15 The tetrakaidecahedron within the dimensional boundary chord model

15.1 Crystal form and symmetry

So far within *the dimensional boundary chord model of the nucleus*, the emphasis has more or less been levelled at the environment in which early processes have one way or another, led to the universe we see today. Central to these many processes however, is the ***tetrakaidecahedron*** and this plays what probably amounts to the 'lead role' in this story.

As whole surviving teddies 'ping' into what would become our space, they would need to evolve in order to eventually produce the elements, the molecules and ultimately us. Just how this evolution would occur, would depend on the environment and the very nature of the tetrakaidecahedron itself. It is by definition, a fourteen-sided polyhedron (originally), but this would change as it evolves into the neutron and proton. Its original geometry would however, have at least some bearing on what would happen to it and this would have to be an important consideration when discussing processes and events that would ultimately involve it. By describing it simply as a 'fourteen-sided polyhedron', doesn't actually say a lot about it or its nature and the teddy will need to be looked at in a little more detail in order to try to establish just what its characteristics may have contributed to the further evolution of a universe.

One of the most important facets of the teddy's characteristics would be how its structure affects subsequent evolution, such as the bonding of the elements during nucleosynthesis (dealt with in somewhat more detail within the next of these chapters) and the later combination of these into the familiar molecules from which much of our world is constructed. Is there a definitive link between this structure and what we find around us? This chapter will briefly try to explore the possibility of a connection between this model's geometric origin within an eighth-dimensional environment and the geometry we find around us at the smallest of scales today. For example, the very way that electrons are believed to configure themselves within the atom's various orbitals, appears very reminiscent of this basic geometry.

Earlier chapters in this submission have tried to establish a 'rule-of-thumb' that strongly involved 'provenance' - or a connection between what has happened in the past - and what *IS* occurring in the present. This would provide a 'reason' as to *WHY* things happen; not just why stars or galaxies form; or why helium can be synthesised from super-heated hydrogen - but why certain elements simply look and behave the way they do. This provenance (if it surely exists) will not *just* provide a connection out there in the depths of space - but here too - and at every conceivable scale. It will provide an explanation as to *why* certain combinations of molecules will combine the way they do and why they may also grow into a set crystalline form.

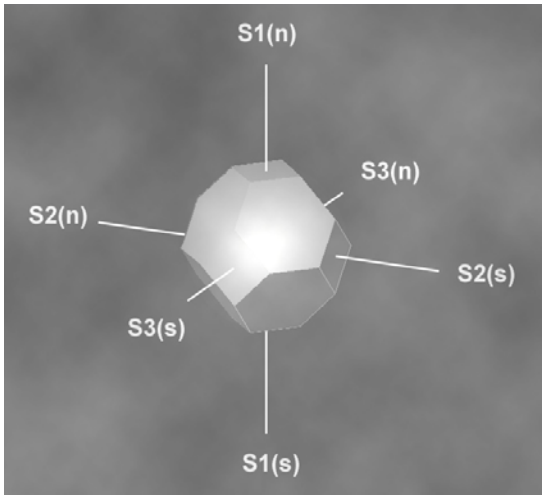

Figure 15.1.01 *The symmetry assigned to the tetrakaidecahedron's original 'S' faces and their identification within the dimensional boundary chord model.*

This particular chapter will therefore try to delve a little deeper into these questions and attempt to unravel the nature of the tetrakaidecahedron; the *ultimate* universal building block. While the early evolution of the lighter elements would be

dependent on what was happening within the environment at the time, it would be the very nature of the whole surviving teddy (now the proton), that would determine just how this bonding process came about. An important consideration of the teddy's characteristics during this early episode of nucleosynthesis would be its *SYMMETRY* - and this concept should be looked at a little more closely.

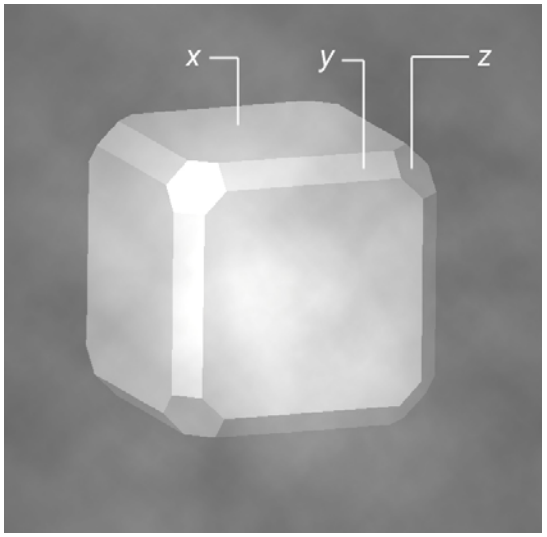

Figure 15.1.02 *The crystalline cube is (not surprisingly) of the cubic system and is a combination of three distinct forms. These are the cubic ('X'); rhomb-dodecahedron ('Y') and octahedron ('Z') forms, producing a total of thirteen axes and nine symmetry planes.*

The tetrakaidecahedron (in this model at least) would be *the* original polyhedron. It is the only shape that can be produced by the pressure modification of 4D spherical (expansional) events during the vacuum collapse that would herald the creation of the eighth-dimensional level. The teddy would at this time, be just a small integral component of a much larger homogeneous 8D lattice, but this structure would already have been determined back in the lower fourth-dimension. The continuity of structure would at the time, provide the lattice with a 'singular' characteristic and whereas the boundary chords have been described as individuals within their later 3D/4D setting, within this 8D lattice, they would be *ONE* chord. The tetrakaidecahedron's symmetry is rather subtle however (see *Figure 15.1.01* on the previous page) and can be defined as a polyhedron (or indeed a crystal for that matter) that results from the combination of two specific crystal forms[1]. This may best be illustrated with the help of a simple crystalline cube that can be used here as a starting point (see *Figure 15.1.02* in the previous column).

The humble cube (perhaps not that surprisingly), is crystallographically of the *cubic system* - one of the seven main groups known as the ***crystal system*** (but also referred to as *'essential' axes of symmetry*).

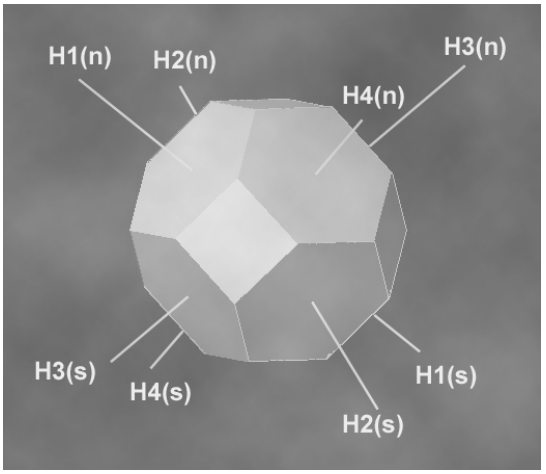

Figure 15.1.03 *Although larger and more numerous, the hexagonal faces of the teddy are actually 'subsidiary' faces - which are normal to the subsidiary octahedral axes.*

In the cubic system, we have the original 'six' faces that make up the cube (labelled 'X' in *Figure 15.2.02*); each parallel pair of which is normal to the axis that runs between them. There are however *subsidiary elements of symmetry* and only one class of crystal in each of the seven groups possesses a maximum number of these symmetry elements. This single class is referred to as a ***holosymmetric class***. In the cubic system, the cube itself is a member of this *holosymmetric class* and this too is inferred within the

illustration. As well as the six original faces, we can have faces that *bevel* the edges of these originals; (labelled 'Y' in the figure). There will be a total of twelve of these and they represent what is known as the ***rhombdodecahedron form***.

A further set of faces can symmetrically truncate the original eight ***coigns*** of the cube (the original corners) and these represent what are known as the ***octahedron form*** (labelled as 'Z' in *Figure 15.2.02*). This produces a combination of three different ***forms*** and the holosymmetric qualities of the cube can therefore be said to comprise the combination of three distinct forms (cubic, rhombdodecahedron and octahedron); each of which can exist independently of one another. By connecting an imaginary axis between each parallel pair of faces, the cube will end up with a total of *thirteen* axes and *nine* symmetry planes and as these are the maximum number of symmetry elements that this particular group can possess - this actually defines this crystalline cube as its own group's cubic *holosymmetric class*.

The octahedral planes (which naturally form hexagons in the illustration because of their incidence against adjacent faces); could be imagined in this scenario, to grow outwardly larger (especially at the expense of their neighbouring rhombdodecahedral faces); until the *twin-form* shape of the ***tetrakaidecahedron*** ultimately appears. As a result, the rhombdodecahedron faces shown in the figure, would disappear completely (as would their axes) and the cubic faces would have to shrink markedly as a consequence (eaten up by the growing hexagons that now mark the faces of the octahedron form).

This resulting crystalline tetrakaidecahedron (or 'teddy' as it is affectionately known in this model) would still however, be a member of the *cubic system* - even though it has reconfigured from a three-form to a twin-form combination. It would also appear to casual observation that the larger and more numerous hexagonal faces make up the 'primary' elements of the tetrakaidecahedron - but it would still be the smaller, square faces that are aligned with the primary or ***essential*** cubic axes. The hexagonal faces are actually normal to the ***subsidiary*** octahedral axes.

The apparent *crystal system* of the tetrakaidecahedron can also be analysed with a procedure known as ***stereographic projection*** which, up until the more recent availability of X-ray diffraction techniques, was the primary method used for determining crystal structure. Although this procedure will not be described in detail here, such analysis was most usually achieved in two-dimensions using what is known as the *stereographic* (or *Wulff*) *net* - but with the advent of good, 3D modelling programmes such as AutoDesk's *AutoCAD* and *3DSMax* (both used extensively by the author), similar results can be achieved a lot less laboriously - and in much greater detail.

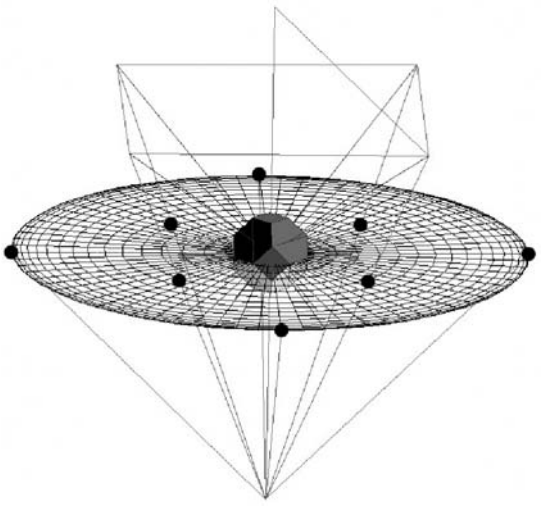

Figure 15.1.04 *3D stereographic projection of the teddy. The great sphere has been omitted for clarity, but the connected face poles above the equatorial plane represent where these points intersect the sphere's surface.*

Suffice to say that stereographic projection imagines the uppermost 'slice' of a crystal placed at the centre of a much larger sphere and the axes normal to each crystalline face (usually referred to as the *face-poles*) are extended outwards until they intersect the surface of this sphere. These produce points that basically transfer the position of these faces in three-dimensional space to a new

position now on the sphere itself. These points are then *all* projected towards the south pole of the sphere and where they intersect the equatorial plane, produce a unique plot of these points on what is now a two-dimensional surface, known as the ***plane of projection***. Each two-dimensional point now represents a face-pole. The crystal structure is thus easily examined from this 2D perspective and this has been attempted here three-dimensionally, using a hypothetical tetrakaidecahedron as the subject (see *Figure 15.1.04* on the previous page).

The projection has been orientated with one of its square faces (and thus *cubic axis*), placed north and one placed south; which also means that the remaining two cubic axes are orientated in the plane of the equator itself. Their points are positioned on the outside edge of the plane of projection (which is the original equator of the sphere) and this is known as the ***primitive circle*** (see *Figure 15.1.05* below).

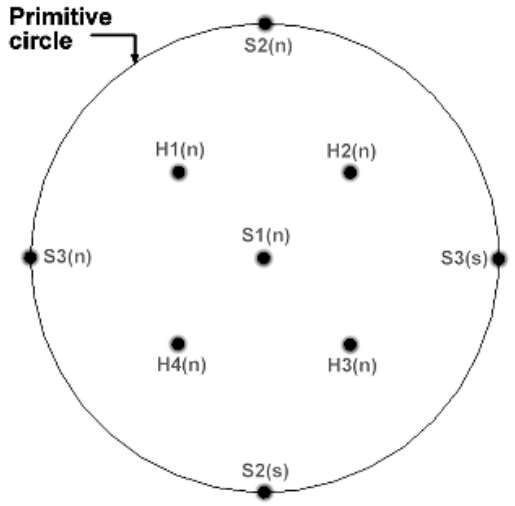

Figure 15.1.05 *The plane of projection produces a two-dimensional plot that by convention, represents a combination of cubic ('S' points at the centre and around the 'primitive circle') and octahedron forms ('H' points etc.).*

The pattern of these 'S' face poles (or their two-dimensional equivalent points) produce the classic representation of the cubic system in stereographic projection - as do the octahedral axes prove their own configuration as represented in the figure by the points marked H1(n), H2(n) etc..

It will have been noticed that only the 'north' poles of the 'H' faces are shown in the projection and this is of course due to the fact that only the top slice - or northern half of any particular crystal is used in this analysis. In all, this is merely another way of confirming that the tetrakaidecahedron is of the cubic system. By convention then, a tetrakaidecahedron in crystal form, should be of a combination of two forms (cubic and octahedron) and be of the cubic crystal system to boot. In reality, it is actually extremely difficult to find these bodies in mineral form at all and even more difficult to find any reference to them in works on the subject. The teddy is certainly a bit of a quandary; at least crystallographically speaking.

15.2 Reconfigured geometry

The original whole surviving teddy is however, no longer a perfectly symmetrical two-form crystal with well defined faces and edges of all the same length. In this model and not long after its appearance in four-dimensional space, it would have reconfigured as environmental conditions (now so very different from the 8D lattice in which it formed), played their part - all in collusion with its own in-built *face-spin bias* that was inherited from the big-snap. This characteristic can be thought of as a rotational tendency caused by the chords around the circumference of the hexagonal faces. As whole surviving teddies *and* their independent boundary chord relatives separated from this eighth-dimensional lattice (see again Chapter Seven), the *elastic rebound* that would have occurred, would set this phenomenon in motion.

Not long after the big-ping that followed this separation (or dimensional differentiation as this was called in an earlier chapter), the teddies would evolve into what in this model at least, are now the proton and neutron in our world - with

their round or circular faces made up from two different *dimensional boundary chord values* (six for the previously hexagonal faces and four for the previously square). The relationship of these new round faces to each other still remains as it was prior to reconfiguration and each face is still normal to the original crystalline axis (just like the hypothetical tetrakaidecahedron used in the stereographic projection illustrated earlier). Its axes *HAVE* therefore, remained (crystallographically) of the *cubic crystal system* even though a significant change has occurred to their structure (see *Figure 15.2.01* below).

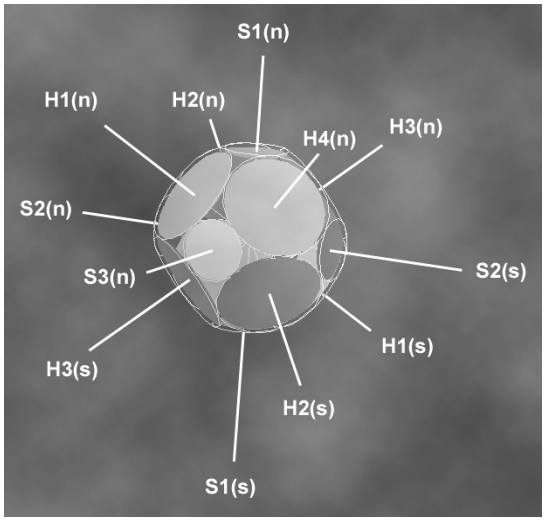

Figure 15.2.01 *The faces of the reconfigured whole surviving teddy (whether proton or neutron), retain the original configuration of their axes.*

There is actually something of a philosophical question hiding away here that will raise its ugly head more than once within this submission. This has to do with whether it is simply that subsequent bonding of proton to proton (resulting in a proton - neutron pair by way of 'S' face to 'S' face coupling); is responsible for the fact that the 'essential' axes of the holosymmetric class of cube are of the cubic system in the first place and not something else resembling the subsidiary 'H' axes shown in *Figure 15.1.03*); or whether it is indeed the other way round? It's a little like the chicken and the egg question at the moment, but subsequent discussions will try and clarify this position further. We often see repetition in nature and this may be the original. In this case, the underlying reason for such apparent 'patterns' may be the structural configuration of the sub-atomic components - where both electron and molecular patterns 'mirror' those that have *already* occurred within the subject's nucleus.

This may well be the reason why the electron shell's configuration right the way through the periodic table, seems to obey a single (basic) set of rules; that is able to determine where an element's electrons are allowed to locate themselves. Moving up a scale or two, many crystalline structures may have their origin within a similar explanation and again, this may be due to the larger scale build-up of structure, mimicking what has already occurred in the nucleus, electron shell and then within molecular form. We will have to wait and see.

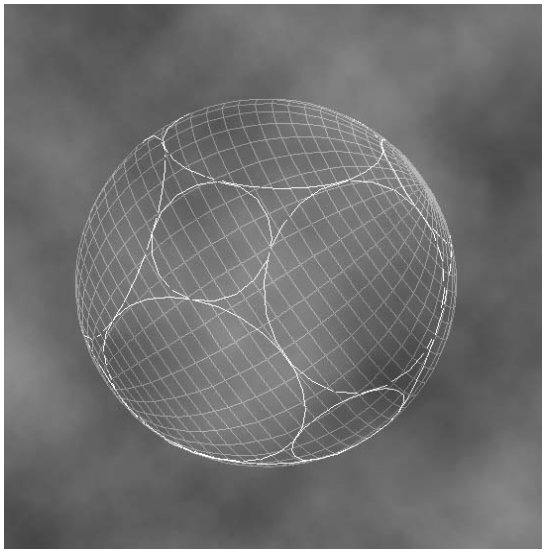

Figure 15.2.02 *The spherical symmetry of the reconfigured teddy superimposed upon a sphere of suitable scale.*

The symmetry of the tetrakaidecahedron (either the original or the reconfigured versions in this model) is such that each pair of parallel faces are also perfectly in line with each other. This

produces a situation where the reconfigured teddy (either proton or neutron), can be perfectly superimposed upon the surface of a suitably scaled sphere and each member of a rotational group (the round faces) will scribe out a perfect segment (see *Figure 15.2.02* on the previous page).

15.3 Spin states

This particular characteristic of the tetrakaideca-hedron, may be of assistance when describing the function of these reconfigured rotational groups, especially when the subject of proton-to-proton bonding is discussed (dealt with in the next chapter). Because of this perfect spherical fit as it were, the mapping of these faces may also be possible in terms of the 'Reimann sphere' and this approach may be useful in trying to determine the 'spin' characteristics of this model's proton, which must have a direct relationship to the rotational groups from which it is comprised. This question will be tackled next.

Each component 'loop' of any particular rotational pair is ***orthogonal*** to its partner - which in this context can be taken as meaning opposite. Each *loop* (made up from its constituent *boundary chord values*) also has a component of rotation brought about by the imposed face-spin bias discussed earlier in this section. Because of their configuration, this rotation will be *complimentary* about the same axis and because they are orthogonal, these components could be described as possessing 'spin', as they rotate around a 'shared' axis.

As this type of arrangement is reminiscent of the quantum geometry of the individual spin states of such massive particles as the electron, proton and neutron in convention (spin-½), then it may be possible to represent any chosen rotational group in terms of the *Reimann sphere* - where this surface can represent ***projective space***^{2} (**P**H^2) and each point on this sphere can possess a distinct spin-½ state. With a rotational group's axis orientated north to south and for this exercise, arbitrarily attributed with a clockwise rotation; the spin conditions of its two component loops can be conventionally described as:

spin-up $|\uparrow\rangle$ (r/handed about the upward vertical)

and,

spin-down $|\downarrow\rangle$ (r/handed about the downward vertical).

The ***spin states*** (which have an intimate relationship with the complex numbers Ψ_0 and Ψ_1 where usually $\Psi_0 = w$ and $\Psi_1 = z$); can therefore be described as {1,0} for *spin-up* and {0,1} for *spin-down* and these two (basic) states are themselves orthogonal (opposites).

One is therefore presented with a picture that will be very similar in nature to that shown in *Figure 15.2.02* on the previous page, although this particular sphere will be describing just *ONE* rotational group instead of all seven - and this has itself been illustrated as *Figure 15.3.01* below.

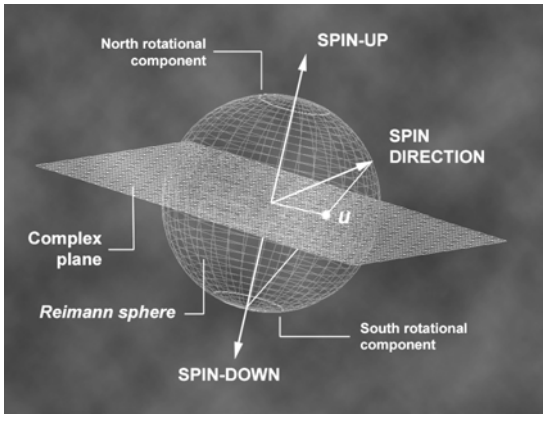

Figure 15.3.01 *The spin direction or spin-½ state of a rotational group can be ascertained by considering it as a Reimann sphere cut through the equator by the complex plane. The sphere itself becomes projective space.*

The Reimann sphere in this particular usage, will include a 'complex plane' because of *w* and *z* and this will quite naturally, cut the equator of the sphere itself. As the surface of the Reimann sphere represents *projective space*, it should be

possible therefore, to determine ***spin-direction***. This has a relationship with the complex-plane, where:

$$w\,|\uparrow\rangle \;+\; z\,|\downarrow\rangle \;=\; |\nearrow\rangle$$

and where the sign '↗' can be made to represent some direction in space; which in turn will be found to be some point on the surface of the Reimann sphere (which is now actually defined as *projective space* $\mathbb{PH}^2$). Not only does projective space become a Reimann sphere - but the teddy's rotational group itself could also be considered as a Reimann sphere too, especially in this particular context. With the complex plane cutting the equator of the Reimann sphere, *stereographic projection* can again be used to plot $|\nearrow\rangle$ (the spin direction or spin-½ state in projective space) and the position where this projection cuts the complex plane, will correspond with the complex number '*u*' and the complex plane itself (the equatorial plane in stereographic projection), can now be considered as being representative of the ratio $u = z/w$.

Within the bounds of this particular exercise, the illustration of a single rotational group by way of the Reimann sphere would seem to mirror that of any other spin-½ system - and the determination of *spin direction* would also seem to be achievable. The teddy (or proton) in this model however, is actually a system with a total of *SEVEN* rotational groups (or actually made up of 4 x 'H' and 3 x 'S' groups). This would seem to complicate matters somewhat, so that the simple picture painted within *Figure 15.3.01* on the previous page[3] - is not quite the whole story. Add to this the *polarity-flip* that may occur between these different groups during nucleosynthesis and the Reimann sphere becomes more than just a little cluttered.

15.4 The permittivity of free space

Allied to spin in this model, is the concept of charge (see again Chapter 10); where the rotation of the proton's 2D membranes within their respective faces, each produce their own component of charge. There would also seem to be the possibility of a relationship between this component *and* the theoretical surface area of the membranes themselves.

Not only is charge an important consideration when discussing the tetrakaidecahedron, but the use of 'ε_0' in Chapter 10 - or the value given to the *permittivity of free space* - would if correct, infer a surface area slightly greater than that of a 'flat' 2D membrane. Both of these inferences should be discussed a little more thoroughly.

From the on-line encyclopaedia 'Wikipedia'[3], this phenomenon that is 'the permittivity of free space' (also known as *vacuum permittivity*) is given the definition:

"Permittivity is a physical quantity that describes how an electric field affects and is affected by a dielectric medium, and is determined by the ability of a material to polarize in response to the field, and thereby reduce the total electric field inside the material. Thus, permittivity relates to a material's ability to transmit (or "permit") an electric field.

It is directly related to electric susceptibility. For example, in a capacitor, an increased permittivity allows the same charge to be stored with a smaller electric field (and thus a smaller voltage), leading to an increased capacitance."

'Wikipedia' goes on to further define the concept of 'vacuum permittivity' as follows:

"Vacuum permittivity (also called permittivity of free space or the electric constant) is the ratio **D/E** in vacuum.

$$\varepsilon_0 \;=\; \frac{1}{c^2\mu_0}$$

$$\approx 8.8541878176 \times 10^{-12}\ \text{F/m (or } \text{C}^2/(\text{N m}^2)),$$

where *'c'* is the speed of light; *'μ_0'* is the permeability of vacuum. All three of these constants are exactly defined in SI units. Vacuum

permittivity also appears in Coulomb's law as a part of the Coulomb force constant,

$$\frac{1}{4\pi\,\varepsilon_0},$$

which expresses the force between two unit charges separated by unit distance in vacuum."

From the arguments in Chapter 10, there would appear to be a (coincidental?) relationship between charge *(Q)*; the numerical value applied to the permittivity of free space and the calculated two-dimensional membrane area of both the 'H' and 'S' circular faces. It was therefore possible to express this as:

$$Q\,\varepsilon_0 = A$$

and this produced a value of:

$$\frac{2.356 \times 10^{-28}}{2.670 \times 10^{-20}} = \mathbf{8.824 \times 10^{-09}}$$

for the 'H' face 2D membranes - and similarly,

$$\frac{7.854 \times 10^{-29}}{8.900 \times 10^{-21}} = \mathbf{8.824 \times 10^{-09}}$$

for the 'S' face membranes.

There was an important qualification however, as the accepted value of *'ε_0'* is actually given as 8.854×10^{-12} *F* m^{-1} and the above results therefore appear to be a full *three* magnitudes too large.

Most linear measurements within this model however, have been given in *centimetres* and not in metres and this can adjust the above value by what amounts to a magnitude of $\mathbf{10^2}$. This would however, still leave a discrepancy of $\mathbf{10^1}$, because the value required for the above expression is 8.854×10^{-09}. This is of course, assuming that the effects of this ratio are being felt *JUST* within a three-dimensional environment (i.e. in the world where *WE* make our measurements and calculations there from). These rotating, two-dimensional membranes *are not* by definition, technically three-dimensional though; not in this model. They are certainly derived from the *de-gassing* of three-dimensional boundary chords, but this de-gassed material is actually *single* dimensional in origin - but must become two-dimensional because it is a *surface area*. This may sound confusing, but an area cannot comprise a single dimension, simply and logically because it is defined as length times breadth. This means that its value is derived from any two single-dimensional entities such as two adjacent or opposite single-dimensional ***de-gassing values***, (see again Chapter Nine), where any two adjacent areas of influence can be said to produce a 2D membrane component such as H1+H2; S1+S2; H4+H3; S3+S2 etc., etc..

The ***3D mass equivalence*** of such a two-dimensional body would therefore be a full magnitude *LESS* than we would measure it here, in our world - because of the simple cubic rule first introduced in Chapter Three. By this same token, three-dimensional effects, measurements (other than linear) and ratios, would be felt much more strongly by a *LESSER* 2D observer or indeed object - such as the 'H' and 'S' face membranes that de-gas because of spin-conflict. In other words, one has to balance both sides of the dimensional equation and this can be achieved by using the analogy of the simple cubic rule again, discussed and illustrated earlier within Chapter Two (*Figure 2.3.01* on page Nine).

One could say that the effects of 'ε_0' on the 3D world could be likened to the value given to all three planes of the cube - i.e. length x breadth x depth and therefore in this context, this could be expresses as:

$$\textit{3D Value of } '\varepsilon_0' = \textit{1000 units (l x b x d)}$$

while in order to arrive at the 2D equivalent where:

$$\textit{2D Value of } '\varepsilon_0' = \textit{100 units (l x b)}$$

in order to balance both sides:

$$\frac{\textit{1000 units (3D)}}{\mathbf{10}} = \textit{3D value of } '\varepsilon_0' \;\mathbf{x\ 10}$$

We must therefore multiply 'ε_0' by ten to arrive at the correct magnitude felt by the 2D membranes thus:

$$8.854 \times 10^{-10} \times 10 = \mathbf{8.854 \times 10^{-09}}$$

This conversion will now give a value that will allow us to both complete the charge expression on page 130 and to look at what may be deemed as evidence of what has already been called *membrane convexity* in an earlier chapter. In terms of the individual face membranes, their areas can now be calculated thus:

$$2.670 \times 10^{-20} \times 8.854 \times 10^{-09} = \mathbf{2.364 \times 10^{-29}}$$

for each 'H' face membrane and:

$$8.900 \times 10^{-21} \times 8.854 \times 10^{-09} = \mathbf{7.880 \times 10^{-29}}$$

for each 'S' face membrane.

Both results are in square centimetres and represent a surface area that is *1.004* and *1.003* times larger respectively, than those required for a simple 'flat' 2D membrane. This also represents a difference in accuracy from the originally calculated areas of less than half of one percent in each case. When one considers the very scale at which these membranes would sit in this model, the possibility of convexity must at present still remain somewhat debatable, although the logic of a convex characteristic would seem plausible because of their rotation.

15.5 Charge

We are however, now presented with definable values of charge for each of the 'H' and 'S' faces of the proton; brought about the rotation of their corresponding 2D membranes within the confines of the face boundary chords. With a different *angular velocity of rotation*, each type (the 'H' and the 'S') can be allotted either a positive or a negative charge which in this case, would seem to suggest a negative for the 'S' because of its spinorial implications. We are thus able to calculate the overall charge on the proton as follows:

$$\frac{(8A^H)}{\varepsilon_0} = Q^{H+}$$

which predicts a positive charge for the total 'H' face membranes and,

$$\frac{(6A^S)}{\varepsilon_0} = Q^{S-}$$

for the negative 'S' face membranes; where A^H is the individual 'H' face membrane area; A^S the individual 'S' face membrane area; Q^{H+}, the resulting overall positive 'H' face Coulomb value and Q^{S-} represents the corresponding negative overall 'S' face Coulomb value. By using the original surface areas and ignoring for the moment the still debatable issue that is *membrane convexity*; we can calculate the resultant proton charge thus:

$$\frac{(8 \times 2.356 \times 10^{-28})}{8.854 \times 10^{-09}} = 2.128 \times 10^{-19}\, Q^{H+}$$

for the total 'H' face Coulomb value and,

$$\frac{(6 \times 7.854 \times 10^{-29})}{8.854 \times 10^{-09}} = 5.322 \times 10^{-20}\, Q^{S-}$$

for the (negative) 'S' face Coulomb value. This will now provide the boundary chord proton with an overall charge of:

$$\begin{array}{rl} & 2.128 \times 10^{-19} \\ - & 5.322 \times 10^{-20} \\ \hline & \mathbf{1.596 \times 10^{-19}}\ \mathbf{Q^{N+}} \end{array}$$

where Q^{N+} represents here, the Coulomb value attributed to the proton *without* the component of *membrane convexity* taken into consideration. Obviously utilising the new surface areas calculated on the previous page to represent this component, will return a Coulomb value much closer to that experienced in the real world.

The apparent connection between the calculated surface areas of this model's proton and the (dimensionally corrected) value given to the *permittivity of free space* is certainly a strange one. If one happens to believe in coincidence (which doesn't really have any place in science); this may simply be one of those chance occurrences - but when one considers that this value is actually a natural ratio involving the displacement of an electric field, these rotational groups and the charge they produce within this model, begin to appear more plausible.

There is still a question as to the possibility of what the author believes to be a very real *polarity-flip* that because of spinorial implications, may occur between these different groups during the process of nucleosynthesis (again, tackled within a later chapter) and this will need to be examined as soon as possible. As already mentioned on page 128, the Reimann sphere pictured in *Figure 15.3.01* represents but a single rotational group - but as there are *seven* of these, this really does make things a lot more complicated in our attempt at describing what could be called the dimensional boundary chord proton. Added together, all these points may lead one to the realisation that the true character of the nucleus may involve interactions that do not simply involve just *three* distinct particles as in the quark model (and their associated gluons *et al*), but occur between active almost 'cog-like' components that rotate as complimentary pairs within a unique system of inter-related parts (actually thirty-six, three-dimensional parts and their 2D membranes). It may be complicated purely by the fact that experimenters are looking for quarks that aren't really there - and, as they say; only time will tell.

15.6 The electron's orbitals

The placement of an element's electrons within defined orbitals, seem to obey specific rules that are the result of intense observation and experimentation over the years. Chapter 12 touched briefly on the early Bohr and Schroedinger models, although these have been continually updated and revised since their appearance in 1913 and 1926 respectively. The concept of specific orbitals, provide areas of 'probability' in which one is likely to find a particular electron, although this will not be dealt with in any great detail here. Suffice to say, that their configuration has yet to be fully understood, although there is little doubt that there are physical reasons why they are the way they are. Perhaps just another one of those coincidences that have popped up time and time again within this model, their depicted orientation in space bears considerable resemblance to the geometry of the dim-wave emissions produced by the dimensional boundary chord proton's seven rotational groups.

The *'s'* orbitals are pretty much what one would expect and can be visualised simply as shells that surround the nucleus (see *Figure 15.6.01* below).

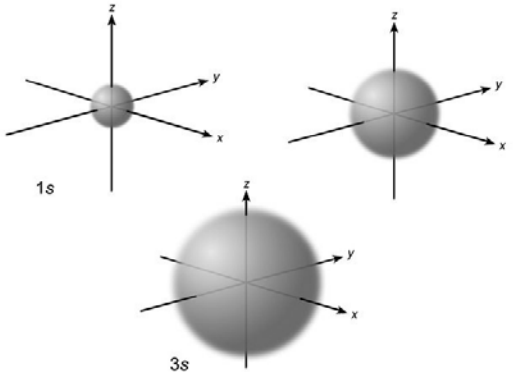

Figure 15.6.01 *The atom's 's' orbitals can be pictured as shells of increasing size and are the closest of the orbital sets to the nucleus. Orbital '1s' contains the electron with the lowest energy.*

These contain electrons which have the lowest energy, although strangely, orbital *'2p'* is filled prior to the *'3s'* (see again *Figure 12.2*.01 on page 96). By convention, an *x, y* and *z* axis is used for orientation. It is when we reach the *'p'* orbital set that things become a little more complicated. These are no longer believed to be just a continuation of the simple shell-like structures seen within the *'s'* orbitals which

appear to surround the nucleus just like the layers of an onion. Instead, the 'p' orbitals are usually illustrated as balloon-like 'probabilities' that extend away from the nucleus as pairs, normal to the x, y and z axes (see *Figure 15.6.02* below).

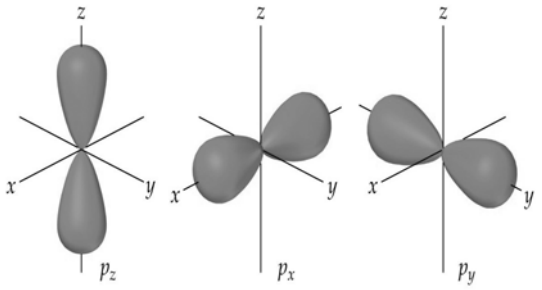

Figure 15.6.02 *The atom's 'p' orbitals extend away from the nucleus as probability pairs, conforming to the x, y and z axes.*

The big question is of course, *why* does this occur? First of all, none of the orbitals are 'precise' paths that electrons travel; instead, they are something like a 95% probability of where one would expect an electron to be - thanks to the *Heisenberg's Uncertainty Principle* and no real explanation has ever been provided that may answer this question. We have seen however from Chapter 12, that the dimensional boundary chord proton's dim-waves produce a caged effect between the 'S' face and 'H' face emissions, which can be likened to the effect of the *'1s'* orbital possessed by hydrogen.

When moving to the first *'p'* orbital however, we are actually exploring the characteristics of atoms that must contain at least five electrons and this will coincide with boron, with a ground state electron configuration [He].$2s^2.2p^1$ which means two electrons in the *1s* orbital (the same as helium); two in the *2s* orbital and one electron in the *2p* orbital. This infers that we are looking at a nucleus that comprises five protons (and five corresponding neutrons), each of which will be producing its own set of 'S' face and 'H' face dim-waves. The picture of this model's e-shell first shown in Chapter 12 becomes somewhat more tangled as a result, as interactions become more complicated. Each proton will still be trying to produce its own set of dim-waves, but the configuration or *bonding* of the atom's protons will tend to modify the overall field pattern and this is introduced in more detail within the next chapter. This new configuration will however, continue to follow the geometry and configuration of the proton's faces.

For the 's' orbitals and for the 'p' orbitals at least, electron capture will continue to be into the repulsion gap between 'S' and caging 'H' face dim-waves and the 'p' orbitals will adopt the symmetry of the 'S' faces as shown in *Figure 15.1.01* on page 123.

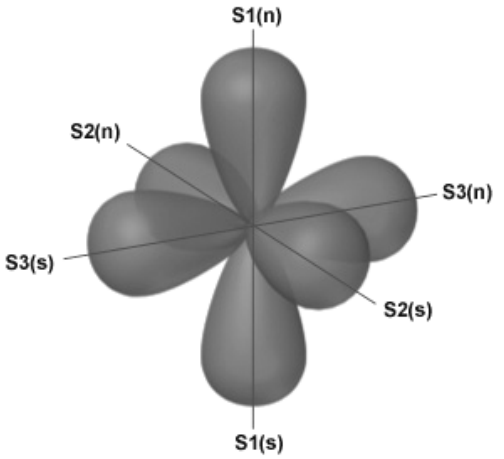

Figure 15.6.03 *The 'p' orbitals will take on the symmetry of the proton's 'S' faces due to a combination of like to like repulsion and field reconfiguration.*

Moving on to the still more complex *'d'* orbitals, there is some early indication that these too align to the symmetry of the proton but in this case, the 'H' face symmetry (see again *Figure 15.1.03* on page 124) come into play. This particular configuration seems to use components of both symmetries and is still being examined at present. This will all actually be dealt with in much greater detail in Volume 2 of this trilogy.

One final characteristic of the proton/neutron system that in this model, has been inherited from

the whole surviving teddy (and something that should also be mentioned at this stage), is the phenomenon that was described as the de-gassing phase of the neutron earlier in this submission. This occurred as the result of a change in the surroundings, as whole surviving teddies pinged into what was effectively a more rarefied (4D expansive) environment as opposed to the 8D lattice from whence they came. This resulted in a proportional amount of boundary chord material de-gassing to form the face membranes of the proton. This would ultimately provide the subtle difference between what was effectively the original neutron - and the *Stage 2* reconfigured proton.

During this early event, the universe would not only have been extremely crowded - it would not have had the chance to expand very much either. As a consequence, this *rarefied* environment (compared to the teddies and *IDBCs* original surroundings), would not be as rarefied as it has become today - all as a result of the universe's component of continued four-dimensional expansion. As the *de-gassing* phenomenon in this model would have a direct relationship to 4D expansion itself, this may imply that a *greater* input of kinetic energy is required to reverse this boundary chord process of de-gassing in the present. In other words, the processes associated with bonding may have been slightly different (originally) when compared to those taking place today. This may be quite an important consideration when discussing the possibility of a 'polarity-flip' within the structure of the proton - and this will be looked at in somewhat greater detail within the next two chapters of this offering.