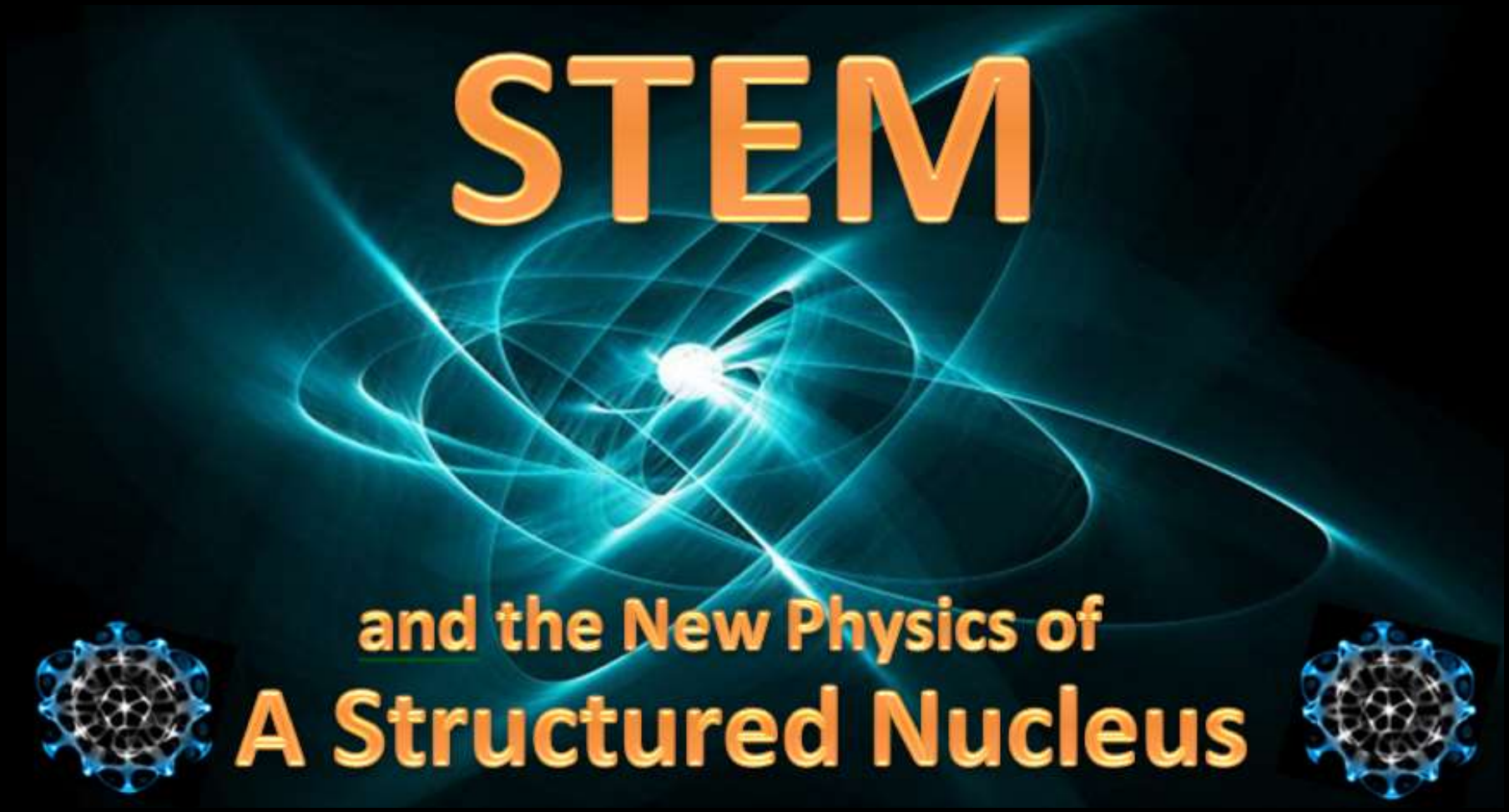


by

the STEM Development Group

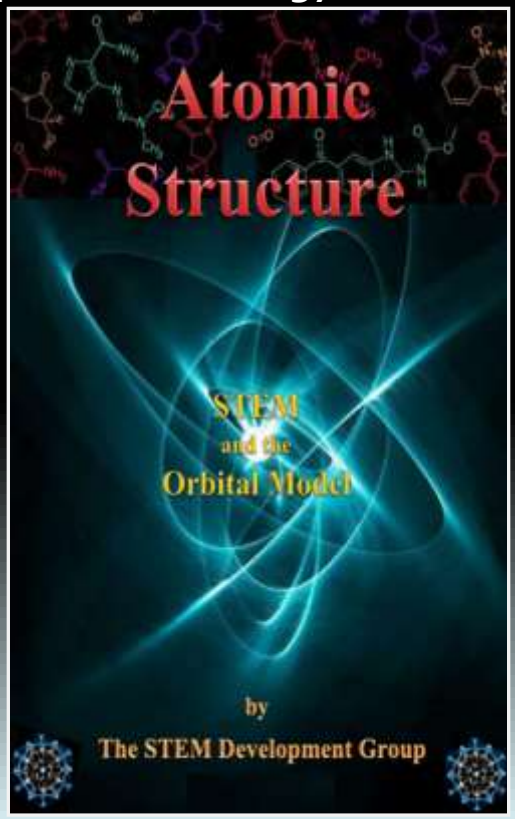
STEM and a Structured Nucleus

This presentation provides a brief overview of the **Spin Torus Energy Model** (**STEM**), which is an approach to atomic structure that is significantly different to the conventional Science **orbital atomic model** as currently supported by the **Standard Model** and **Quantum Mechanics**. STEM provides new insight to the sub-atomic world that could well lead to an exciting **new Physics** era and have huge ramifications for all theoretical and applied areas of Science and technology.

STEM is an **energy-centric** approach. It is based upon the hypothesis ***there is only one type of energy***, with **electric** and **magnetic fields** considered to consist of the same type of **field-energy**, but with different flow patterns.

STEM is a **pragmatic** approach that provides **feasible explanations** for a wide range of phenomena, many of which are poorly explained, or are not addressed at all, by the **conventional Science** approach. The atom structures and geometries proposed by STEM are more compatible with the bonding geometries of molecules and chemical compounds than are the '**spdf**' orbitals of **Quantum Mechanics**, which require a range of hybridisation work-arounds.

A more detailed coverage of the content of this overview can be found in the STEM publication titled 'Atomic Structure: STEM and the Orbital Model'.

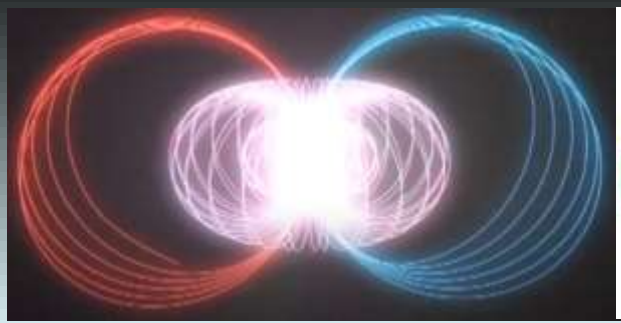
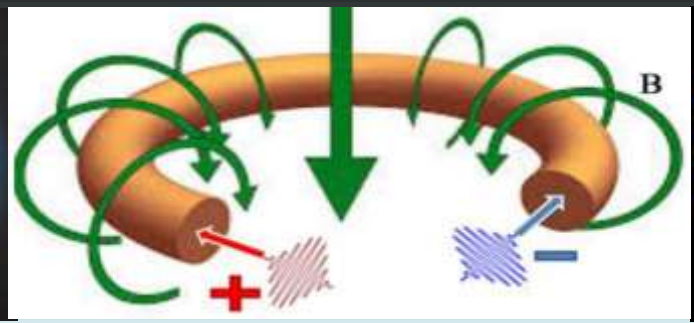


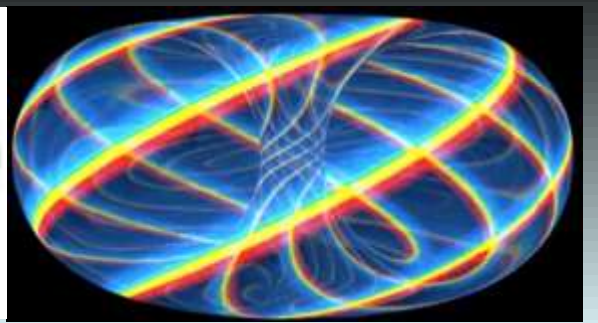
STEM and a Structured Nucleus

As evidenced at the macro-level by cyclones and galaxies, it would seem that whenever energy becomes concentrated, circular energy flows result.

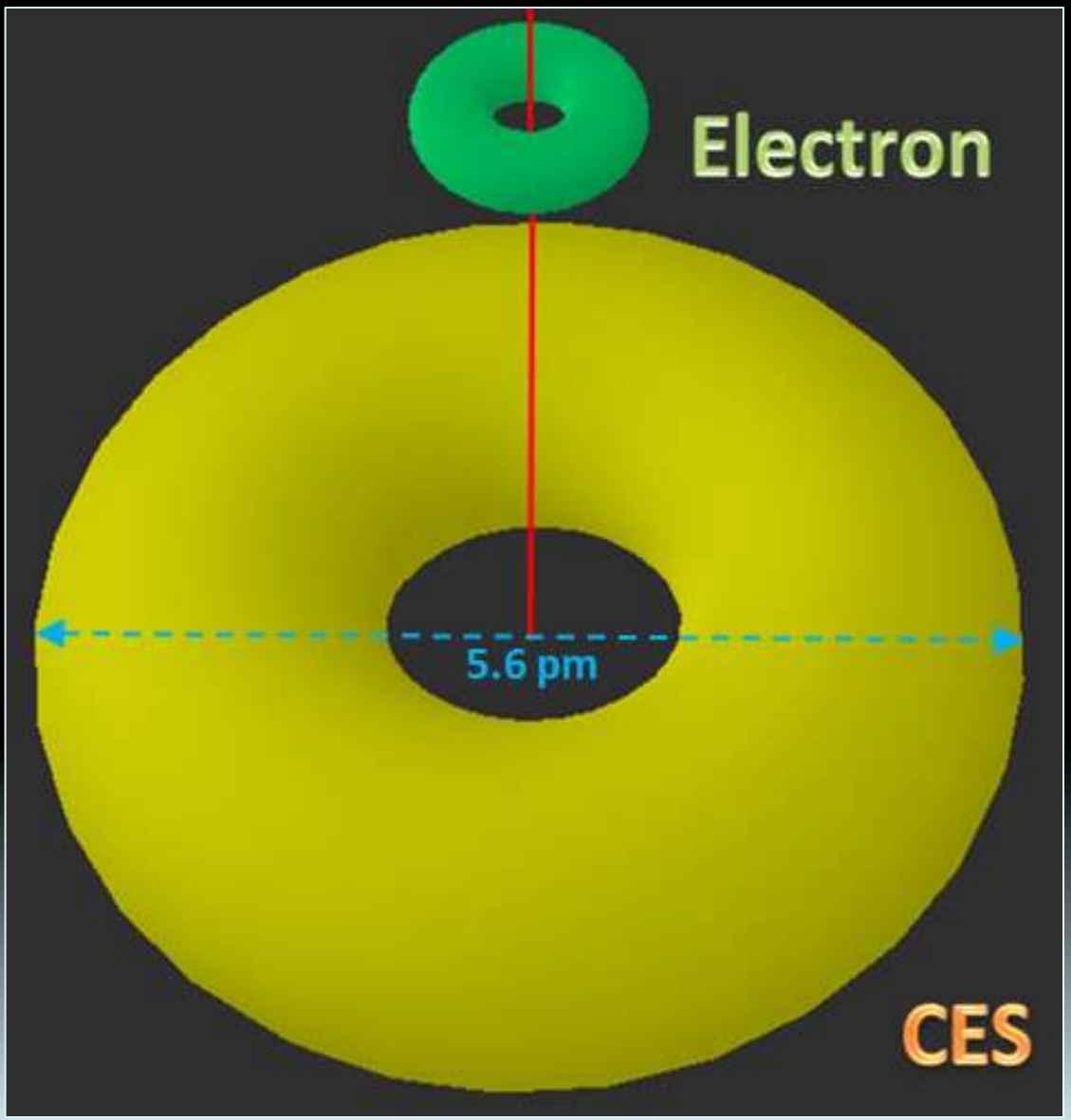



STEM is not alone in contending that , at the **sub-atomic** level, the circular motion of concentrated energy is more likely to have a **toroidal** rather than a **spherical** form. On this basis, fundamental particles such as an **electron** and a preon would have a **toroidal form**.



STEM and a Structured Nucleus

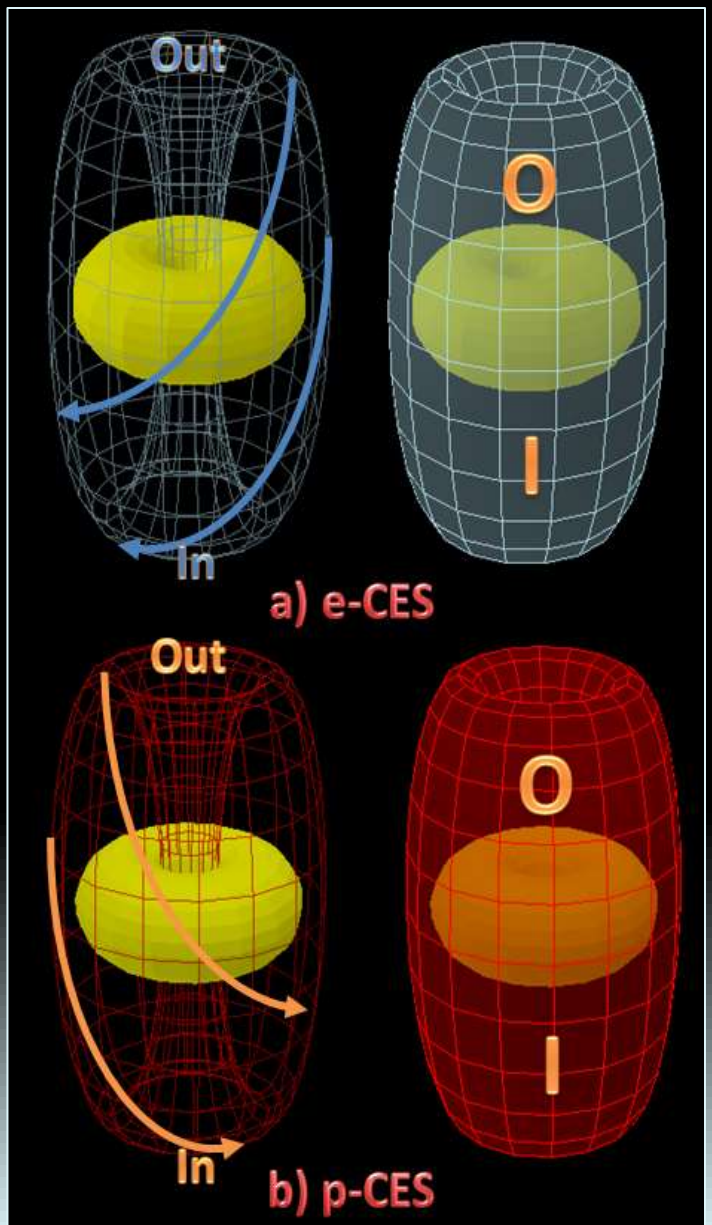


The **preon** is considered to be the smallest fundamental particle. Preons build into **quarks**; and quarks to **nucleons**; and nucleons to the **atoms** that constitute **matter**.

To avoid confusion with other definitions or uses of the term 'preon', STEM uses the term **CES**, which is an acronym for **Concentrated Energy Source**.

Shown left is a close-to-true scale representation of a STEM **electron** and a **CES**. They both have a **toroidal energy-core** in which the concentrated energy flows or spins at close to the speed of light.

STEM and a Structured Nucleus



Concentrating on CESs at this stage (we will return to discuss electrons later on), not all their energy is confined to the toroidal **core-energy**. They also have an **outer torus** of less concentrated **field-energy** that flows in synch with the core energy.

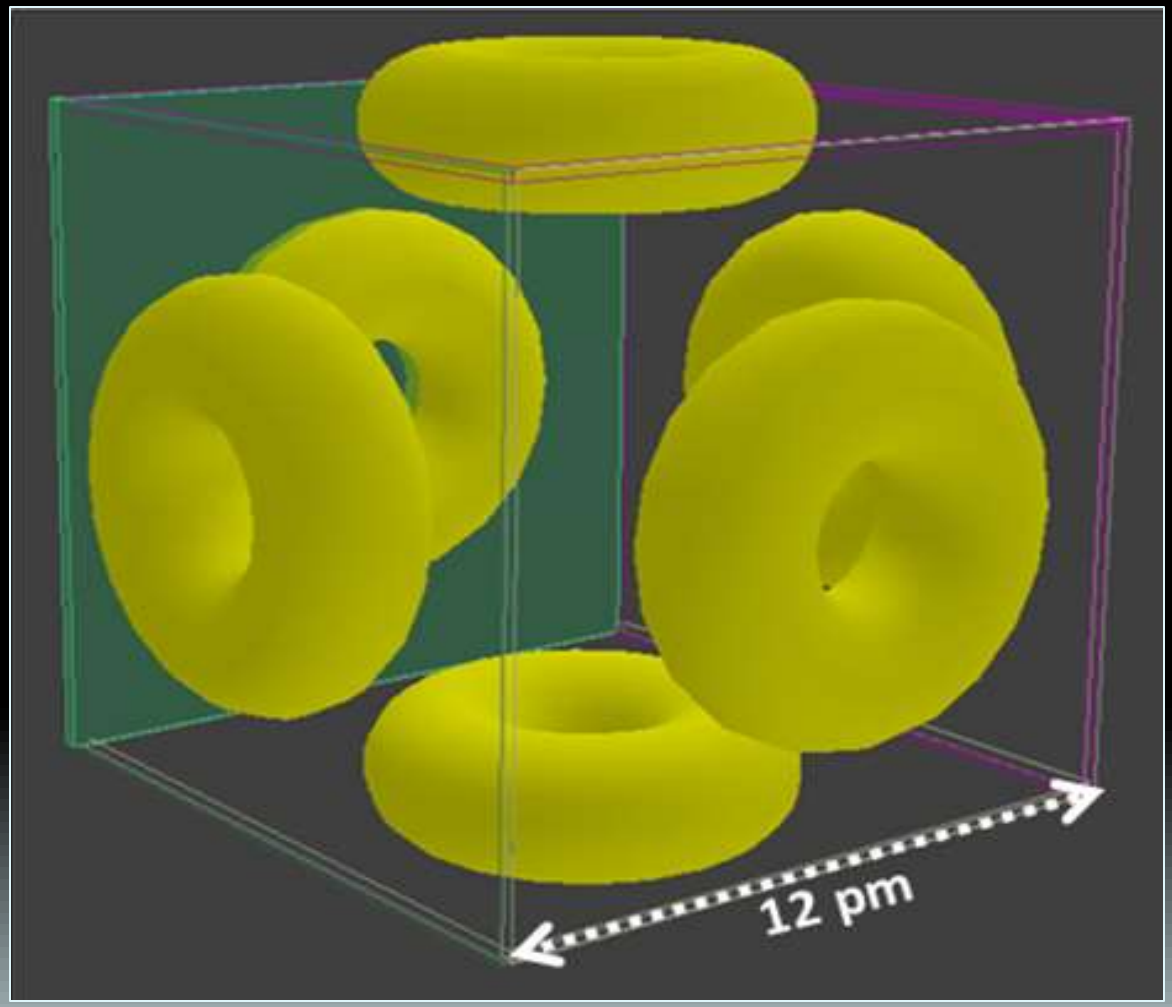
The field-energy (see figures left) is responsible for the CES's electromagnetic and bonding characteristics, and thus controls how a CES interacts with the outside world.

Importantly, because the field-energy has both **toroidal** and **poloidal** flow components, it has **chirality** (i.e. an e-CES ≠ an inverted p-CES)

By convention, an **e-CES** (with **blue** coloured field-energy) is considered to have left-handed (LH) chirality and a net electric charge of **-1/6 e.**

A p-CES (with **red** coloured field-energy) is considered to have right-handed (RH) chirality and a net electric charge of **+1/6 e**.

STEM and a Structured Nucleus

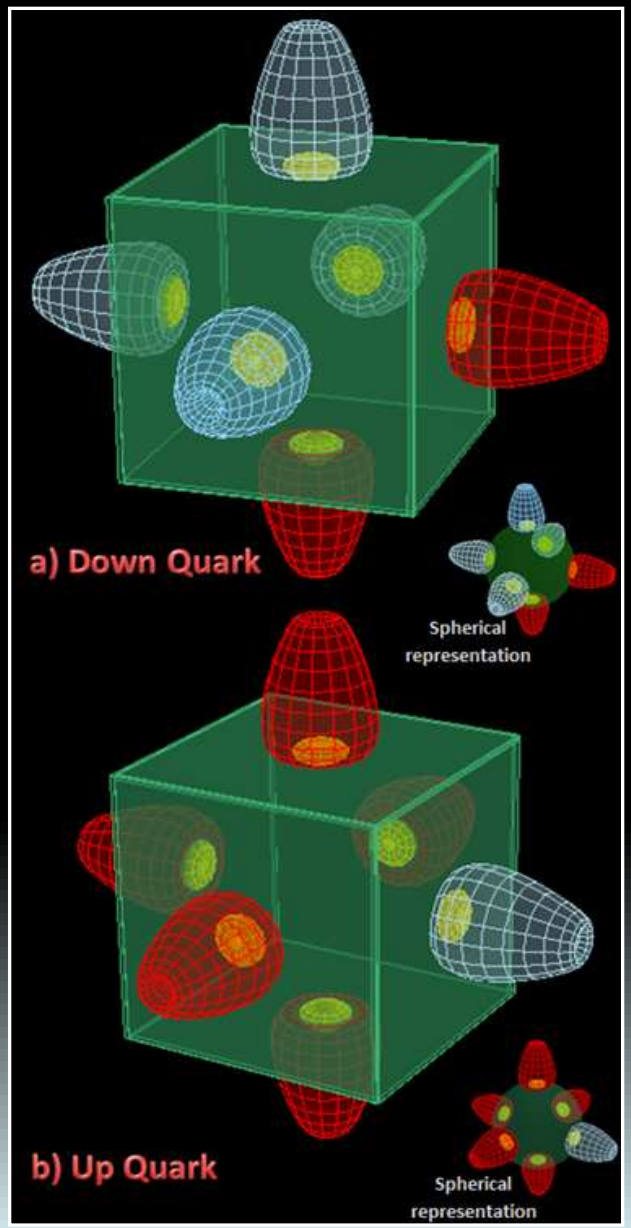


Up (and **down**) **quarks** consist of a cubic three-dimensional array of six CESs.

As shown left, up/down quarks have a **face-centred cubic** form that has a side length of 12 pm (where 1 pm = 10^{-12} m).

Note that STEM diagrams represent a quark as a green brick-like cube. However, it should be kept in mind that quarks are simply an array of 6 interlocked but independent CESs.

STEM and a Structured Nucleus

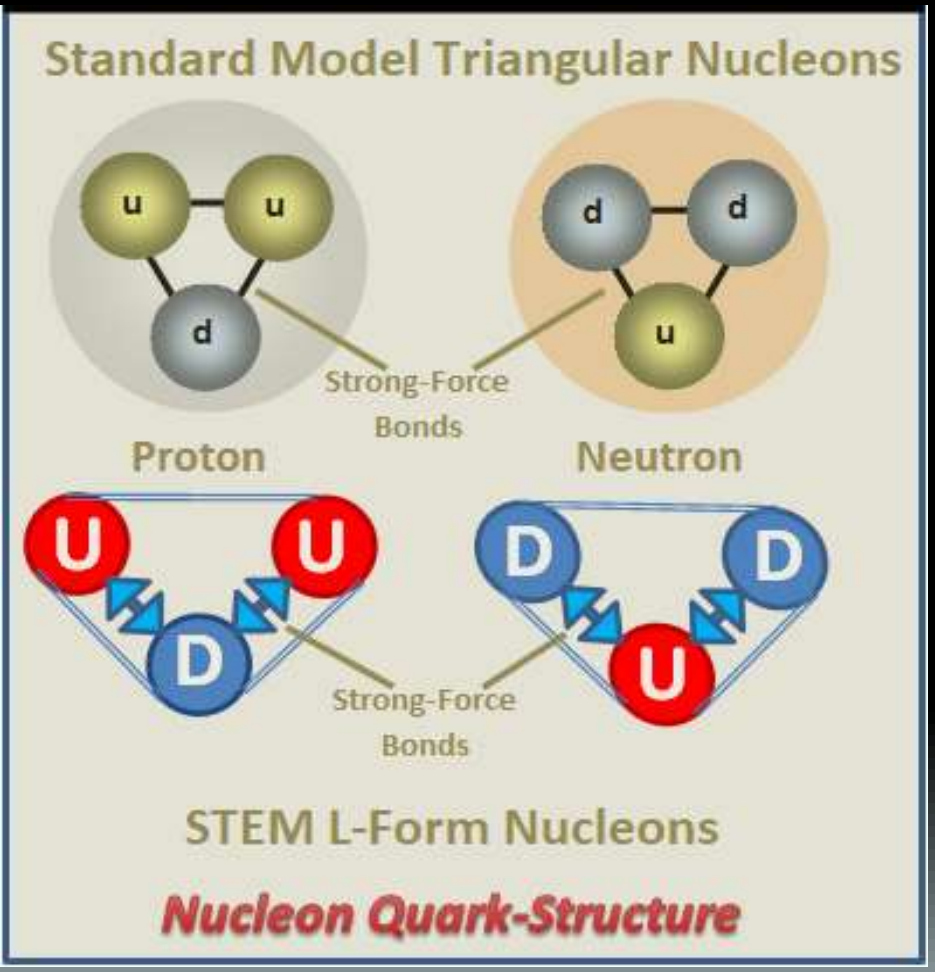


A **down quark** contains two p-CESs and four e-CESs, and thus carries a net electric charge of **-1/3 e** (calculated as 2*(+1/6) + 4*(-1/6)).

An **up quark** contains five p-CESs and one e-CES, and thus carries a net electric charge of **+2/3 e** (calculated as 5*(+1/6) + 1*(-1/6)).

The electric charge of CES-based quarks thus corresponds to the experimentally determined charge values for up and down quarks.

STEM and a Structured Nucleus



The Standard Model contends that **nucleons** consist of three up/down quarks held together by three strong-force bonds to create an equilateral triangular form.

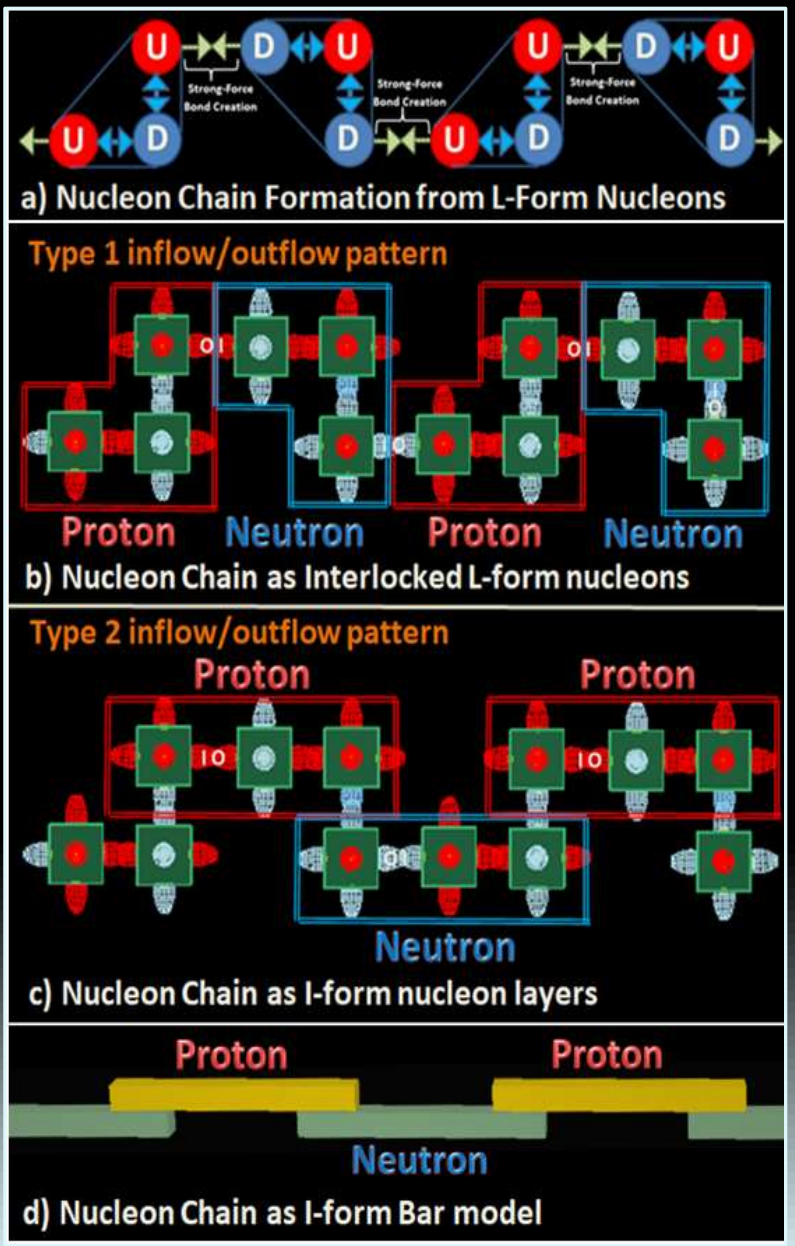
STEM, however, contends that only two strong-force bonds are involved, so forming an 'L' shaped right-angled isosceles triangle, and are thus referred to as **L-form nucleons**.

A **proton** is considered to consist of two up quarks and one down quark, which results in a net electric charge of +1e.

A **neutron** consists of two down quarks and one up quark, which results in a net electric charge of zero.

You can check the maths.

STEM and a Structured Nucleus



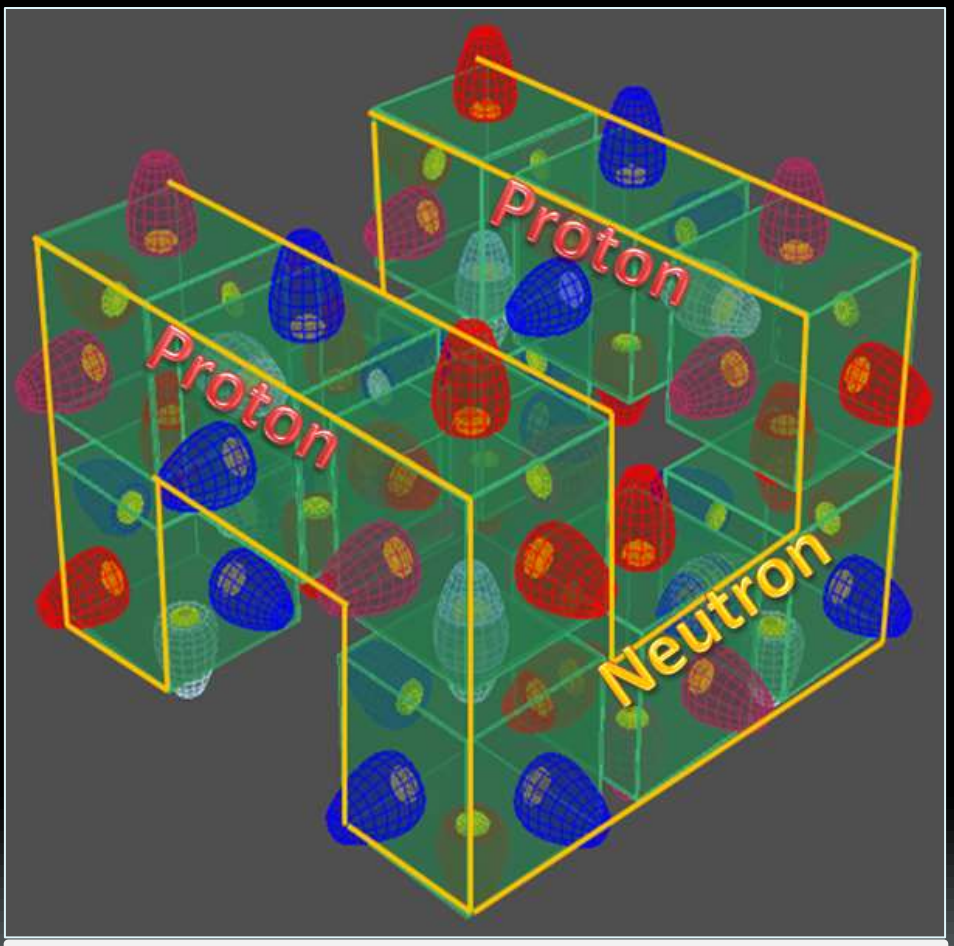
L-form nucleons are considered to have two preferential bond directions as represented by the light-green arrows of the figure (part-a) shown left. One preferred direction is **parallel** to one arm of the 'L', and the other **perpendicular** to the other arm.

These preferred bond directions result in L-form nucleons interlocking via strong-force inter-quark bonds to create **nucleon chains** (part-b).

Nucleon chains consist of separate I-form **proton** and **neutron** layers (an **I-form proton** has a straight-line **UDU** pattern and an **I-form neutron** has a straight-line **DUD** pattern).

The distinct I-form proton and neutron layers (part-c) can be represented as bar-shaped nucleons (part-d). As well as highlighting the I-form nucleon geometry, **bar models** speed up the atomic modelling process.

STEM and a Structured Nucleus



But something is missing from this quark model of helium-4.

What is it?

When **nucleon chains** are end-joined, they create **polygonal structures** with distinct separate I-form proton and neutron layers.

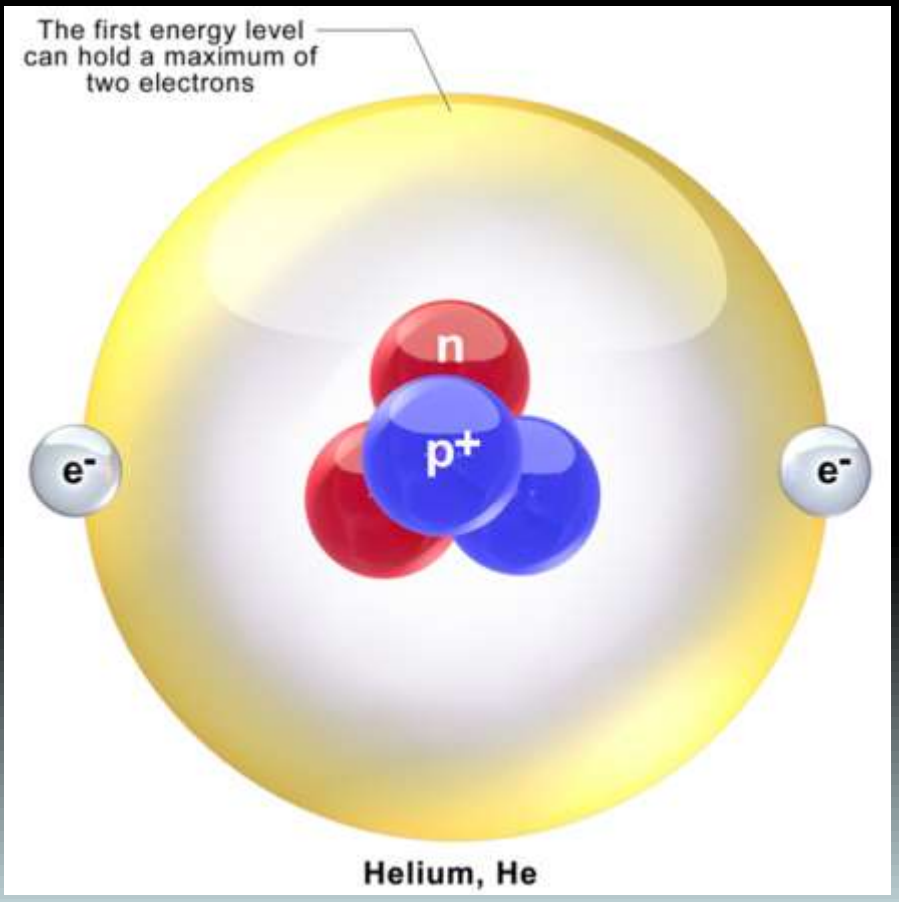
These **polygonal forms** provide the structural framework that underpins all atoms (except for **hydrogen**, which consists of a single L-form proton).

Shown left is a **quark model** for the **helium-4** atom. It has been formed from a **2-layer nucleon chain**. One layer contains two I-form protons and the other two I-form neutrons.

The nucleon chain has been **end-joined** to create a strong 4-sided polygonal atom, with a square or **cubic** form characteristics.

STEM and a Structured Nucleus

Yes - there are no orbital electrons!



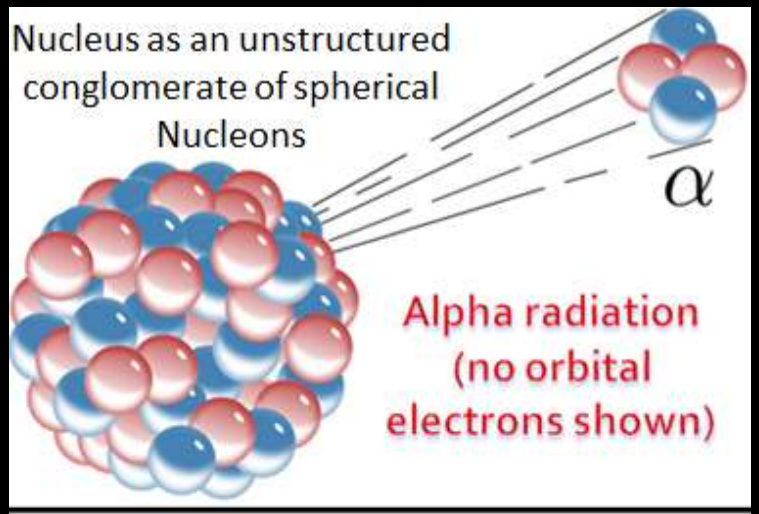
With the STEM approach, although atoms can have electrons attached, **orbital electrons** are not required in order to offset the positive charge of protons within the nucleus.

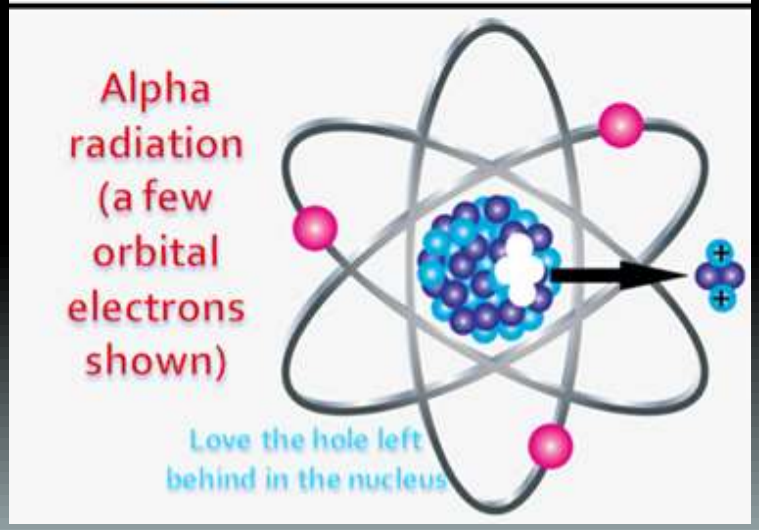
The more conventional orbital model for a helium-4 atom is shown left and in this animated gif.

Alpha radiation is quite a destructive form of radiation which, according to Wikipedia, consists of '*two protons and two neutrons bound together into a particle identical to a helium-4 nucleus*'. So, it is pointedly described as being the equivalent of a helium-4 atom that has been stripped of its electrons, rather than simply being a kinetically energised helium-4 atom.

For STEM, there is no need to create special 'with and without' orbital electron cases for helium atoms. Instead, **alpha radiation** simply consists of **energised helium-4 atoms**.

STEM and a Structured Nucleus





The conventional Science view is that **alpha radiation** is created when a pair of protons and neutrons are magically plucked from the **amorphous** (i.e. having no particular structure) **nucleus** of a heavier atom.

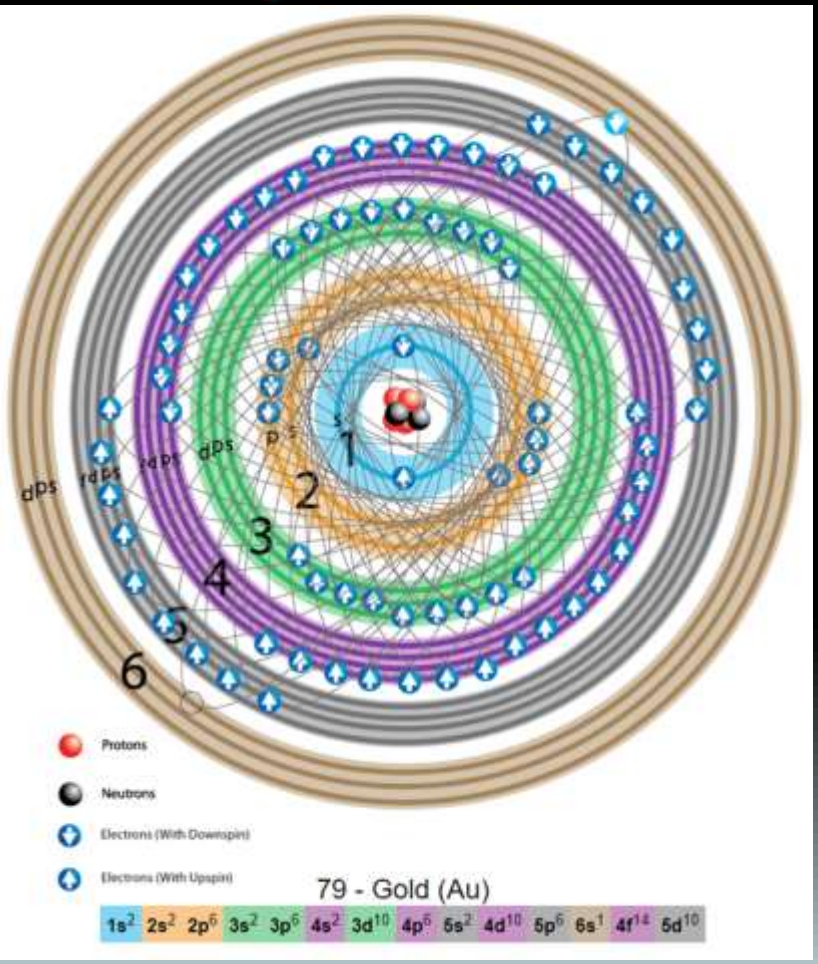
Some of the problems associated with this approach, but which are conveniently ignored, include:

- what happens to the electron pair associated with the removed protons?; Is an **anion** created?
- how can a positively charged alpha particle manage to pass through heavily populated electron orbitals without disturbing or interacting with them?;
- why do only four nucleons separate from the nucleus - is this some type of magic number?

Consequently, it is quite difficult to find a diagram that shows exactly how the alpha radiation process takes place. Most diagrams simply ignore the existence of the orbital electrons; a few show them, but only in an over simplistic and unconvincing way (see lower left figure).

STEM and a Structured Nucleus

'spdf' mapped orbitals for a gold atom



Another aspect of **electron orbitals** is their crowding and complexity, particularly for larger atoms. For example, according to the conventional Science view, a **gold atom** has an unbelievable **79 orbital electrons**, all whizzing around the nucleus in particle or wave-form (nobody is sure which applies) without any mutual interference or collisions taking place.

Elements with an atomic number greater than 100 have more than 100 similarly well-behaved high-speed orbital electrons whizzing around. It all sounds quite **unbelievable**; and as such is likely to be **untrue**!

The legacy of the **Bohr model** of 1913 is that the **planet-like** electron orbital concept became well and truly embedded in the psyche of the Science community. Despite the **Standard Model** leading to the discovery of **quarks** in 1964, and **Quantum Mechanics** producing the '**spdf**' orbital patterns, electron orbitals are still consistently shown as being **planet-like**, as evident in the diagram left.

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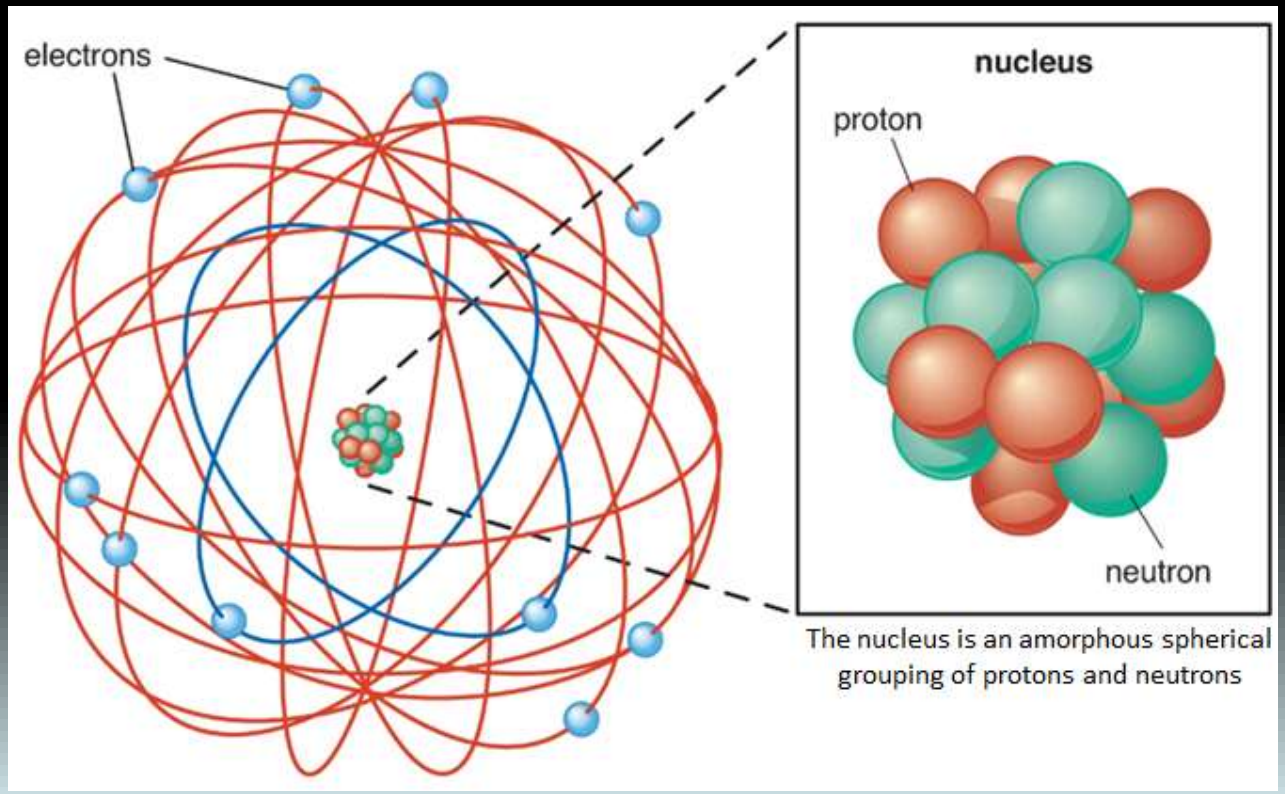
So, although now supposedly consisting of '**spdf**' orbitals, blatant planet-like electron orbital imagery permeates most Science-related educational resources, appearing in pre-school books for toddlers through to the Encyclopaedia Britannia (such as the example below) and University post-graduate courses.

Such ambivalent atomic orbital concepts are presented to students **as fact** at all stages of the education system. Although possibly confused, most individuals believe in the orbital model, and find it quite difficult to contemplate an atom without orbital electrons.

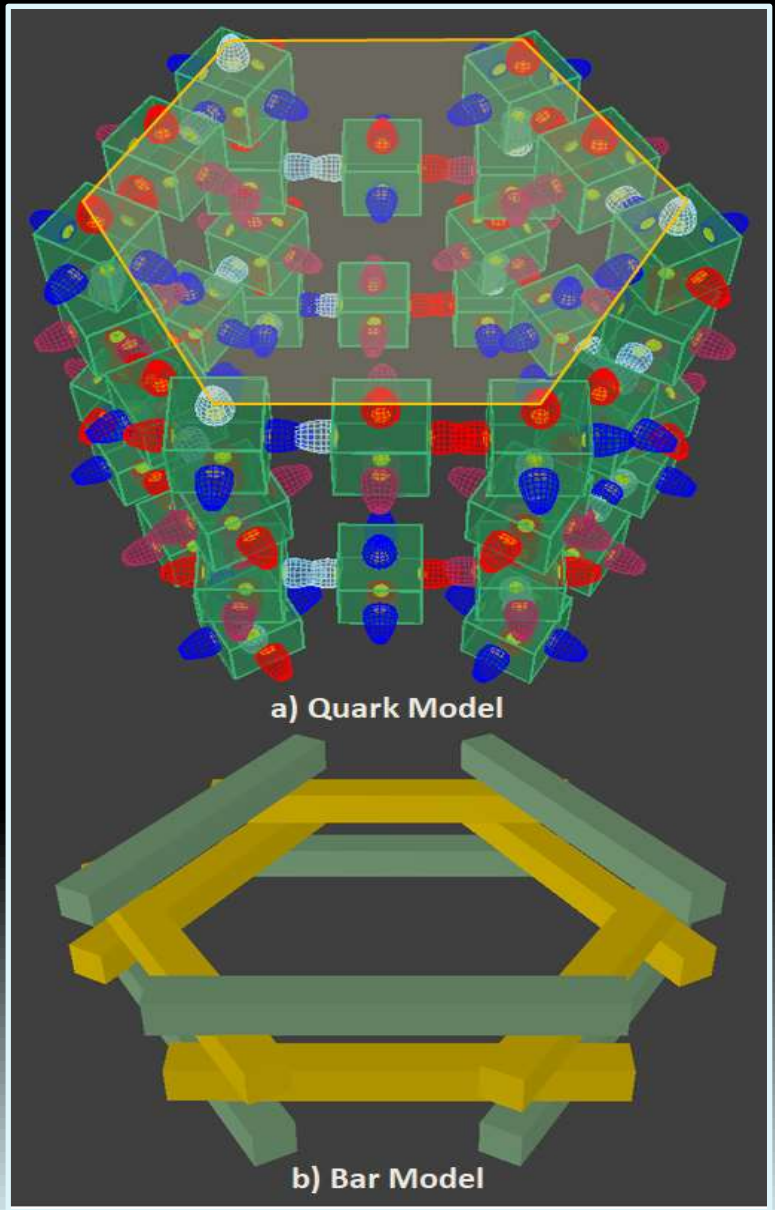
For **physicists**, many of whom have spent a lifetime working in niche areas of atomic research, the concept of an atom without orbital electrons is difficult, if not impossible, to contemplate.

However, with STEM, there are no orbital electrons.



The nucleus is an amorphous spherical grouping of protons and neutrons

STEM and a Structured Nucleus



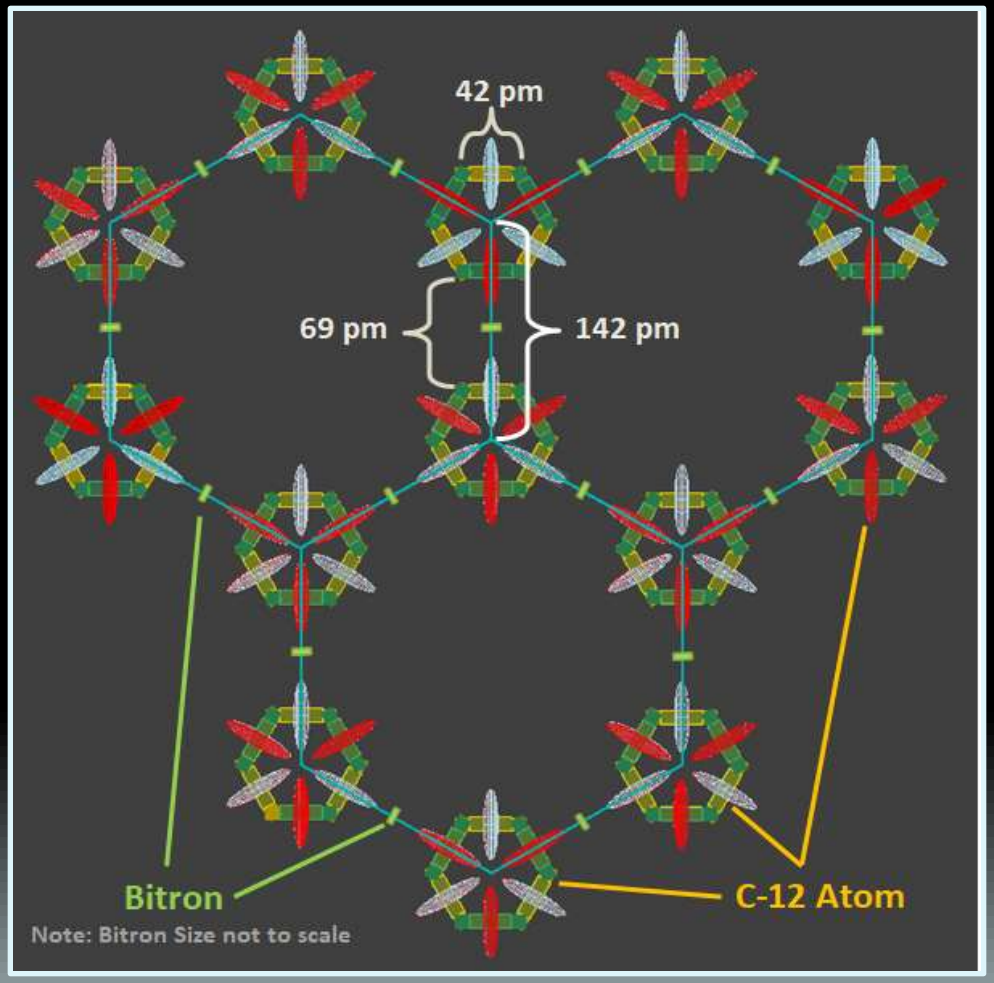
So, continuing with the STEM approach: **Carbon-12** consists of 6 protons and 6 neutrons, and has two allotropic forms: **diamond** and **graphite**. Graphite is a layered, grey material that is soft. In contrast, diamond is clear, semi-transparent and sparkly; it is hard enough to cut glass and represents the hardest natural substance known.

Conventional Science's orbital approach has no real explanation for why there are two allotropic forms of carbon-12, let alone why they have such vastly different physical properties.

STEM, on the other hand, claims the physical characteristics of graphite and diamond are dependent upon the structure of their respective nuclei.

The **hexagonal** structure of the **carbon-12 graphite** atom is shown left as quark and bar models.

STEM and a Structured Nucleus



In **graphite,** the **hexagonal** carbon-12 atoms are held together by what STEM refers to as **bitron bonds**.

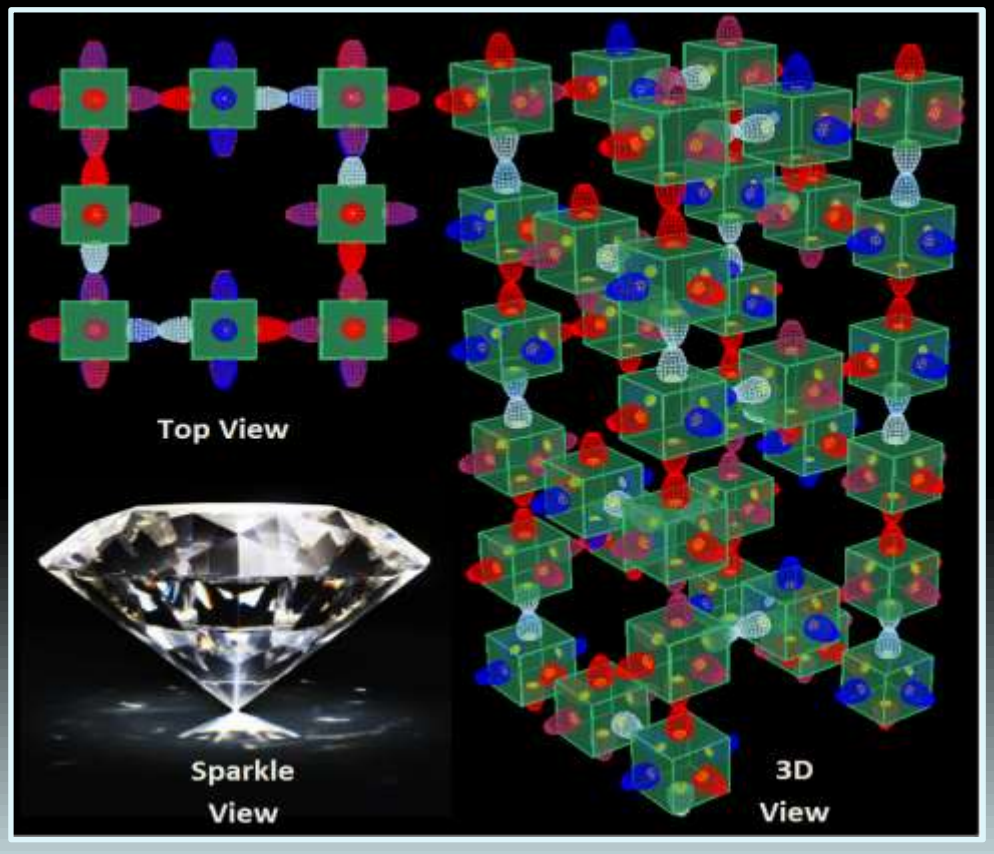
Bitron bonds contain **electron pre-cursors,** that are called **bitrons**. Bitrons present as **free electrons** upon release from the bitron bond.

Although functionally equivalent to **covalent bonds,** bitron bonds do not involve orbital electrons, shared or otherwise.

Shown left is a top-view of the hexagonal sheet-like form of graphite. *Note that it is a **true-scale** diagram, with no cheating by scale distortion (except for the size of the bitrons, had to be made larger so they are visible) or bond hybridisation*.

STEM and a Structured Nucleus

B-bonds are far weaker than **strong-force bonds**, but are strong enough to hold the graphite sheets together; even strong enough to create single atomic-layer **graphene** sheets. Importantly, the b-bonds can provide a ready supply of electrons, which accounts for the **high electrical conductivity** of graphite.

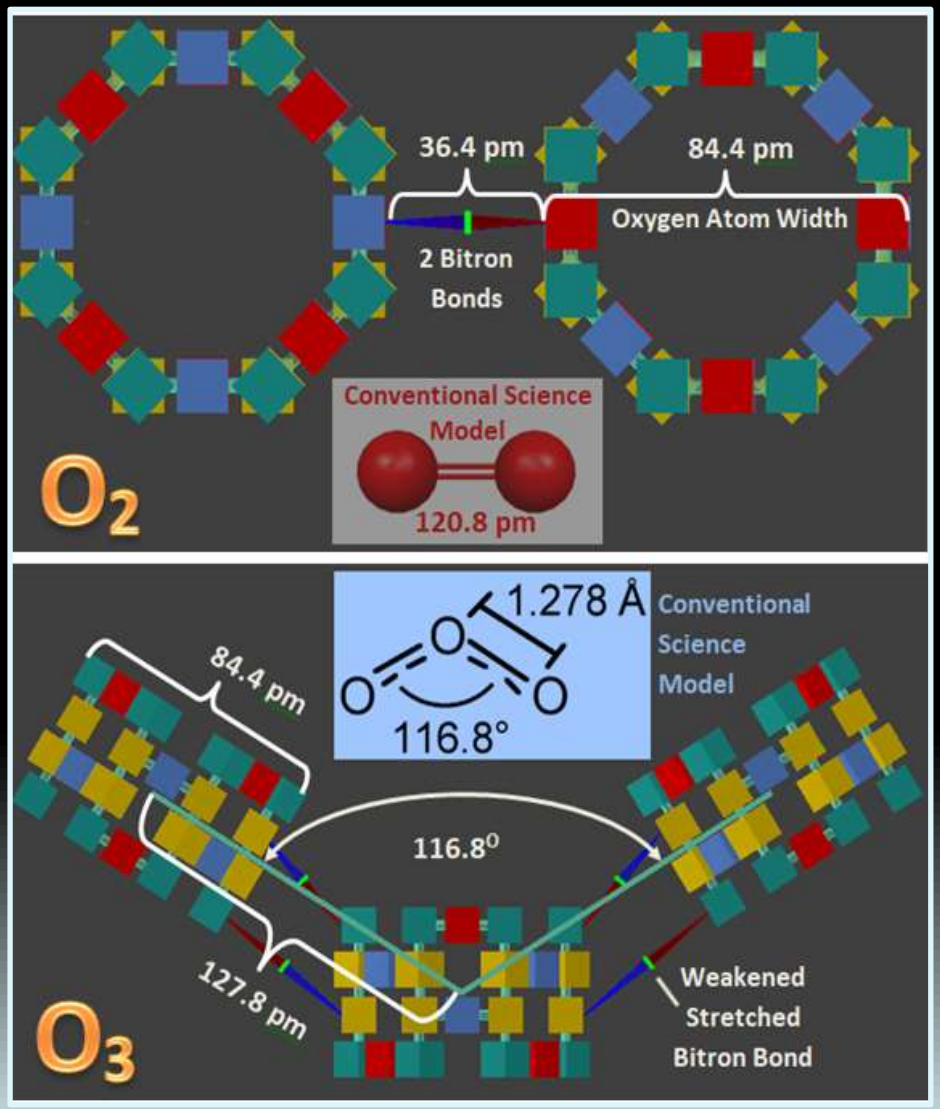


Atoms of **carbon-12 diamond**, on the other hand, consist of three helium-4 atoms strong-force bonded together as a **tetragonal C-12 atom** (see 3-D view left).

In crystalline form, diamond atoms form a face-centred cubic Bravais lattice in which each tetragonal C-12 atom is bonded with the 4 surrounding (i.e. adjacent) C-12 atoms.

Due to the bond lengths, these are bitron-less **p-bonds** (**polar bonds**). The bitron-less bonds result is a lack of available free electrons: thus diamond does not readily conduct electricity (i.e. diamonds are a very expensive **electrical insulator**).

STEM and a Structured Nucleus



Oxygen is an example of an atom with an 8-sided polygonal (i.e. **octagonal**) structure consisting of 8 protons and 8 neutrons organised into 4 separate nucleon layers.

Dioxygen (**O2**) is the diatomic molecular form of oxygen gas that is so essential to life on Earth. **Ozone** (**O3** or tri-oxygen) is an allotropic molecular form of oxygen that is far less stable than the dioxygen.

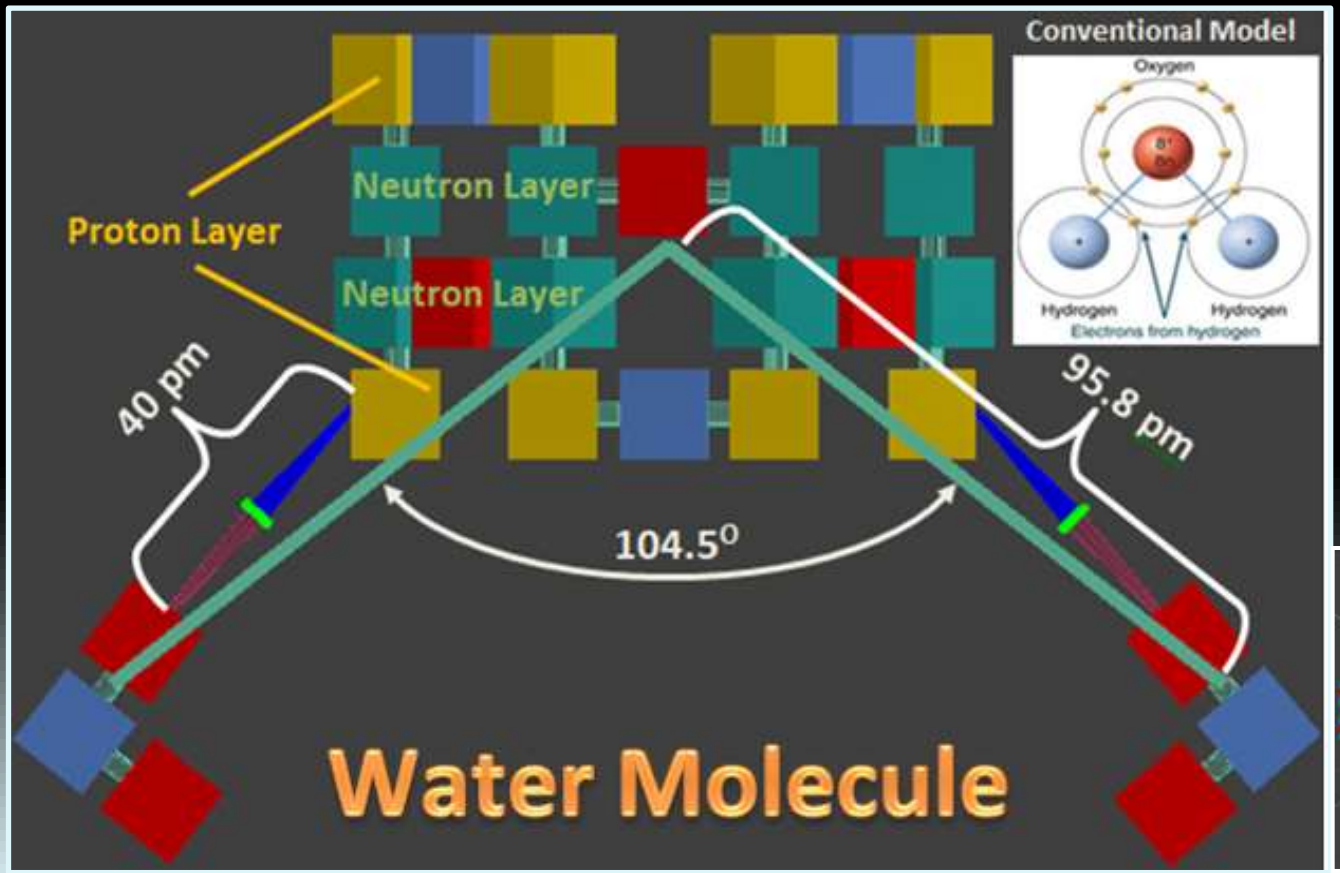
Two bitron bonds hold a pair of oxygen atoms together as a straight-line **dioxygen molecule,** whereas the b-bonds supporting each of the two outer oxygen atoms in an **ozone molecule** subtend an angle of 116.8⁰.

STEM also explains the Chapman Cycle, which takes place between dioxygen and ozone, quite well.

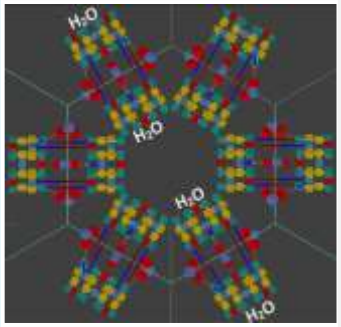
STEM and a Structured Nucleus

A **water molecule** consists of two L-form protons (each effectively a single **hydrogen atom**) bonded to a single oxygen atom. The nominal **H-O-H** bond angle of water is 104.5^{O} and the centre-to-centre **O-H** bond length is 95.8 pm.

STEM provides a good explanation for why and how this angle varies (called **bend**) and the apparent bond length varies (called **stretch**) within a sample of steam.

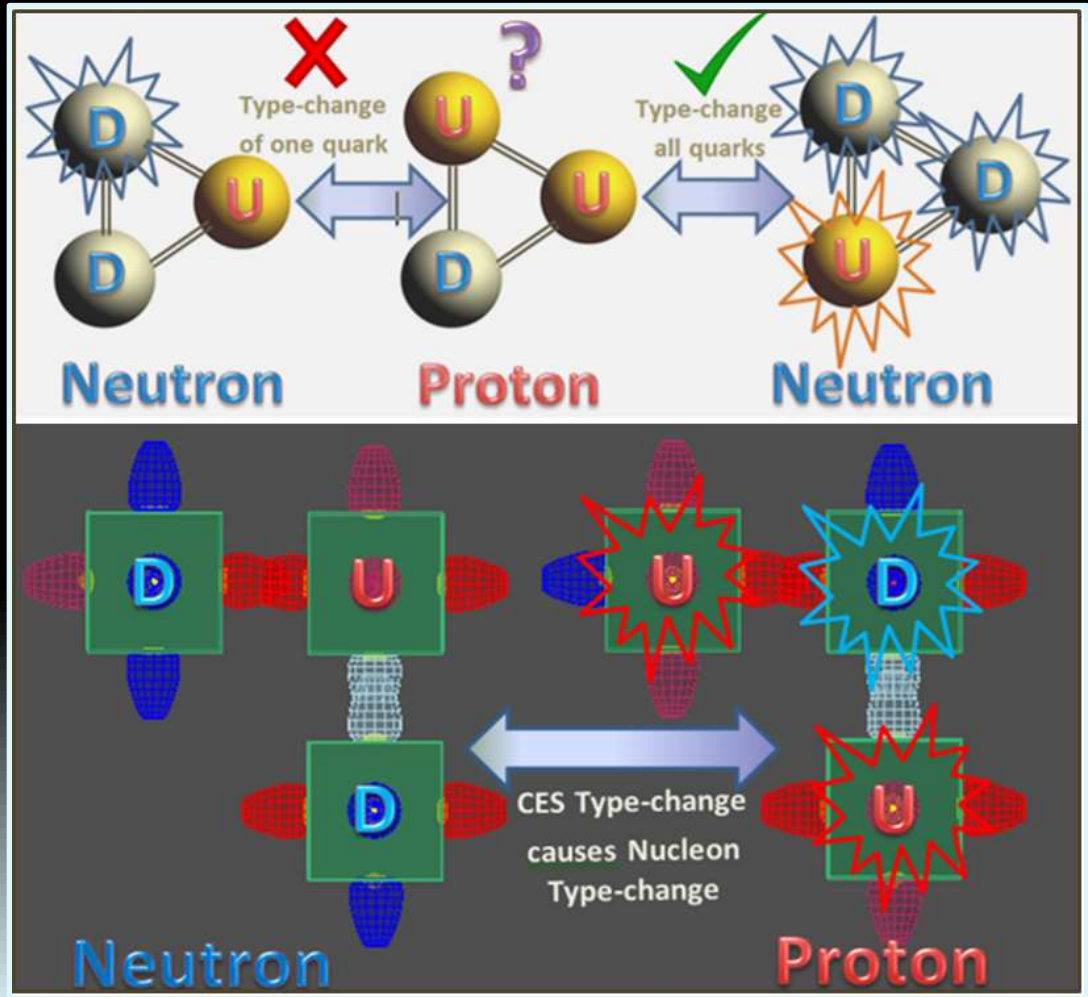


STEM also proves a good explanation for the **non-linear density** variation of water near its freezing point; and of the formation of **snow flake** patterns by the hexagonal groupings of water molecules.



STEM and a Structured Nucleus

Of major importance, STEM provides a feasible explanation for **nucleon-type conversion,** which is the process that underpins **beta decay** and **electron capture**. Conventional Science cannot even decide whether nucleon-type conversion involves changing the type of only one up/down quark or of all the quarks, let alone explain how or why quarks can type-change.



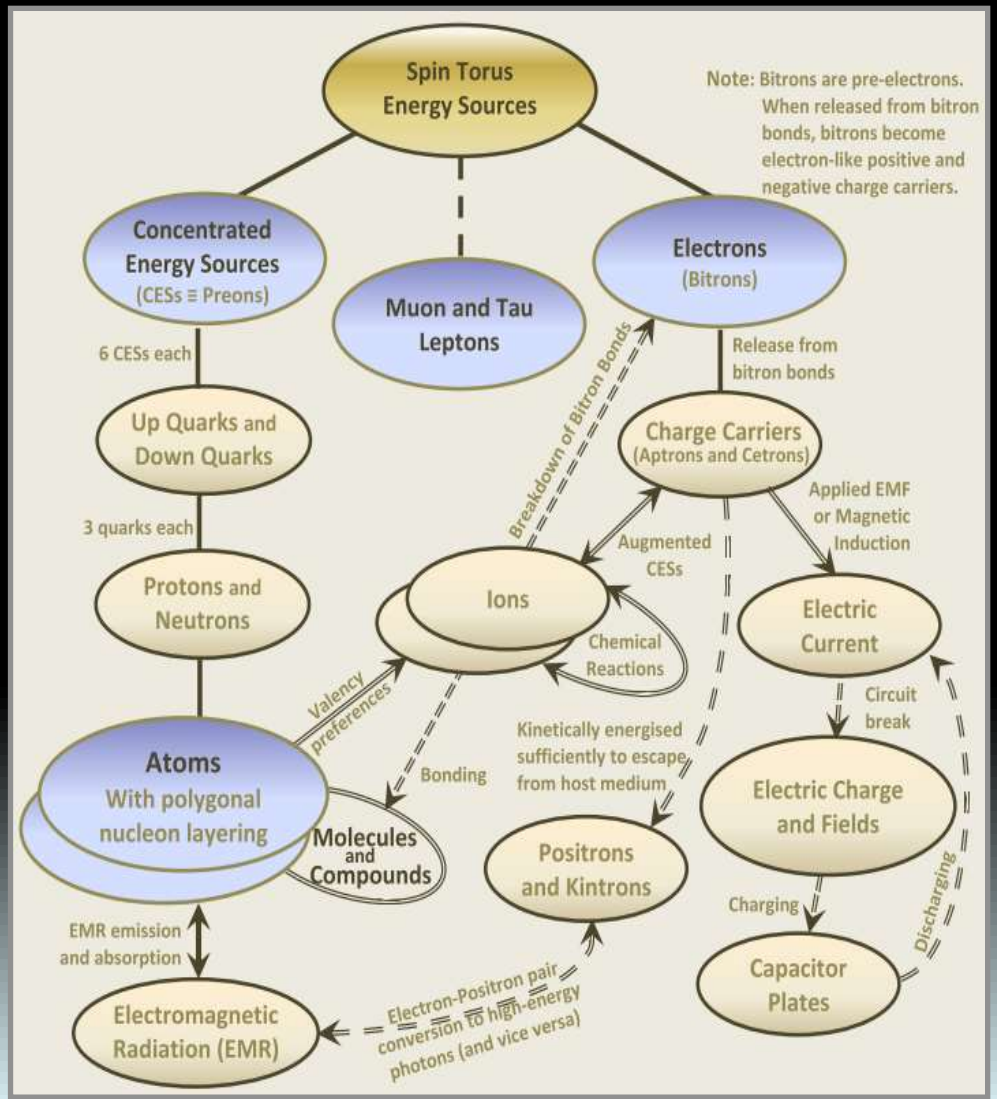
With STEM, nucleon-type conversion can occur because CESs can relatively easily be type-converted (i.e. an **e-CES** can be converted into a **p-CES,** and vice versa).

When a **trigger CES** is type-converted by the impact of a **free electron** or **positron,** all three quarks are simultaneously type-converted, resulting in a type-converted nucleon as in the bottom graphic shown left.

STEM provides a comprehensive feasible explanation for all aspects of **beta decay** and **electron capture,** including the creation of derived **neutrinos**.

STEM and a Structured Nucleus

CESs and the CES-styled preon **structure of up/down quarks** are key aspects of the STEM approach to atomic structure and, arguably, represent its most important concepts.



Although their structure is quite speculative, **CES-based quarks** have led to STEM's **structured nucleus** model that is significantly different to the **orbital model.**

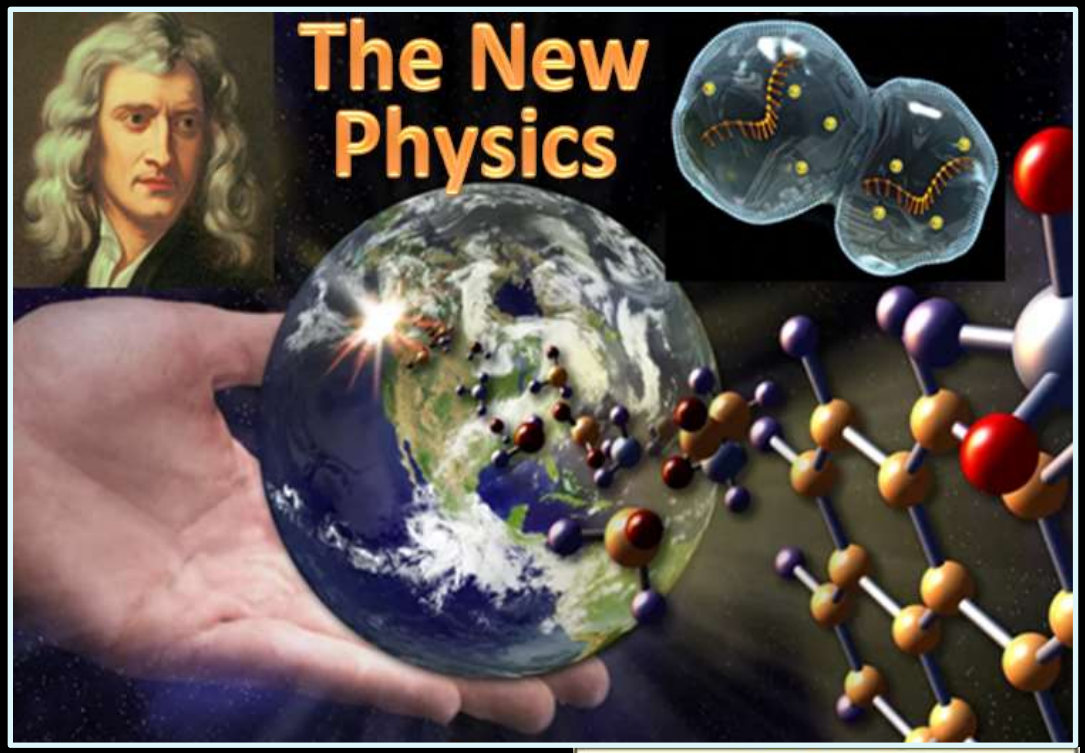
The STEM approach provides new, exciting and consistent explanations for topics such as **atomic bonding, electromagnetic fields, electricity, light** and even **Gravity**.

Ultimately, the **pragmatic** approach of STEM may prove to be a game-changer for Science and related technologies.

However, undoubtedly STEM still has flaws, and will need to be appropriately modified, corrected and expanded: this is expected and unavoidable. And certainly, at this stage, far more research and mathematical modelling is required to further develop and underpin the STEM approach.

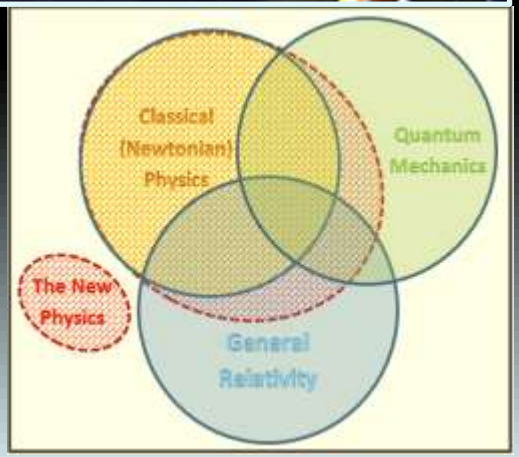
STEM and a Structured Nucleus

The toroidal structure of STEM-based **CESs** and **electrons** are amenable to the **wave equations** of **Quantum Mechanics**, but it is expected that the mathematical models developed to underpin STEM will be more aligned to **Newtonian (or Classical) Physics**.



Thus the **New Physics** to be developed for the STEM approach will be more aligned to Classical Physics theory. It will also, hopefully, lead to predictive simulation tools that will well serve all areas of theoretical and applied Science.

The **New Physics** approach will possibly overlap Newtonian Physics, Quantum Mechanics and General Relativity as indicated right.



As a pragmatic approach, STEM's explanations are straight forward, consistent and without work-arounds to overcome 'problems' related to known phenomena. STEM often challenges the **orbital model**, but does so in good faith and does not intentionally attempt to denigrate or undermine it or its promoters and supporters.

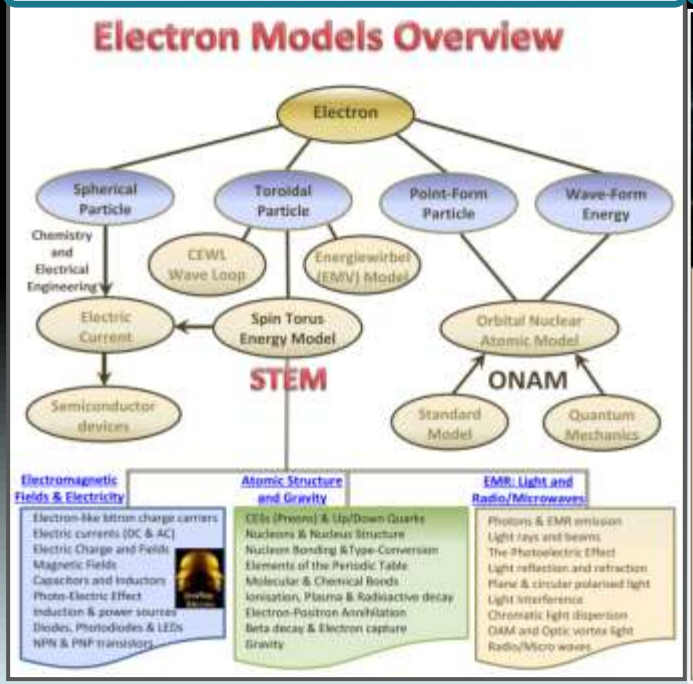
STEM and a Structured Nucleus

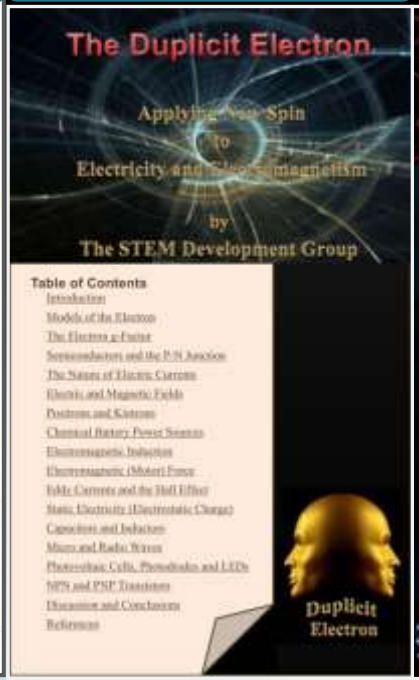
To finish this presentation off, the **next seven slides** provide a **summary** of the most significant claims, explanations and implications of the STEM approach.

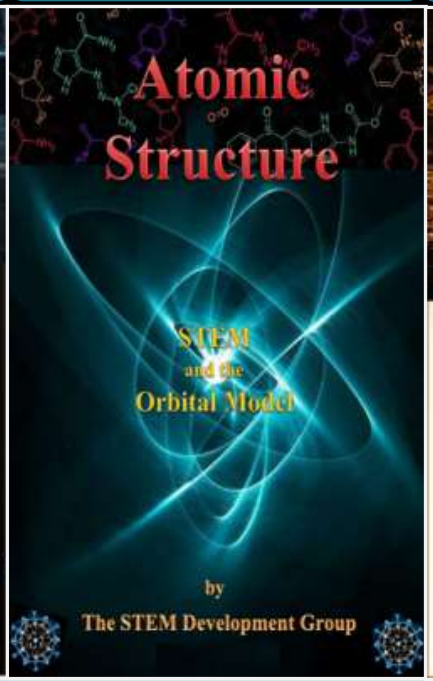
All comments and feedback relevant to STEM and the new Physics are welcomed and, where possible, will be answered promptly: email = STEMdevt@yahoo.com.

To find out more about the STEM approach, follow the links below to access other **STEM Development Group** publications that provide for more detailed coverage of specific topics.

STEM Overview (2 pages)	78 page pdf	85 page pdf	51 page pdf







STEM and a Structured Nucleus

These are points 1 to 3 of a 19-point summary of important aspects, explanations and claims of the STEM approach.

1. STEM provides an explanation for the differences between **ortho-hydrogen** and **para-hydrogen** gas; and the structure of **deuterium** and **tritium**.
2. STEM provides an explanation of the differences between **tetragonal C-12** and **hexagonal C-12** related to the allotropic forms of **graphite** and **diamond**. Also addressed is **cubic diamond** (natural diamond) and **hexagonal diamond** (or lonsdaleite); and how bonding patterns indicate that tetragonal C-12 is prevalent in **aliphatic hydrocarbons** and hexagonal C-12 in **aromatic hydrocarbons**.
3. The concept of a **CES** being '**flipped**' involves a CES's external **outflow vortex** being impact-converted into an inflow vortex, so changing its **chirality**. **CES flipping** can only occur within attached L-form nucleons that are appropriately orientated. When it does occur, it results in **nucleon-type conversion** and the associated creation of **neutrinos**: it thus underpins the **beta decay** and **electron capture** processes.

STEM and a Structured Nucleus

These are points 4 and 5 of a 19-point summary of important aspects, explanations and claims of the STEM approach.

4. A proportion of an atom's **protons** in any concentrated sample of a particular element can be randomly derived from **β-decay neutrons**. This can result in a **natural variation** in the proton count of individual atoms within the sample, but without necessarily changing their structural form or element type.

   Thus, a more **stochastic approach** to element classification involving a **P-# signature** is suggested to extend the current simplistic approach (which is that proton count alone uniquely defines an element, and that any beta decay will automatically change the element type).

5. **Helium** atomic forms can be **embedded** within or **attached** to a larger atom, and later become impact-released and kinetically energised to present as **Alpha radiation**. Alpha radiation results both in a change of the parent's atomic structure, and a reduction of atomic number; and thus a change of element type.

STEM and a Structured Nucleus

These are points 6 and 7 of a 19-point summary of important aspects, explanations and claims of the STEM approach.

6. STEM contends that the bonding patterns within chemical compounds are closely related to the polygonal shape of nucleon layers and separation distance of participating atoms.

   Conventional Science, on the other hand, considers chemical bonds to be **covalent** or **ionic**, and needs to use a combination of **hybrid orbitals**, **resonance** and **molecular orbitals** to build tailor-made bonds from '**spdf**' orbitals to reflect required bond orientation.

7. **Bitron bonds** (**b-bonds**) are the main bond type within molecules and chemicals. For some chemicals (hydrocarbons in particular), a weaker **bitron-less** polar-bond (or **p-bond**) can be formed. **Intermetallic compounds** and **coordination complexes** contain a combination of p-bonds and **weak-bonds** (**w-bonds**), the latter which are a variation of **Van der Waals** force bonds.

STEM and a Structured Nucleus

These are points 8 and 9 of a 19-point summary of important aspects, explanations and claims of the STEM approach.

8. **Electrons** can be considered to be a **renewable resource**, with bitron-bonds acting as electron breeders. **Free electrons** are either **negative charge carriers** (cetrons) or **positive charge carriers** (aptrons), which are generated in approximately equal numbers from b-bonds.

9. For **redox reactions**, **oxidation** is defined as aptron gain and cetron loss, creating an aptron sink and a cetron source. **Reduction** is aptron loss and cetron gain, creating an aptron source and a cetron sink.

   STEM thus provides a **source** and a **sink** for both positive and negative charge carriers.

   Conventional Science, on the other hand, only provides for a source and sink for negative charge carriers (i.e. electrons). Due to this restriction, it then needs to introduce the specious concept of **positive holes** to explain electric currents within **semiconductors** (e.g. **diodes** and **transistors)**.

STEM and a Structured Nucleus

These are points 10 to 12 of a 19-point summary of important aspects, explanations and claims of the STEM approach.

10. **An electric current** consists of the simultaneous two-way (duplex) movement of positive and negative charge carriers (i.e. aptrons and cetrons); it may be generated by a **source/sink mechanism** (e.g. a chemical battery)or by **induction**.

    Within metal conductors, such movement occurs within **same-spin bitron strands,** which in turn generates a circular magnetic field around a wire conductor.

11. **Electric fields** consist of field-energy that has a circular twist to its flow pattern, whereas **magnetic fields** consist of field-energy that has no net twist component to its flow.

12. STEM provides a detailed explanation of **galvanic cells** (chemical batteries) and **electrolytic cells** (chemical battery re-charge), **eddy currents** and the **Hall Effect**; and for the operation of **capacitors, inductors, diodes, photodiodes, LEDs** and NPN/PNP **transistors**.

STEM and a Structured Nucleus

These are points 13 to 16 of a 19-point summary of important aspects, explanations and claims of the STEM approach.

13. STEM distinguishes between **photonic** and **non-photonic** electromagnetic radiation (**EMR**). **Light** is an example of **photonic EMR,** whereas man-made **micro** and **radio waves** are examples of **non-photonic EMR**.
14. **Photonic EMR** consists of concentrated ringlets of field-energy called **Field-Energy Rings** (**FERs**) that are generated by outwards-facing **CESs** within nucleons, so acting as a surplus-energy release mechanism.
15. A **light ray** consists of a **double helix** structure of **FERs**. The **wavelength** of the FER spirals determines light ray wavelength: it varies dependent upon the **FER packing density** within any specific transport medium.
16. A **light beam** is a group of multiple light rays with of various frequencies (and thus various wavelengths), and of various ray lengths; many of which have different phases.

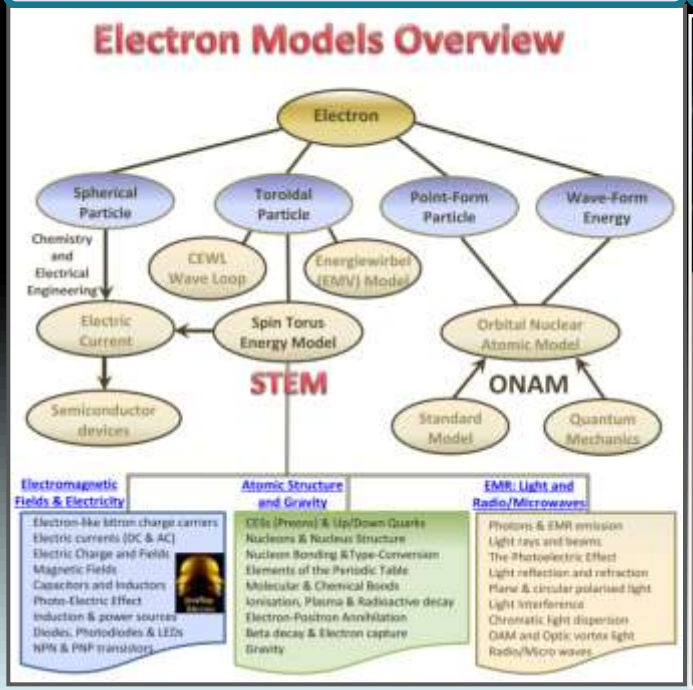
STEM and a Structured Nucleus

These are points 17 to 19 of a 19-point summary of important aspects, explanations and claims of the STEM approach.

17. FERs provide an explanation for light's apparent **wave-particle duality**; and for light's **polarisation** characteristics due to **refraction** and **reflection** when a medium of different refractive index is encountered (as evident in **Fresnel coefficient** graphs plotted by angle of incidence).
18. FERs can provide a detailed explanation of light's many forms: Plane Polarised Light (**PPL**), Circularly Polarised Light (**CPL**), Elliptical Polarised Light (**EPL**), Optical Vortex Light (**OVL**) and **laser** light.
19. Outfacing inflow vortices of CES are considered to be marginally more efficient than their outflow counterparts, so creating a **small positive pull** by each atom on available external field-energy. STEM suggests that this minute net inwardly-directed force, when summed over the billions of atoms within 'normal' matter, is the pull of **Gravity**.

STEM and a Structured Nucleus

STEM Overview (2 pages)



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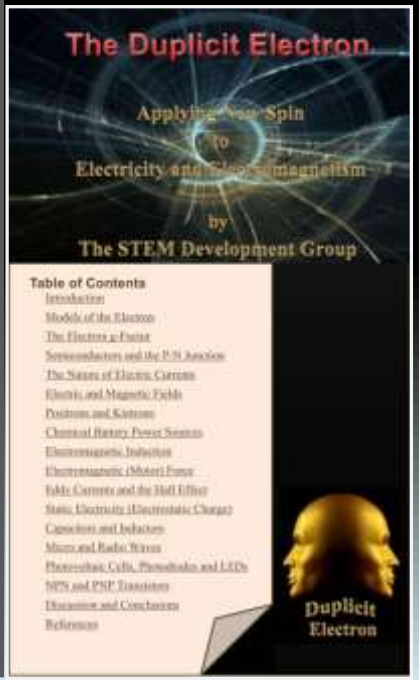

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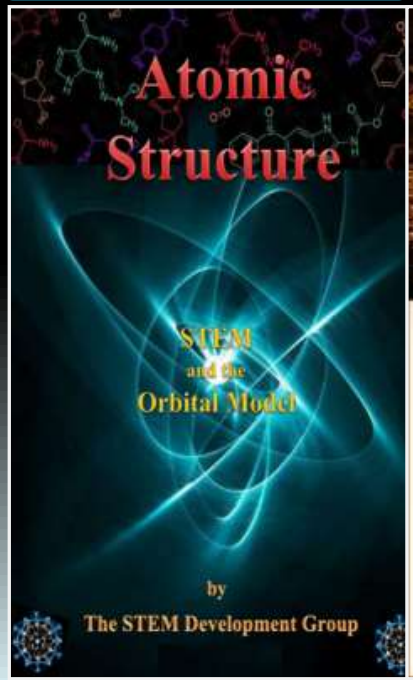

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