molecule. All organisms rely on a set of chemical compounds and chemical reactions to digest food, transport energy, and reproduce.
But atoms are made of smaller particles, called protons, neutrons and electrons. An atom consists of a small, dense nucleus of protons and neutrons surround by a cloud of electrons.

Protons and Neutrons

Protons carry a positive charge of +1. The number of protons in the nucleus determines the total quantity of positive charge in the atom. In an electrically neutral atom, the number of the protons and the number of electrons (with exactly the opposite electric charge) are equal, so that the positive and negative charges balance out to zero.

Neutrons are about the same size as protons but their mass is slightly greater. Without neutrons present, the electrical repulsion among the positively charged protons would cause the nucleus to fly apart. Such a state is termed "unstable".

Quarks

Quarks are the yet smaller particles that make up protons and neutrons. Physicists believe that quarks are true fundamental particles, so they have no internal structure and cannot be split into anything smaller. Quarks are unique among all elementary particles in that they have electric charges that are fractions of the fundamental charge.

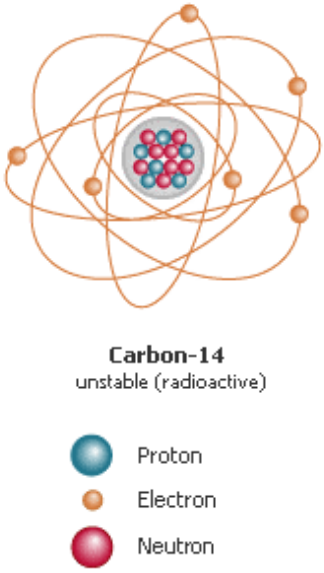
Up-quarks and *Down-quarks* are two of the six known different kinds of quarks. Up-quarks have fractional positive electric charges, while down-quarks have negative electrical charges.

Electrons

The Electron is one of the most fundamental and most important of elementary particles. It is one of the few elementary particles that is stable, meaning it can exist by itself for a long period of time.

Electrons are among the smallest of all elementary particles and have no detectable shape or structure. They do have a property that scientists can measure called "*spin*", or intrinsic angular momentum. An electron's spin makes it act as a tiny magnet. Electrons can spin clockwise or counter-clockwise.

Electrons also have a property called electric charge, which affects the way they interact with each other and with other electrically charged particles. This is a single unit of negative electric charge, or –1. The attraction between electrons and protons holds the atom together.



Electrons, as tiny, negatively charged particles form a fuzzy cloud around the nucleus of an atom.

Electrons can behave as both particles and waves. Wave behaviour is measurable and important. Electrons travel around the nucleus of an atom, but because they behave like waves, they form regions of negative electric charge around the nucleus. These regions are called orbitals. This wave behaviour is very significant because it can be subject of interference.

Quantum Theory

Scientists of the early 20th Century found they could not explain the behaviour of atoms using their current knowledge of matter. This led to a new view of matter and energy being developed to accurately describe how atoms were found to behave, called the Quantum Theory.

Quantum Theory describes matter as acting both as a particle and as a wave. In the visible objects encountered in everyday life, the wavelike nature of matter is too small to be apparent. Wavelike nature becomes important, however, in microscopic particles such as electrons that behave like waves as they exist as a fuzzy cloud of negative charge – in atoms around the nucleus - instead of as a particle located at a single point.

Forces Acting Inside Atoms

In physics, a force is a push or pull on an object. There are 4 fundamental forces acting inside atoms. The most familiar of these forces at work inside the atom is electromagnetic force.

Electromagnetic Force

The electromagnetic force keeps electrons attached to their atom.

This electromagnetic force is the same force that causes people's hair to stick to a brush or comb when they have a build-up of static electricity.

Electromagnetic force at work inside the atom

The electromagnetic force causes –

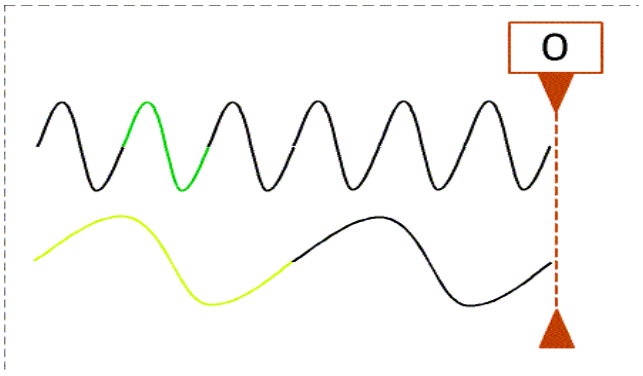
- opposite electric charges to attract each other ….
  negatively charged electrons in an atom are attracted to the positively charged protons in the atom's nucleus so binding the electrons to the atom.
- like charges to repel each other …
  negatively charged electrons repel one another, although the positively charged nucleus exerts enough electromagnetic force to keep the electrons attached to the atom.

Physicists eventually learned that particles as small as electrons can behave like waves, and this property keeps electrons at set distances from the atom's nucleus.

Electrons as Waves

Electrons behave as both particles and waves in atoms. This characteristic is called wave-particle duality. It affects all particles and collections of particles, including protons, neutrons, and atoms themselves.

In terms of the structure of the atom, the wavelike nature of the electron is the most important.



As waves, electrons have wavelengths and frequencies. The wavelength of an electron depends on the electron's energy. Since the energy of electrons is *kinetic* (energy related to motion), an electron's wavelength depends on how fast it is moving. The more energy an electron has, the shorter its wavelength is. **Electron waves can interfere with each other**, just as waves along a rope do when varied or interrupted by someone holding the end of the rope.

Electron waves can interfere with each other !

Wave Behaviour

Waves are vibrations that repeat regularly over and over again. A familiar example of waves occurs when one end of a rope is tied to a fixed object and someone moves the other end up and down. This action creates waves that travel along the rope. The highest point that the rope reaches is called the crest of the wave and the lowest point is called the trough of the wave. Troughs and crests usually follow each other in a regular sequence.

- **Wavelength** = *the distance from one trough to the next trough, or from one crest to the next crest.*
- **Frequency** = *the number of wavelengths that pass a certain point in a given amount of time.*

In physics, the word "*wave"* usually means the entire pattern, which may consist of many individual troughs and crests. For example, when the person holding the loose end of the rope moves it up and down very fast, many troughs and crests occupy the rope at once. A physicist would use the word "*wave"* to describe the entire set of troughs and crests of the rope.

When two waves meet each other, they merge in a process called interference. Interference creates a new wave pattern. If two waves with the same wavelength and frequency come together, the resulting pattern depends on the relative position of the waves' crests. If the crests and troughs of the two waves coincide, the waves are said to be "in phase".
If two waves are not the same – "out of phase" – destructive interference can occur.

- **Constructive Interference** = *Waves "in phase" with each other merging to produce higher crests and lower troughs.*
- **Destructive Interference** = *Waves "out of phase" with each other have respective crests and troughs that do not coincide.*

In destructive interference, if two identical waves are exactly half a wavelength out of phase, the crests of one wave line up with troughs of the other so these waves cancel each other out completely, and no wave will appear.

In destructive interference, if two waves meet that are not exactly in phase and not exactly one-half wavelength out of phase, they will interfere constructively in some places and destructively in others, **producing a complicated new wave.**

When 2 Electron waves are not exactly in phase they interfere producing a complicated new wave

These characteristics of wave interference are very significant in realising the effect that man-made EMF (ElectroMagnetic Force) radiation waves may have on the subtle electromagnetic force of human cells and energy.

Electron Energy Levels

Each electron in an atom has a particular energy. This energy depends on the electron's speed, the presence of other electrons, the electron's distance from the nucleus, and the positive charge of the nucleus. For atoms with more than one electron, calculating the energy of each electron becomes too complicated to be practical. However, the order and relative energies of electrons follows the order of the electron orbitals.

Physicists call the energy an electron has in a particular orbital the *energy state* of the electron. For example, the "*1s orbital*" holds the two electrons with the lowest possible energies in an atom. These electrons are in the lowest energy state of any electrons in the atom.

Adding & Loosing Energy

When an atom gains or loses energy, it does so by adding energy to, or removing energy from, its electrons. This change in energy causes the electrons to move from one orbital, or allowed energy state, to another.

Under ordinary conditions, all electrons in an atom are in their lowest possible energy states, given that only two electrons can occupy each orbital. Atoms gain energy by absorbing it from light or from a collision with another particle, or they gain it **by entering an electric or magnetic field.** When an atom absorbs energy, one or more of its electrons moves to a higher, or more energetic, orbital.

gain / lose energy by entering an electric or magnetic field ! ! !

Atoms loose energy **by entering an electric or magnetic field.** When electrons drop back down to their original energy states, they release their extra energy in the form of a photon (a packet of radiation).

Photon

The photon is a quantum of the electromagnetic field and one photon is the smallest amount of electromagnetic radiation that can exist. All electromagnetic radiation is quantized as photons. Photons were originally called "energy *quanta"*. They are commonly in packets with the intensity relating to the number of photons in the packet.

Unlike most particles, photons have no detectable intrinsic mass, or "rest mass". Photons are always moving at the speed of light, which varies according to the medium in which they travel.

Photons can be created and destroyed when interacting with other particles. A photon's interactions with electrons and atomic nuclei account for a great many of the features of matter such as the existence and stability of atoms, molecules and solids.

The photon can be perceived as a wave or a particle, depending on how it is measured.

Despite their lack of mass, photons have momentum proportional to their frequency (or inversely proportional to their wavelength), and this momentum can be transferred when a photon collides with matter (like a moving billiard ball transfers momentum into another ball). This is known as radiation pressure. An EMF field exerts such an influencing pressure force.

A wide variety of low-energy photons are created by the oscillation of electric fields in conductors in transmitters used for telecommunication – radio waves, television and radar signals, etc. These enable packets of photons to flow as broadcast electromagnetic waves.

Herein lies scientific explanation for
EMF wave interference
and resulting
EMF stress on humans