The 'Boundary Chord' Nucleus And Its Lack Of Dependence On The Quark†

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Abstract

By looking at the nucleus in a slightly different way, it has been possible to compile a history of both the proton *and* neutron, which demands the inclusion of specific 'string' entities or *boundary chords* within this structure. This has also led to a picture of the nucleus that will be shown to include a total of seven distinct *rotational groups* that in turn, endow this most fundamental of bodies with its observed spin, charge and mass. This paper will also show that proton and neutron are each different evolutionary stages of the other, where the proton especially, can be considered as a *Stage 2* reconfiguration of a more basic and essentially earlier form that is the neutron. These *Stage 1* and *Stage 2* reconfigurations will be the result of a difference in threshold energy within these nuclear *rotational groups* and the legacy of these evolutionary processes will be an 'interchangeability' between these two stages, brought about solely by changes in the environment. Central to this scheme of things, will be a new geometry that allows for the re-mapping of both proton and neutron and an important consequence of this, will be the lack of dependence upon the *quarks* - which effectively become redundant within this model.

1.0 Introduction

Any discussion on the possibility of integral dimensional levels will not be new, but this does however, become an important aspect of this model in so much as it can provide an arguable explanation as to the evolutionary origin of the proton, neutron *and* electron. This would infer a process of *dimensional differentiation* coupled with an abstract quantative unit of measurement that can be defined as *dimensional energy*. Simply put, this is the ability of being able to apply different (arbitrary) energy values to differing complexities of dimensional form. A single-dimensional entity for example, would comprise *less* dimensional energy than a two-dimensional body, which in turn would be less energetic than a three-dimensional form. With a distinct relationship between the three (physical) dimensions, the ratio between these energy values is quite easily represented visually and can be achieved here with the assistance of the humble cube (see *Figure 1.0.1* below) where one could construct a single dimensional line using but a single edge of the cube in question.

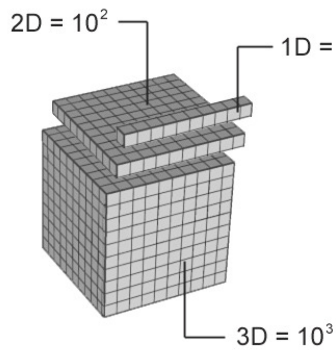

Figure 1.0.1 *Like length, area and volume in our world, the relationship between first, second and third dimensional energies can be likened to the values of a cube.*

This line would contain 10 of the smaller cubes, giving it a value of 10^1 units. A two-dimensional value would be length x breadth or 10 x 10 smaller cubes or 10^2 units. Similarly, a 3D value

† Conclusions drawn from *'The Boundary Chord Model'*

would contain *ALL* the smaller cubes that make up the original or 10 x 10 x 10 or 10^3 units and the relationship between first, second and third-dimensional energy levels would follow this simple rule, where each is an order of magnitude greater than the one below.

In this model, any initial differentiation of our universe would need to evolve from simple, to more complex - and any such event would most likely involve a transfer or exchange of energy. The purpose of this paper is not to debate any cosmological creationary event, but to allow for a single dimensional stage that may then evolve to more complex forms (for a more complete discussion, see *'In Search Of A New Physics'* by this author[1]; Chorthe Press; 2009).

With the help of what may be termed *'higher dimensional branes or membranes'* and a series of sporadic reduction (or *de-gassing*) first events, we *can* indeed provide an environment that places us in an ideal position to commence such an evolutionary journey. For simplicity's sake, such a 'single-dimensional' universe may be pictured as a somewhat over-sized ball of string (see *Figure 1.02* below).

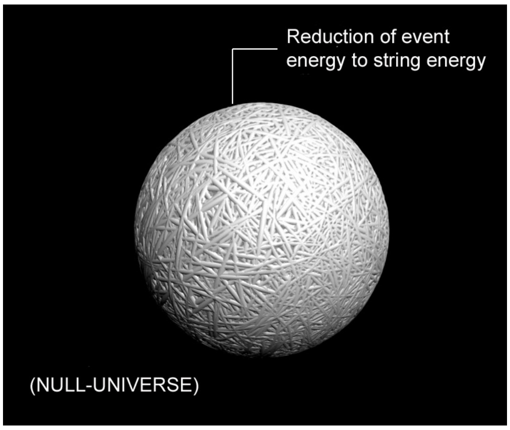

Figure 1.0.2. *With an initial reduction of 'higher' dimensional energy by a process similar to de-gassing, a single-dimensional environment can be the starting point of our evolutionary journey.*

Any change in this scenario could *only* be single-dimensional in nature and the very fact that string segments are touching string segments within our ball of string, allows us the use of ***loop dependent traces***, or *'loop variables'* to provide a reasonable method of evolving '2D' being from single-dimensional strings. The reduced structure of this original '1D' event can be imagined to result in a ***uniform spreading of weaves***[2], as the necessary loops and knots in this structure produce *enclosed* areas (the loops), bounded by the original single-dimensional string. This would allow a 'crossing of paths' and the transition to a *two*-dimensional universe would need to involve the formation of specific ***loop areas*** caused by this 'intertwining' of '1D' strings. In order for this to be effective in terms of a continuing evolutionary process, there would need to be involved some form of *limiting factor*, which would allow and promote the subsequent evolution of '2D' values within these areas (or ***membrane values***), each of which would need to possess a *similar* value right across the board. While this *could* take the form of a familiar *delta-function* in this area measure (i.e. $\emptyset_2$ *(value)* = $\delta\Delta$); this may not be necessary because of the resultant structure of this single-dimensional world anyway (see *Figure 1.0.3* below).

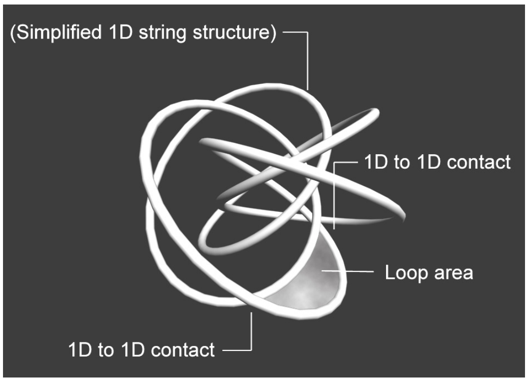

Figure 1.0.3 *As the single-dimensional string propagates, it will cross under and over its previous self, creating loop areas that herald the next stage in its evolution.*

Where the string appears to cross over or under part of its previous self within this overall structure, we are presented with a definable coordinate that can be referred to as an ***intersection point*** – and this would provide both a definitive value *and* a two-part component to each particular resultant loop area. This value is already well established, but includes constants such as *G* and $\hbar$, which at this stage, would not be expected to perform any true function. Although the loop can be thought of as constructing a firm '2D' area within the bounds of a single-dimensional circumference, it is actually comprised of *TWO* intersecting components, each of which provide part of a '2D' value to the overall area. At this point, these cross-over or *intersection points* are separated by what can be termed an ***intersection difference***. The loop segments *between* the intersection points, will *lose* energy and therefore 'shrink' in what effectively is their single dimension of length. This will also shorten the *intersection difference*, bringing the 2D membrane values closer together (see *Figure 1.04* below).

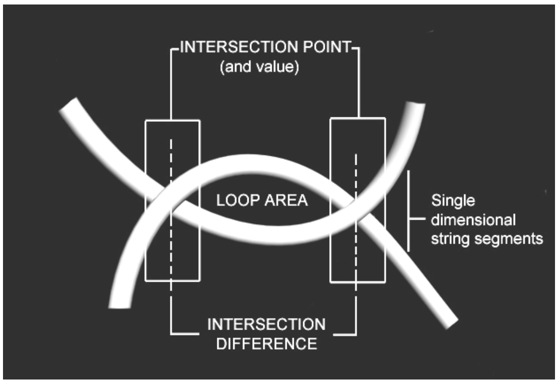

Figure 1.0.4. *The anatomy of the loop area and its formation.*

These paired *intersection points* and the resultant contraction of their *intersection difference*, (as '1D' energy is translated into '2D' membrane energy) will provide the mechanism for what will be the *next* stage in this process of dimensional differentiation. Thus far, the labeling of this series of events has been avoided, but as things begin to chance and grow in complexity, it may be advantageous to introduce a system that will allow us to keep track of this progression.

Utilising the concept of the ***set*** (Penrose[3] 2002), our initial (pre-event) *null-universe* can be represented by a *null-set* or *empty-set*; usually represented by *Ø* in current convention. This *null-universe* can therefore be expressed as:

$$Ø \;=\; \{\ \},\ \text{or just } Ø$$

Similarly, the first single-dimensional (string) event, can now be described as the first in a series of progressions that in this case, can be represented by the natural number '1' (one) thus:

$$Ø_1 \;=\; \{Ø\},$$

We are therefore presented with the super-imposition of *Ø* over *{ },* which allows us to describe in very simplistic terms, the appearance of a single-dimensional (first) event. The next progression of the *set* can be applied to the *next* natural number or two and this combines the two previously defined sets thus:

$$\{\ Ø, \{Ø\}\ \},$$

so, we could say that our next dimensional state can be represented as:

$$Ø_2 \;=\; \{\ Ø, \{Ø\}\ \},$$

and the newly evolved '2D' element of the universe can thus be defined as including those of the *null-universe AND* the '1D' entry event and would proceed via the afore mentioned processes involving *loop variables* and their associated *uniform spreading of weaves*.

Things now chance slightly, as we arrive at what is basically a *doubling-up* of the $Ø_2$ value, in order to provide the necessary energy required by the next step in this model's evolution - and can thus be described as:

$$Ø_4 \;=\; \{\ Ø_2\ ,\ Ø_2\ \}$$

where $Ø_4$ represents what will be equivalent to a 'fourth-dimensional' state, perhaps the most important as far as we are concerned and this takes us into the realm of expansion.

The transformation of $Ø_2$ to $Ø_4$ is analogous to the properties of the familiar 'reef-knot'. As the *intersection difference* shrinks closer to zero, this occurs because 2D *membrane energy* taps single-dimensional string energy. The membrane values themselves can be considered as 'point' values in as much as they occur *only* where two single-dimensional strings or vectors cross.

Each loop area therefore comprises *TWO* membrane values and the separation between these will shrink to near zero and these 'points' will eventually combine. This will occur because the single-dimensional string segments *between* the intersection points will have shrunk to zero as they lose energy, effectively placing these points within the *SAME* time-span.

Using the reef knot as the analogy, we arrive at a new compressed area that includes the intersection of *FOUR* single-dimensional strings and these now form what could be likened to an extremely 'tight' knot (see *Figure 1.0.5* below).

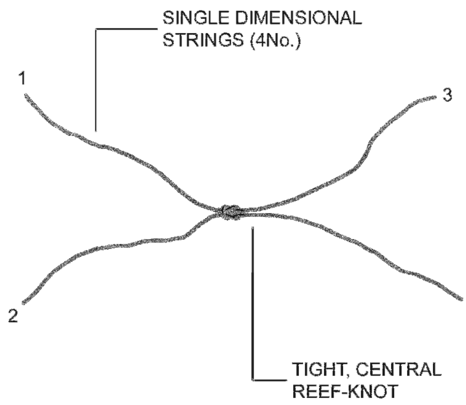

Figure 1.0.5. *As the intersection difference shrinks to zero, the tight central knot has the characteristics of a four-dimensional entity, equivalent to four, single-dimensional string energies.*

This 2D + 2D event must logically produce a higher dimensional state, and a four dimensional universe (sans time‡), would seem to have a *surplus* physical dimension when compared to our own. We would need to include an extra dimension, whose involvement in this new world, would define a very real function and this can only be the characteristic of ***SCALE***.

Scale as the fourth physical dimension, in what could now be defined as the fourth-dimensional state *{Ø$_4$}*, would affect *all* the other three dimensions in real-time and would become an integral part of length, breadth and depth. Unlike the other three with which we are more familiar, our fourth physical dimension of scale would be determined by its need to use energy. These fourth-dimensional *KNOTS* would evolve from 'zero' time (this zero intersection difference), along the only direction they can and this is determined by their four available vectors and these four (string) connections, will now fuel a multiple 4D 'scalar' event.

Returning to the 'reef-knot' analogy, it is clear that there is only *ONE* possible direction in which any scalar event can operate and this is 'outwards'. To produce such an effect, one can imagine picking at a taut reef knot in real-life and pulling its loops apart. This produces what in essence is *still* a 'reef-knot', but one that is obviously a great deal looser and one that takes up much more apparent volume within the bounds of the knot itself. This increase in the 'size' of the knot, cannot just come from nowhere, but must instead, be gained at the expense of the strings from which the knot is constructed. As with any real-life reef knot, these strings will tend to diminish in length as the knot expands. In the case of this '4D' equivalent entity, an increase in 'scale' will mean that in order to obey conservation laws, the knot must *absorb* '1D' string energy (labelled 1, 2, 3 and 4 in *Figure 1.0.6* below).

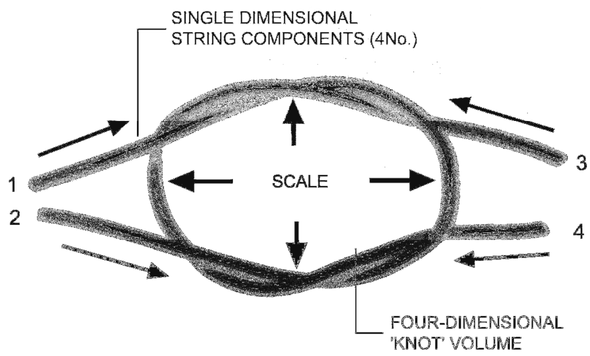

Figure 1.0.6. *As the four-dimensional 'knot' expands as a result of 'scale', the single-dimensional vectors to which it is connected will shrink (arrows 1, 2, 3 & 4 in the figure).*

This has a two-fold effect. Firstly, each single-dimensional string shrinks as its energy is transferred to the knot and secondly; because each string is also connected to *another* knot each separate '4D' event will be connected to either another two, three or four neighbouring events. The consequence of this shrinkage or ***retraction***, is that adjacent 4D events will be drawn closer and closer together as the component of scale feeds on single-dimensional string energy.

The resultant exponential increase in all three of what we call the physical dimensions would produce built-in inflation and the appearance of such an event would be spherical. This emerging fourth-dimensional state {Ø$_4$}, would soon seem to be full of mutually approaching, almost uniformly inflating 'bubbles' as the connecting single-dimensional strings grow shorter and shorter as their energy is absorbed. It would be this configuration; this smooth percolation, that will ultimately be responsible for the next stage

‡ Within this model, time is not included as the fourth dimensional state but is relegated to the first-dimension.

in the evolution of this multi-dimensional universe (see *Figure 1.07* below).

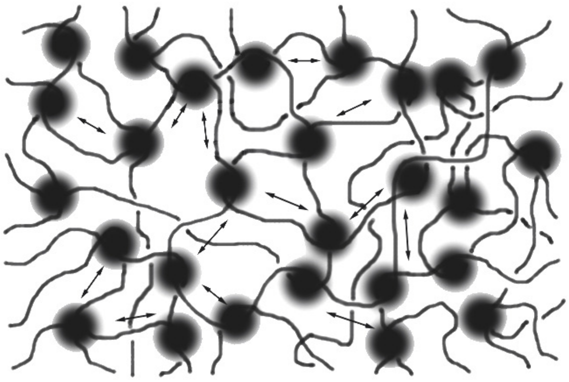

Figure 1.0.7. *As the constituent string energies are absorbed by the expansion events, each would be drawn closer and closer in time to its neighbours.*

The more these events expand, the closer will each be drawn towards its neighbours - until all of these connective *string energies* are exhausted. This will herald the start of a further sequence of events that will be all important to the evolution of the *boundary chords* themselves.

2.0 Boundary Chord Origins

With a mechanism that now provides the fuel, that in turn fires a four-dimensional outward expansion of *mini big-bang events*, individual scalar expansion will continue and the boundary surfaces of each of these events will be drawn closer and closer together (see *Figure 2.0.1* below).

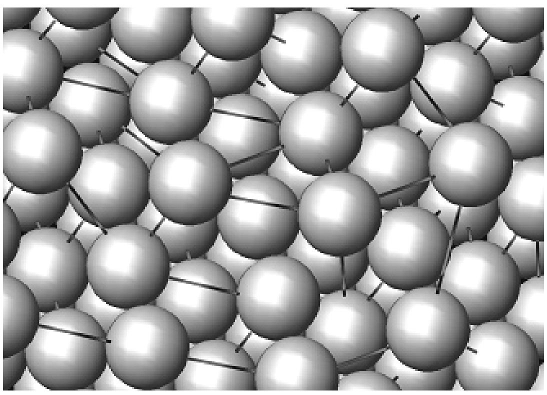

Figure 2.0.1 *As 4D events undergo expansion, they are each still connected to a total of four, single-dimensional strings. These shrink in line with expansion and pull these events closer together.*

Thus far, this dimensional evolution has produced a 'hierarchy' of dimensional energy levels that increase with complexity. Expansion (or inflation) at this stage, must use energy from the less complex dimensions that sit lower down, on what may be called the ladder of dimensional hierarchy. In the introduction to this paper, the fourth-dimensional level was assigned the (set) label $\emptyset_4$ and consequently:

$$\emptyset_4 = \{ \emptyset_2 , \emptyset_2 \},$$

where $\emptyset_2$, is the set that represented the lower two-dimensional level that evolved via the loop variable operation. This in turn, combined the null-universe and the original single-dimensional vector thus:

$$\emptyset_2 = \{ \emptyset, \{\emptyset\} \}.$$

The rate of expansion at this point will be proportional to the amount of energy used and can at this stage, simply be expressed by '*E*'. Therefore:

$$E\,\emptyset_4 = \frac{\{ \emptyset_2 , \emptyset_2 \},}{E}$$

Both lower dimensional states will lose energy to expansion and the conservation laws are satisfied. The consequence of this, is that as the expansion events are drawn closer and closer together they will exhibit what can only be described as an *elastic tension* as the single-dimensional strings lose energy and shorten.

Cooling would seem to have a universal affinity with expansion, as our own gas laws illustrate and as these four-dimensional results of 2D-to-2D combination inflate over time, the energy contained therein, will tend to rarefy and some energy *must* be dissipated. It should be remembered however, that these events are still within a 'null-universe' setting, in that any movement of energy *can only* occur within the material that makes up these expansion events and the single-dimensional strings that feed them. This dissipation of expansional energy can only take the form of a phase-change, or a *condensation* and these events could now be pictured as a myriad of inflating bubbles, all becoming very closely packed together. They are quickly differentiating as their volume increases and this condensation might better be defined as a conversion of *kinetic* to *potential* energy. Due to the *elastic tension* experienced by these expansion events, their packing in relation to one another will strive towards equilibrium and ultimately; their spherical surfaces must touch. There will however, be a natural repulsive effect as all exhibit an outward (expansive) push, but they will tend to configure themselves into a state of equilibrium which will allow them to occupy the *least* relative volume. There is however, a fundamental problem with spheres when they become very tightly packed together and this may have caused an initial inflationary phase to come to an abrupt halt.

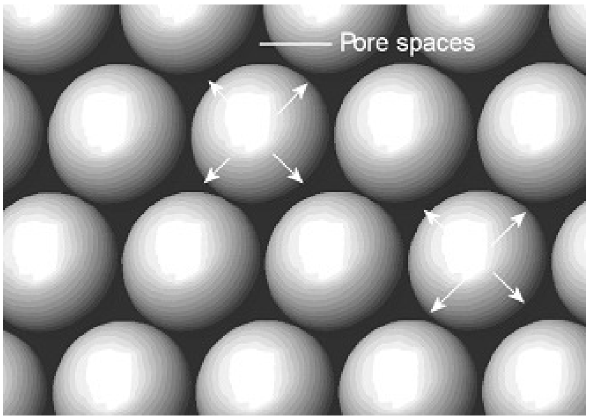

Figure 2.0.2. *The pore spaces that form between inflating mini big-bang events, will eventually become vacuums that pull spherical boundaries out of shape.*

Two-dimensional circles, or three-dimensional spheres, create *pore spaces* between their surfaces and these are at the inevitable boundary between three or more adjacent spheres, where the surfaces of neighbours are in almost perfect contact with one another. There is always a curved triangular space between them or pyramidal in three dimensions (see *Figure 2.02* above) and it's these characteristics that instigate the next stage in this evolution. The pore spaces, (which to all intents and purposes are still *null-universe*), will be increasing their own volume as they keep pace with the inflating spherical boundaries of these individual '4D' mini big-bang events and they would be the perfect definition of a vacuum. With continuing inflation, the pull of the vacuum making up these pore spaces would eventually overcome the resistance of the expansive spherical boundaries and these 4D shells would be pulled out of shape. During this expansive episode, each event would also be undergoing a differentiation (or phase change, as this energy would be stored as a potential and would play a major part in what was to happen next. At the same time, the single-dimensional strings that connect these events together, would have shortened to such an extent, that they would correspond to the depth of the pore spaces, as they continue to pull expansional surfaces together. As the pore spaces increase in volume (keeping step with the increasing volume of the 4D bubbles), the *elastic tension* of the connective threads would also increase as their energy was diminished. This would create a 'runaway' effect, as these single-dimensional strings ultimately begin to *STRETCH* with catastrophic consequences.

This stretching, together with the increasing influence of the *null-universe* pore spaces, would provide the impetus that pulls boundaries out of shape. Each adjacent spherical bubble would effectively increase its volume by approximately twenty percent, as its boundary snapped outwards to fill its share of the pore space vacuum that surrounds it. In so doing, these spheres would dramatically change their shape accordingly, as boundaries made perfect contact with other boundaries; thus destroying *ALL* the pore space volume between them as the potential energy of their stretched, single-dimensional connecting strings is released. This dramatic closure of pore-space vacuum would result in a change in the geometry of these spherical events as they metamorphose into a unique type of polyhedron called a ***tetrakaidecahedron*** (see *Figure 2.0.3* below).

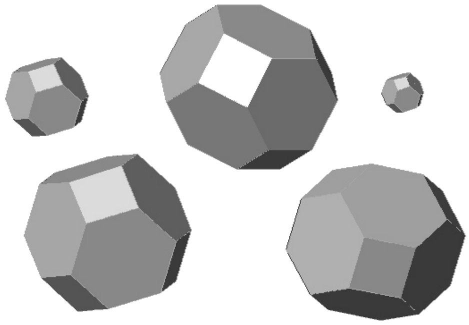

Figure 2.0.3. *The tetrakaidecahedron (or teddy); a fourteen sided polyhedron made up from hexagonal and square faces.*

The *tetrakaidecahedron*; (tetra [four]; kai [and]; deca [ten]), is a fourteen sided, 3D solid; consisting of eight hexagonal and six square faces and several of these will cluster easily in space because of their angles of incidence and it is also the best shape to use other than a cube, if you want to completely fill a volume with as little free space left as possible (i.e. no pore spaces or gaps). This phenomenon is not new and under certain conditions, tetrakaidecahedral structures will very often result from the 'pressure' modification of spherical bodies[4]. This resulting structure is also the 'idealised' shape of the human fat cell, as well as forming many other basic cellular structures in nature - and is also well known within the plastics and foam industries[5]; (often referred to as 'Kelvin's Cell')[6].

In this evolving four-dimensional world, such an event would occur simultaneously and would involve *ALL* of these spherically inflating mini big-bang events. There would be a ***vacuum collapse*** in very real terms, as boundaries *SNAPPED* to their new tetrakaidecahedral configuration. Those previously existing pore spaces, originally located between all 4D expansion events, would now be closed permanently (see *Figure 2.0.4* below).

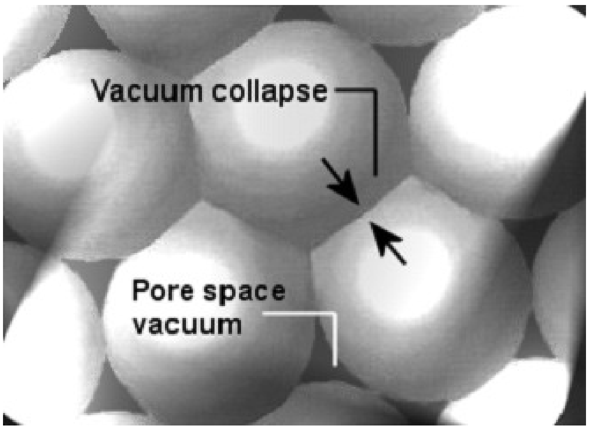

Figure 2.0.4. *The 'vacuum collapse' occurs when the strength of the pore space vacuum over-comes the resistance of the inflating spherical boundaries and they are violently pulled out of shape.*

What were originally a myriad of *individual* 4D expansion events, would now take the form of a *singularly* continuous, homogeneous tetrakaidecahedral-lattice, that because of the *vacuum collapse*, would now display 'cellular-like' characteristics. Each of these individuals (or ***teddies*** in this model), would also have simultaneously increased its volume accordingly and this would produce a massive release of the previously stored (differentiated) potential energy, right across this entire new homogeneous *teddy-lattice*. This would herald the next dimensional stage in the evolutionary processes of this young, embryonic universe. As the *vacuum collapse* occurs, we are witnessing a series of multiple, fairly violent collisions between four-dimensional objects (previously adjacent 4D expansion events). With such 4D to 4D contact, we have the perfect scenario for the evolution of an even higher dimensional plane; this time, one that would involve the sum of *ALL* these 4D to 4D boundary contact points and the *teddy-lattice* configuration would form the basis of what would be an eight-dimensional world.

This eight-dimensional concept would comprise just inter-connected planes inherited from the teddies back in their fourth-dimensional state. These planes, would exhibit *ONLY* those areas where 4D to 4D contact was made and they would consequently be of two shapes, namely ***square*** and ***hexagonal*** (the planes that make up the tetrakaidecahedron in the first place). Inflation back in the fourth-dimension, would have been slowed as the *vacuum collapse* acted like a brake and this would give way to a more sedate rate of expansion.

Fuelled by the original momentum of what have already been labeled as *mini big-bang* events, this too would also be carried over to what can clearly be defined as a newly created eighth-dimensional level because of these 4D-to-4D surface contacts.

The earlier 4D 'scalar' expansion would now be devoid of the individuality characterised by its original countless, separate *mini big-bang* events, as their individual boundaries would have metamorphosed into the 8D lattice; keeping pace expansionally, some way up the dimensional ladder. The 4D world (now devoid of these boundaries) would result in a completely *homogeneous* kind of expansion, more akin to what we witness in the universe today.

Inherited expansion in the eighth-dimension would cause a further cooling or *condensation* of this energy and there would be a further phase-change. This will be occurring to what is newly evolved *eight-dimensional* energy and can thus be labeled $\emptyset_8$ within our *set* description and would be equivalent to:

$$\emptyset_8 = \{ \emptyset_4, \emptyset_4 \}.$$

A ***secondary condensate*** would result as once again, phase transitions occurred. The potential energy released during what has been dubbed the *vacuum collapse*, would be both cooler and somewhat less energetic than the original, which propagated at the moment of 2D-to-2D membrane contact, or at the very birth of the inflating fourth-evolutionary stage. This eight-dimensional world would also be very different structurally, from that of the 4D level below it (see *Figure 2.0.5* below).

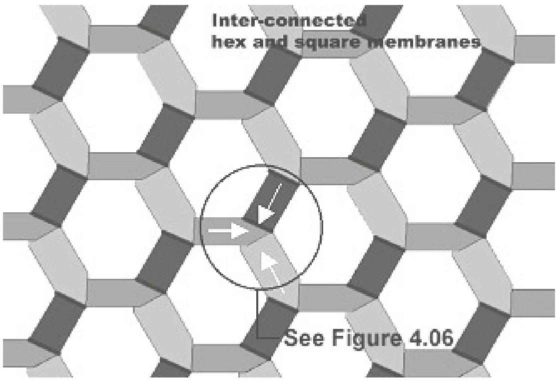

Figure 2.0.5. *A sectional view through the 8D lattice, showing its hexagonal and square planar construction. A secondary condensation would occur, which would have a profound effect on the future evolution of the universe as a whole.*

It should be noted at this stage, that these square and hexagonal faces are 'idealised' and are represented here as perfectly geometric shapes but in reality, not only will their structure change when our own part of the universe is discussed, but apart from their tiny size, their description as perfect tetrakaidecahedra should be considered as simply the best way of illustrating them for the purposes of this model. Their true appearance would be more akin to distorted, wispy membrane like surfaces that are themselves far from this idealised description.

This (8D) energy would be seeking equilibrium in its own right and would still be undergoing expansion, *parallel* to that of the fourth. With its new configuration as a tetrakaidecahedral lattice, this 8D world would take on a cellular appearance and this would consequently result in the formation of the *TWO* distinct kinds of membranes already described above; *square* and *hexagonal* – where each of these cells met another. Each of the four sides of the square and each of the six sides of the hexagonal membranes would be the same length, but the overall area of these geometric shapes would be different. The hexagonal would have an area that is just under 2.6 times larger than that of the square and this would result in two different power signatures for this new secondary release of dimensional energy, all initially caused by the vacuum collapse back in the 4D world. As mentioned earlier, what may have been an initial four-dimensional *inflationary* phase of the universe would have ceased because of the braking effect of the *vacuum collapse* and this would have given way to a more sedate rate of expansion. Although far from the break-neck speed of the earlier, explosive 4D event, this expansion would *still* produce a cooling effect and this would affect the eighth-dimension too. This time though, the energy prone to such cooling (or condensation) would be the *secondary potential energy* that now makes up the square and hexagonal membranes within the 8D teddy-lattice. As this begins to cool, it will collect as a *secondary condensate* along what are effectively the edges or natural boundaries located between the membranes and this re-distribution of material will result in *STRINGS*. The edge (or boundary) of each and every two-dimensional plane (hexagonal or square), also becomes the junction of two hexagonal and a single square plane within this lattice, all separated by angles close to 120° - or what can be called a ***tri-planar coordinate*** in this model (see *Figure 2.0.6* below).

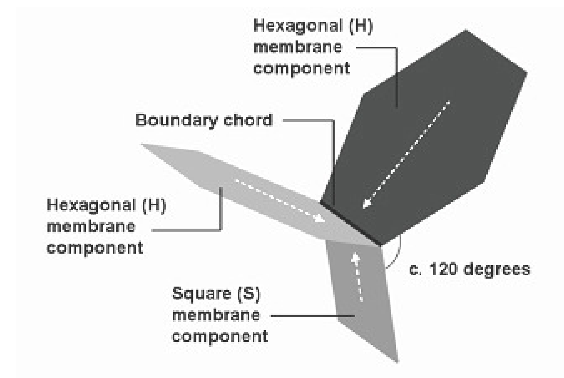

Figure 2.0.6. *The 'tri-planar coordinate' is the source of the boundary chord and results from the reduction of the three associated boundary membrane energies produced by the vacuum collapse.*

As these membranes now form a cellular-lattice, each one of these edges or boundaries becomes a *tri-planar coordinate*, where a total of three boundary membranes meet (two hexagonal planes and a single square). The *strings* that ultimately condense and form at these locations will therefore each be made from these *THREE* independent boundary energies - and because of this tri-part characteristic, have thus been renamed ***boundary chords*** within this model (see *Figure 2.0.7* below).

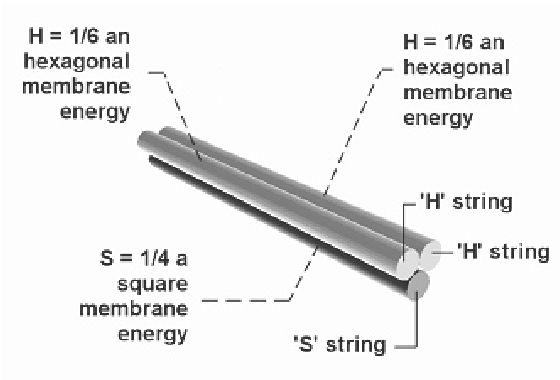

Figure 2.0.7 *Each boundary chord is made up from a percentage of three independent membrane energies; two hexagonal and one square. They can be considered as comprising three separate strings.*

These strings (or now more specifically, *boundary chords*), would form at the boundary edges of the condensing membranes as closed, circular varieties. The geometry of these surfaces would of course (loosely) take the form of square and hexagonal loops. Due to the nature of their creation from the reduction of *THREE* individual membranes (or percentages thereof), although acting as single entities, they would be a combination of *THREE* string energies. This property will become an important one in their later description, as this independence will also determine their character in our world. These string combinations will each possess a ***string value*** and these will be inherited from the secondary membranes *prior* to their reduction and must be carried over to these resultant strings. Considering the (idealised) geometry of these membranes, each boundary chord will therefore be made up from *ONE- SIXTH* of each of the hexagonal membranes at its tri-planar coordinate and *ONE-QUARTER* from its single square membrane.

The newly formed *boundary chord* lies at the junction where sides of these hexagon and square faces meet. This all results in boundary chords of equal string value and each is therefore made up from three parts that have been labelled 'HSH' (the 'H' resulting from one-sixth a hex membrane and the ‘S’ resulting from one- quarter a square membrane).

At this stage in the game, there are no three dimensional concepts such as *depth* or indeed *volume* because the third-dimension has not yet evolved within this model. Such parameters would be meaningless, as would their (3D) relationship with one another and as a consequence, any 3D concepts such as *volume*, *mass*, *area* and *density* may be considered as all possessing the *same* value of *VAMP = 1* or:

$$V \text{ (volume)} = A \text{ (area)} = M \text{ (mass)} = P \text{ (density)}$$

Relative 'HSH' *string values* will be determined by the area of each hex and square component (as indicated in *Figure 2.0.8* below), but as each one-sixth hex and one-quarter square are resulting in *SINGLE* dimensional string values, they will eventually need to be converted into a ***boundary chord volume*** (V^{bc}) once our own three-dimensional component is taken into consideration.

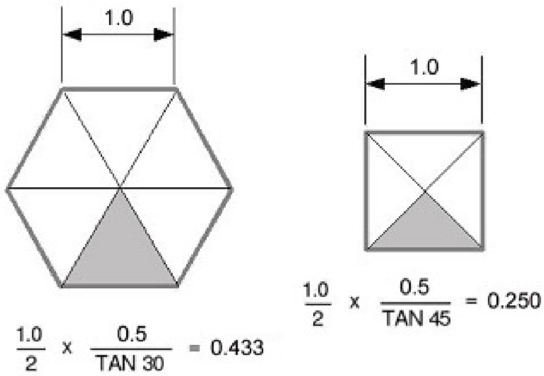

Figure 2.0.8 *Relative areas of hexagonal and square membrane components*

In our terms, these *tri-planar* coordinates can be considered as being equivalent to the three-dimensional ‘*xyz*’ axes, which define 3D form. The (three-dimensional) *boundary chord volume* will therefore comprise the components:

$$V^{bc} = HSH$$

$$\text{or } 0.4330 \times 0.2500 \times 0.4330$$

and this will produce an individual *boundary chord volume* that can be expressed as:

$$V^{bc} = 0.04687$$

This figure can thus provide what will be a *quantative* description of the boundary chords (or more correctly, the boundary chord energies) that will be explored more fully in due course. It will also allow this model the means to evolve further and this value will be intimately linked to processes and events that occur in our own world. During the condensation of these boundary chords, the expansion of the universe would of course be continuing and this would also result in the expansion of the teddy-lattice that in the eighth-dimension, is now exclusively made-up of these condensed-out boundary chords *AND* a residual proportion of *uncondensed* secondary energy (see *Figure 2.0.9* below).

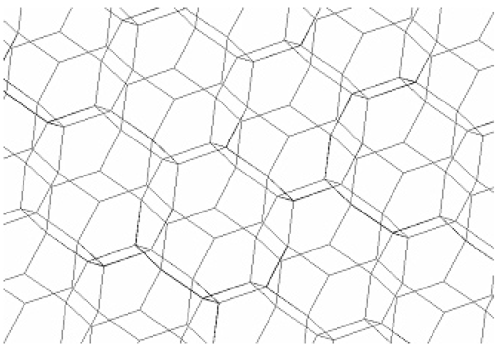

Figure 2.0.9 *The eighth-dimensional teddy lattice will condense down to a net-like structure of one continuous, tri-planar boundary chord that grows in line with 4D expansion.*

This continuing expansion would have the effect of *stretching* this lattice – which may have only been able to take a certain amount of this kind of punishment. This boundary chord lattice would not comprise individual condensed chords, but *ONE* complete, continuous, eight-dimensional network and stretching due to expansion would have eventually come to an abrupt end. The chords (made up from condensed secondary energy) would no longer be able to resist the forces of expansion and the response to this stretching would be a catastrophic chord separation.

This may have produced areas where isolated, *intact* tetrakaidecahedral shaped portions of the lattice became separated as entities in their own right, snapping back to the size they had originally configured to, the moment after their condensation into boundary chords proper. There would occur what in this model, will be called a ***big-snap***. Individual boundary chords and whole tetrakaidecahedra (teddies), would separate as this cellular lattice disintegrated, but having been formed from their tri-planar coordinates, they would by definition, have evolved into *three-dimensional* boundary chords within an *EIGHT*-dimensional universe but are effectively separated from this world because of the *big-snap*. With a new, lower dimensional character, they *cannot* now exist at this eighth-dimensional level. They will have been the product of a less energetic *rarefied* environment, coming into being as they did, some time *AFTER* the 4D universe had expanded considerably. This *secondary condensate* would be of an even lower energy signature than earlier fourth-dimensional expansion. At this stage, there exists a dimensional energy *GAP* between the 2D loops or membranes - *and* the now homogeneous 4D expansion event and this would infer a vacant position that would logically coincide with the equivalent of a 3D energy level and both whole surviving teddies and independent boundary chords would drop to their own equivalent energy level, filling this apparent gap; effectively suspended *within* the expansive envelope *that is* the fourth dimension. There would occur a ***big-ping*** as these 3D objects appear into what we would now consider as being *our own* part of the universe (see *Figure 2.0.10* below).

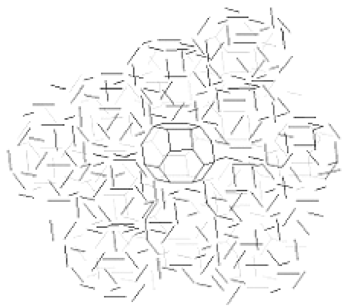

Figure 2.0.10 *Independent boundary chords and whole surviving teddies 'ping' into the supporting structure of four-dimensional space, creating the universe we recognise today.*

Individual boundary chords will make up the bulk of these new three-dimensional objects and these will display a characteristic that at the instant of the *big-ping*, could be likened to tiny rods or *spicules*, each with a 3D boundary chord volume of 0.04687 (see above). The whole surviving teddies will also be comprised of these *SAME* boundary chords, but these will be held in an open tetrakaidecahedral form and this configuration will equate to a total of thirty-six independent boundary chord values. This volume needs to be referenced to the scale of our own processes and events and will also be dealt with in due course.

The characteristics of the boundary chords will change fundamentally as they drop to their new 3D rung on the dimensional ladder as new environmental conditions make their presence felt. Returning for a moment to the eight-dimensional lattice, what would happen to its remaining material *and* the energy from which it was made?

Now devoid of its secondary three-dimensional condensate (the independent boundary chords and whole surviving teddies); the eighth dimension would now comprise an energy signature that is considerably *less* than that with which it originally started. This new energy level must now correspond to eight, minus three, or *FIVE* and after the removal of the 3D boundary chord components that drops to form our world during the *big-ping*; this remaining, dimensionally less energetic material *MUST* migrate downwards too. This resultant energy would possess its own characteristics too and while it may be considered as remnant 8D material, it would have undergone rapid *contraction* as the teddies and boundary chords from which the lattice was made, snapped-back to their original size after their brief but stressful episode of stretching.

This new 5D energy drops into *ITS* new (lower) energy level at the same time as the appearance of the boundary chords and teddies into what would become *our* world. This *contractive* characteristic would have an important consequence on the future of the universe as a whole and its resultant position directly adjacent to the fourth-dimensional energy plane, would mirror the properties exhibited by 4D expansion. For such an opposite (or negative) phenomenon, this logical drop next to this original 4D expansional event, seems to provide a fortuitous mechanism of equilibrium, that both connects and will be seen to provide the *room* for these two very oppositely behaving levels. In simple terms, this takes the form of the classic 'piston-effect' (see *Figure 2.0.11* below).

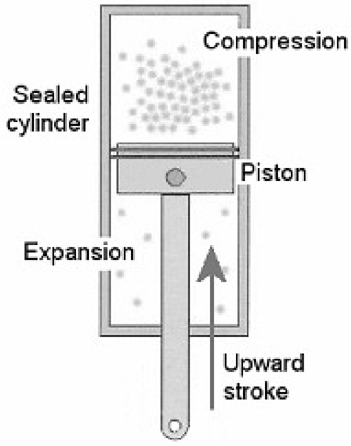

Figure 2.0.11 *The 'piston effect'. The material in the sealed cylinder ahead of the piston will be compressed as the volume decreases; whilst that behind the piston will expand as its volume increases.*

3.0 The Origin Of The Nucleus

The stretching of the 8D lattice ultimately came to an end with the *big-snap*, when independent boundary chords and whole surviving teddies broke free when they achieved a size comparable to that of the atom - or circa 10^{-08} *cms*. There may have occurred, a certain amount of ***elastic rebound*** as the component chords contracted in length, perhaps shortening by something like a magnitude, to produce a final boundary chord length that would correspond to circa 10^{-09} *cms*. Whilst it could be argued that these statements are somewhat assumptive at this stage, this referencing to processes a little closer to home does however, allow the area calculation shown in *Figure 2.08* above to produce a more realistic *'HSH'* value which will now be able to equate to 0.4330×10^{-09} for the 'H' component and 0.2500×10^{-09} for the 'S' and overall:

$$(4.330 \times 10^{-10}) \times (2.500 \times 10^{-10}) \times (4.330 \times 10^{-10})$$

$$= \mathbf{4.687 \times 10^{-29}}$$

and this conversion has been illustrated within *Figure 3.0.1* on the following page. As the boundary chord volume will be equal to the *boundary chord mass* within the original 8D lattice (from whence it was derived), this relationship can now be expanded upon and expressed as:

$$M^{bc} = 4.687 \times 10^{-29}\ kg$$

Independent boundary chords will break free from their 8D lattice and *ping* into our own three and four-dimensional part of the universe, with a mass equivalent to $4.687 \times 10^{-29}\ kg$. The whole surviving teddies on the other hand, will each comprise a mass that will be equivalent to *thirty-six* times this individual boundary chord mass, or:

$$36 \times 4.687 \times 10^{-29}\ kg, \text{ therefore,}$$

$$36\, M^{bc} = \mathbf{1.687 \times 10^{-27}\ kg}$$

The new environment in which both *teddies* and *independent boundary chords* now find themselves suspended, will induce a series of reconfigurations prompted by these surroundings which in the case of the *whole surviving teddy*, will involve a further ‘split’ in the boundary chord material. These *new* string components will be of a *different* value when compared to those of the original tri-planar coordinates and a combination of environmental effects such as pressure, heat and induced ***face-spin bias*** will all contribute towards an unavoidable change in the nature of the whole surviving teddies. The independent boundary chords will fair no better, but for a more detailed discussion of these refer again to *‘In Search Of A New Physics’* by this author[1]; Chorthe Press; 2009.

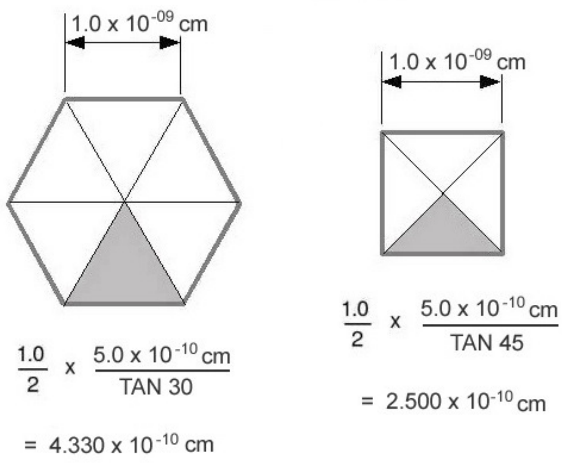

Figure 3.0.1 *Allowing the boundary chord to ‘rebound’ after the big-snap, can provide a corroboration between the 8D area rule and the scale of 3D boundary chord events.*

The newly appeared teddy would have entered our world as a rather unstable object in the first place. *Face-spin bias* can be described as the tendency of the boundary chords to exhibit an induced spin centered on and around the hexagonal faces of the teddy (see *Figure 3.0.2* below) and this would have been caused initially, by the break-up of the 8D lattice where independent boundary chords had detached from the whole surviving tetrakaidecahedra. This rotational tendency of the teddy’s chords will also induce a ***spin conflict*** where two chords meet, as double the volume (or chord mass) is trying to fill the space of a *single* chord volume.

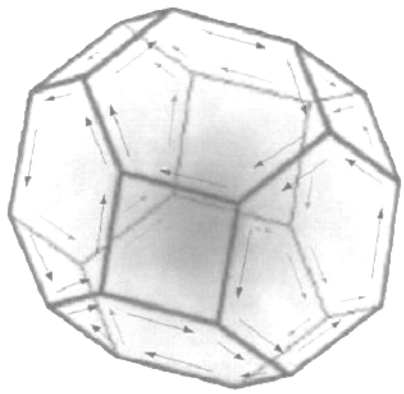

Figure 3.0.2 *A component of ‘face-spin bias’ will be inherited from the inertia of the big-snap, which will manifest itself as a rotational tendency of the boundary chords that mark the edges of the hexagonal faces. This will create ‘spin-conflict’ within the body of the teddy.*

Coupled with an un-confined surrounding space and the resultant heat of this embryonic cosmos, a reconfiguration will occur as this unstable teddy strives for a new equilibrium. This will basically take the form of *two* distinct stages. The *face-spin bias* will try to push two boundary chord volumes into a single space, which will result in a separation at the ***point of convergence*** where two hexagonal faces meet. These *POCs* are areas where the individual boundary chord volume is situated and it is here that the chords start to separate first. The individual boundary chord mass *must* be conserved and this will continue to occur at the *point of convergence (POC)*. The overall structure of the teddy will also be conserved (i.e. its fourteen tetrakaidecahedral based surfaces) and this will necessitate the two-way split of the chord material into two series of differently sized, equally valued chord components (see *Figure 3.0.3* below).

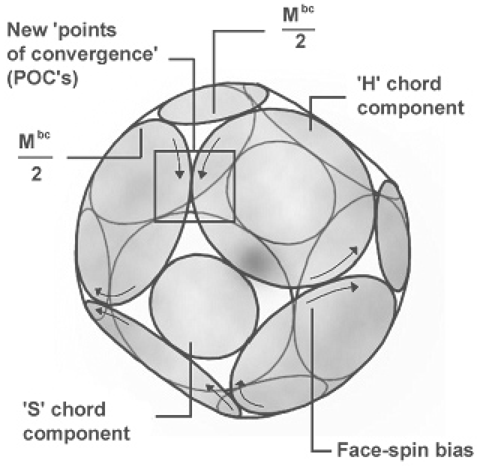

Figure 3.0.3 *With spin conflict and other physical influences playing their part, the original teddy must reconfigure its boundary chords in order to regain its equilibrium.*

This has the effect of altering the teddy's *POCs* so that they are now points where *TWO* chord components come together to produce the original boundary chord value (and thus mass) and allow unhindered rotation of chord components, centered around the hexagonal faces. The new, previously square faces will not (at this stage) exhibit *face-spin bias* because they are trapped between contra-rotating areas bounded by four (previously hexagonally shaped) circular chords.

The second significant point is that dimensional energies will have changed. The original boundary chords were all of the same three-dimensional mass equivalence (and therefore 3D energy) and this produced the teddy's overall mass signature of 1.687×10^{-27} *kg* shown on *page 12*. A boundary chord mass *is still* produced by the teddy's *POCs*, but there is a subtle difference because of the resultant split within these chords. Each original boundary chord *POC* was of the same finite length (with thirty-six in total) and each of these produced a mass component equivalent to 4.687×10^{-29} *kg*.

The *spin-conflict* will induce a separation of boundary chord material that will commence at these hexagonal to hexagonal boundary positions and effectively 'split' the chords because of this attempted rotation. This will result in independent 'face-centered' chords that will induce a modification in what is an unsupported and more rarified environment and they will become *circular* in shape. Their *mass equivalence* should therefore become *HALF* that of the original chords, so that:

$$\frac{M^{bc}}{2} = \frac{4.687^{-29}\ kg}{2} = \mathbf{2.343^{-29}\ kg}$$

This split in these components also provides the teddy with *twice* the number of boundary chords (8 x 6 'H' chords and 4 x 6 'S' chords) or 72 instead of 36.

This event will not however, be quite as straightforward as it would at first sight appear. The old 'points of convergence' (*POCs*) or the original *corners* of the tetrakaidecahedron, will become areas where there occurs a ***tri-lateral chord separation*** and this process will release a great deal of energy. The reconfiguration of the teddy's chords around these areas must result in the juncture of *three* circular chords (centered upon three different faces). They will also be areas where two boundary chords were originally 'pushing' together from adjacent faces, both trying to fill the space meant only for a *single* boundary chord (see *Figure 3.04* below).

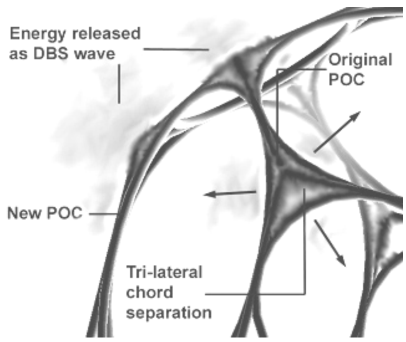

Figure 3.0.4 *Face-spin bias will cause a recon-figuration of the whole surviving teddy's chords as they split in two. At the old POC's there will be a conversion of mass to dimensional boundary surface wave energy.*

The *points of convergence* will be shifted away from where the corners once were (as they will no longer exist) and these *new POCs* will locate at what were previously the centers of the original boundary chords. These *POCs* will have a mass equivalence of the two newly converging (half) chords at this point – but there would have also been a mass loss because of these chord separation events. Each of these *tri-lateral* *chord separation points* can be thought of as comprising what in essence, will resemble an asymmetric triangular area of positive curvature, bounded by *three* circular chords (see again *Figure 3.0.4* above). The total mass loss experienced by the teddy will be the same as the combined mass conversion at each of these points and this will be intimately related to the ***2D membrane capacity*** of these asymmetric positively curved triangular areas.

Any 2D membrane capacity would be proportional to the *area* in question. These areas in question (previously occupied by the whole surviving teddy's *corners*), are also related to the original boundary chord's area conversion figures (see again *Figure 2.0.8* on *page 9*); where the hexagonal faces were given a value of *0.433* and the square a value of *0.250*. As the teddy reconfigures, these areas must become the juncture where two (previously) hexagonal and a single (previously) square chord now meet (although they are now circular). Any possible conversion of chord material at these tri-lateral separation points, would actually come from this combination of *H+H+S* boundary chord material and this *tri-lateral split* would involve a proportion of the original boundary chord's mass that can be expressed as follows:

$$H = \frac{4.687 \times 10^{-29}\,kg \times 0.433}{10^2} = \mathbf{2.029 \times 10^{-31}\,kg}$$

$$S = \frac{4.687 \times 10^{-29}\,kg \times 0.250}{10^2} = \mathbf{1.171 \times 10^{-31}\,kg}$$

where *0.433* and *0.250* represent the original boundary chord area conversion and 10^2 represents the equivalent 2D membrane conversion factor. The mass loss at each and every tri-lateral separation point (*TLSP*), will therefore be equivalent to:

$$\begin{array}{r} 2.029 \times 10^{-31}\,kg\ (H) \\ +\ 2.029 \times 10^{-31}\,kg\ (H) \\ +\ 1.171 \times 10^{-31}\,kg\ (S) \\ \hline \mathbf{5.229 \times 10^{-31}\,kg} \end{array}$$

As there are a total of twenty-four *tri-lateral separation points* around the original whole surviving teddy, the total (*Stage 1*) mass loss will in turn equate to:

$$24 \times 5.229 \times 10^{-31}\,kg = \mathbf{1.255 \times 10^{-29}\,kg}$$

This figure represents the total (apparent) three-dimensional mass loss during this *Stage 1* reconfiguration of the whole surviving teddy as *face-spin bias* acts as the catalyst that results in a new circular chord configuration. This mass loss can now be deducted from the original, in order to glimpse the character of this *new* teddy as it now displays its presence in our three-dimensional world:

Original teddy mass:	$1.687 \times 10^{-27}\,kg$
Stage 1 mass loss:	$-\ 1.255 \times 10^{-29}\,kg$
***New* teddy mass:**	$\mathbf{1.674 \times 10^{-27}\,kg}$

As the teddy completes this *Stage 1* reconfiguration, this mass loss (comprising the total of 24No. tri-lateral separation points), will induce a redistribution of its overall mass component, resulting in a drop at the *POC* to give the boundary chord a new mass value of:

$$M^{bc} = \frac{4.651 \times 10^{-29}\,kg}{2} = \mathbf{2.325 \times 10^{-29}\,kg}$$

With such an induced conversion from the original boundary chord configuration to *Stage 1* circular chords, the whole surviving teddy has in this model, become the ***neutron*** (see *Figure 3.0.5* below).

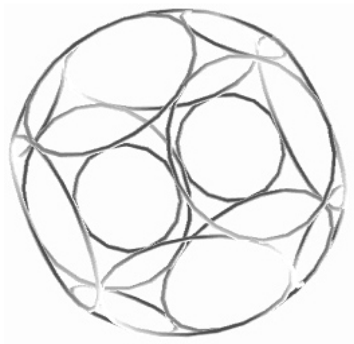

Figure 3.0.5 *As the whole surviving teddy undergoes what has been called its 'Stage 1' reconfiguration, its mass loss at the 'tri-lateral separation points' (TLSPs), will produce what we would recognise in our world as the neutron.*

As the neutron suffers from rather a short 'half-life' however, this may draw us to the conclusion that this *Stage 1* reconfiguration *IS NOT* the end of the story. As the *neutron* is produced by the conversion of its *TLSPs*, it must still be unstable in the sense that this well measured half-life infers that this entity ultimately undergoes further conversion to a *proton*. Although this is an 'over-simplification', something else clearly happens to the neutron - and this is where there occurs what in this model, can now be referred to as the teddy's ***Stage 2*** reconfiguration.

This must logically follow the first - for two very good reasons. First of all, the whole surviving teddies have *pinged* into what will become our version of the universe as *individuals* and not as part of the 8D lattice of which they were originally an integral part and this new environment in which the teddy finds itself, (i.e. the four-dimensional universe), will no longer be providing a supportive structure. This will not only help instigate the *Stage 1* reconfiguration already described above – but will also cause a form of ***degassing*** of boundary chord material *within* what have now become *circular* chord areas.

This will result in the condensation of a proportional amount of 3D boundary chord material that will be characterised by a lower dimensional energy signature, not unlike the 2D membrane material already discussed in earlier pages. This *de-gassing* will occur in a similar manner to that described in the *Stage 1* reconfiguration that occurred at the *tri-lateral separation points* (*TLSPs*), although the 2D membrane components produced in this instance, will be proportional to the overall boundary chord mass of each type of circular chord.

The original hexagonal and square faces of the whole surviving teddy originally shared (straight) boundary chords with neighbouring or adjacent faces but, each type of face (whether hexagonal or square) could be said to comprise the same *boundary chord values*. This would result in a value of 'six' for the hexagonal face and 'four' for the square face and these same values will need to be carried over to the newly configured (round) *Stage 1* teddy.

As a result of the teddy's new geometry, the circular 'H' chord's *membrane component* will now be comprised of 2D condensate that originates from *SIX* areas of influence (*H1 – H6*), whilst the smaller 'S' chord will gain its membrane component from just *FOUR* areas of influence (*S1-S4*) and this is illustrated in *Figure 3.0.6* below.

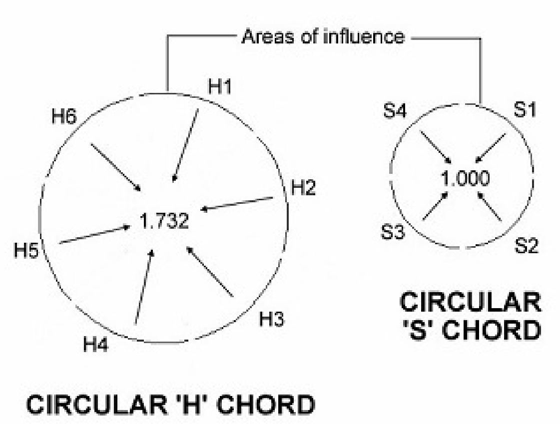

Figure 3.0.6 *Two-dimensional membrane component 'areas of influence' for the circular 'H' and 'S' chords (and their relative overall areas)*

The membrane *area* of the 'H' chord will be 1.732x greater than that of the smaller 'S' chord and because we define a two-dimensional area as the result of two *single*-dimensional components (in other words, length times breadth) 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.. By definition then, these values will be *single* dimensional in nature and each of these components will be proportional to the new split boundary chord mass, relative to that particular *area of influence*.

These relative areas are derived from the original area rule of the 8D lattice's *tri-planar coordinates*, which saw a figure of *0.433* and *0.250* for the hexagonal and square component respectively and this provides the ratio of 1.000 to 1.732 shown in *Figure 3.0.6*.

As these *areas of influence* actually produce single-dimensional component values, they will require a 'one-dimensional' conversion factor and from our use of the simple cube in previous pages, this will necessitate the division of such resultant values by 10^3 and thus:

the 'H' chord 2D membrane component at each *POC* will equate to:

$$\frac{2.325 \times 10^{-29}\,kg}{10^3} = \mathbf{2.325 \times 10^{-32}\ kg}$$

and similarly, the 'S' chord's 2D component will be:

$$\frac{2.325 \times 10^{-29}\,kg}{10^{3}} = \mathbf{2.325 \times 10^{-32}\,kg}$$

As the circular 'H' chord's 2D membrane component is the product of *SIX* areas of influence in total, this will give an overall (3D) mass equivalent of $6 \times 2.325 \times 10^{-32}\,kg$ or:

$$1.395 \times 10^{-31}\,kg \text{ per 'H' chord.}$$

The circular 'S' chord's 2D membrane component (from *FOUR* areas of influence in total) will be $4 \times 2.325 \times 10^{-32}\,kg$ or:

$$9.300 \times 10^{-32}\,kg \text{ per 'S' chord,}$$

This process of *de-gassing*, will produce 'H' and 'S' chord membranes that will 'use-up' and therefore *contain* a proportional amount of the teddy's apparent mass; provided as it is, by the boundary chords themselves (measured in this model at the *POC*s). The apparent mass conversion will therefore be:

For all the 'H' faces:

$$8 \times 1.395 \times 10^{-31}\,kg = 1.116 \times 10^{-30}\,kg$$

and for all the 'S' faces:

$$6 \times 9.300 \times 10^{-32}\,kg = 5.580 \times 10^{-31}\,kg$$

Total *Stage 2* mass conversion: $\mathbf{1.674 \times 10^{-30}\,kg}$

Therefore, it can be argued that the *Stage 1* reconfigured teddy, (which has already lost mass), makes it presence felt in our world as what we recognise (mass-wise at least) as the *neutron* and furthermore:

Stage 1 teddy (neutron):	1.674×10^{-27} kg
Less *Stage 2* mass conversion:	1.674×10^{-30} kg
New teddy mass:	$\mathbf{1.672 \times 10^{-27}\,kg}$

As the de-gassing continues and produces these 2D membrane components within each of the circular chord areas, the *face-spin bias* (which will still have been in a certain amount of spin-conflict at what were previously the square faces of the original whole surviving teddy *prior* to this reconfiguration), will be transferred to these membrane surfaces and this will cause them to rotate. This will not only solve what has been an inherent *spin-conflict* within the structure of the teddy, but will also create its own reaction at these rotating membranes. This conversion of *face-spin bias* into a rotational phenomenon, will not only produce what will be measurable *spin* within the new 2D membranes, but will also provide a very real component of ***charge*** too.

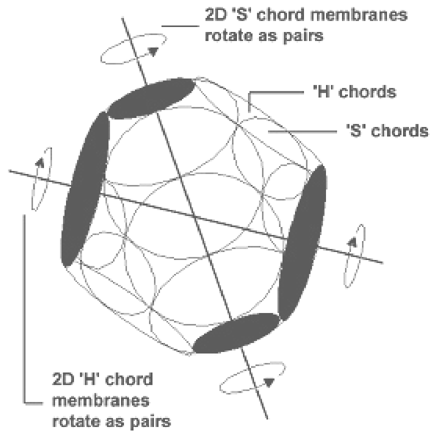

Figure 3.0.7 *Two-dimensional membranes rotate as pairs within their chord structure and each type will contribute a specific characteristic to the teddy's charge. (Only one of each pair shown for clarity).*

4.0 The Component Of Charge

The surface of the teddy has a geometry that will allow it to exist after its *Stage 2* reconfiguration with circular 'H' and 'S' chord 2D membrane components and because of the original *face-spin bias* was centered on the hexagonal faces (now the 'larger' of its circular faces); these will rotate as complimentary pairs.

This will produce 4 x 2 'H' charge components and 3 x 2 'S' charge components (see *Figure 3.0.7* above). The teddy's charge will be based on its ***spin ratios*** and these can in turn be calculated from the total areas of the 'H' faces against those of its 'S' faces (now both comprised of circular boundary chords). Each of the 'H' faces will have an area of circa $2.356 \times 10^{-28}\,cm^2$ so therefore the total 'H' face area becomes:

$$8 \times 2.356 \times 10^{-28}\,cm^2 = \mathbf{1.884 \times 10^{-27}\,cm^2}$$

and likewise, each of the 'S' faces has an area that equates to circa $7.854 \times 10^{-29}\ cm^2$, so overall:

$$6 \times 7.854 \times 10^{-29}\ cm^2 = \mathbf{4.712 \times 10^{-28}\ cm^2}$$

The *spin ratio* will therefore be:

$$\frac{4.712 \times 10^{-28}\ cm^2}{1.884 \times 10^{-27}\ cm^2} = \mathbf{0.25}$$

The total 'H' face area is obviously the larger of the two and this will be allotted the ***positive*** component of charge usually associated with the proton. Charge-wise, this relates to $+1.333$ or $+^4/_3$, which by convention is usually assigned to that produced by the proton's two 'up' quarks, but with *FOUR* 'H' face pairs each can be allowed to produce a charge of $+^1/_3$ and the total 'H' face charge in this model will correspond to that previously contributed by these two ghostly 'up' components. Using the *spin ratio* of *0.25*, this allows the 'S' face pairs an overall counter charge of:

$$1.333\ (\text{or } ^4/_3)\ (\uparrow\uparrow) \times 0.25 = \mathbf{0.333}\ (\text{or } ^1/_3)\ (\downarrow)$$

This 'counter' charge is usually defined as *negative* (provided by a single 'down' quark), but this is more readily achievable within this model due to the rotation of what can now be described as the teddy's integral ***rotational groups***. The easiest way of illustrating this phenomenon of rotation in the first instance, may perhaps best be achieved by looking at what is basically the 2D membrane's ***moment of inertia*** (*I*). The apparent 3D *mass equivalence* of the 'H' face membrane can be calculated from the resultant *Stage 1* boundary chord mass (M^{bc}), where the 'H' face chord mass 2D equivalence:

$$6 \times \frac{M^{bc}}{10^3} \quad \text{or}$$

$$6 \times \frac{2.325 \times 10^{-29}\ kg}{10^3}$$

$$= \mathbf{1.395 \times 10^{-31}\ kg}$$

where '10^{3}' is the appropriate '1D' conversion factor – which will be the same for both types of faces. The above value becomes the 'H' face 2D membrane's ***3D mass equivalence***. As these membranes can in this example, be considered simply as rotating disks contained within the circular boundary of its parent 'H' face, their *moment of inertia* can be gleaned from the conventional expression:

$$I = \tfrac{1}{2}Mr^2$$

where the radius of the face in this instance, has already been calculated at $8.660 \times 10^{-15}\ cm$. Thus, the *moment of inertia* of each 'H' face 2D membrane becomes:

$$\frac{1.395 \times 10^{-31}\ kg}{2} \times (8.66 \times 10^{-17}\ m)^2$$

$$\text{Therefore, } \mathbf{I^H = 5.23 \times 10^{-64}\ kg\ m^2}$$

Similarly, the *moment of inertia* of the teddy's 'S' faces can also be calculated through similar methods, because the resultant masses of the 'S' face membranes are also known within this model. Therefore, the total 3D *mass equivalence* of these particular 'S' face 2D membranes will have a value that equates to circa $9.300 \times 10^{-32}\ kg$ together with a corresponding radius of $5.000 \times 10^{-15}\ cms$ (remembering that these are the smaller of the two types of membrane).

In this instance, the 'S' face membrane *moment of inertia* will in turn be equivalent to:

$$\frac{9.30 \times 10^{-32}\ kg}{2} \times (5.00 \times 10^{-17}\ m)^2$$

$$\text{and so for the 'S' face: } \mathbf{I^S = 1.16 \times 10^{-64}\ kg\ m^2}$$

As it is 'rotational symmetry' that gives rise to angular momentum and its conservation - it is the transfer of *face-spin bias* to the teddy's 2D membranes that results in an angular momentum about the membrane's center of mass. This is all very well with a simple 'single' spin axis , but in this case - the angular momentum of a 'massive' particle like the teddy, will actually comprise four 'H' pair and three 'S' pair components. This means that the teddy (in reality) contains a total of seven *rotational groups* and each of these groups will occupy a specific axis location or ***axis coordinate***, which will be the same as the teddy's constant motion axes – (defined in *Tregellen*[1]). Each *rotational group* therefore comprises two, 2D membranes with complimentary-rotating components, which produce a paired system with a combined angular momentum. These may (but certainly not yet) be equivalent or comparable to the *Lie Algebra* of rotational groups such as O(3) or SO(3) – but this work has a long way to go before such comparisons can be properly made. The resemblance of these 'paired' rotational components to *Pauli matrices* is also a possibility and this too will be explored at a somewhat later date.

Before the effects of this angular momentum can be discussed more fully, the rotational characteristics of these 2D membranes need to be examined in a little more detail. It is also possible that this rotational aspect of the teddy can be described as a *wave function* and the value of these components could be referred to as *spinors* or ***spinorial objects***[7] and as such, the original *face-spin bias* of any particular 'H' face, must allow itself the ability of being described in terms of *multiples* of – or indeed *divisibles* of, a full 360° or $\boldsymbol{2\pi}$ rotation. In other words, and for this purpose, it would be handy if these 2D membranes could be provided with a value that corresponds to their ***angular velocity of rotation*** (ω).

At this moment in time, such a value for the original *face-spin bias* component would be pure conjecture *but* - this is not important for an understanding of just how this concept of charge may work within the body of the proton (or *Stage 2* reconfigured teddy). What is important is the relationship that can be afforded these 'H' and 'S' face membranes in terms of the *production* of elemental charge. In this respect, this 'H' face membrane's *angular velocity of rotation* (ω) can be given any value one wishes for the time being - as long at it can also be shown that the corresponding 'S' face membrane's own *angular velocity of rotation* bears a direct and calculable relationship to it.

Therefore, for this exercise – and considering the character of the 'H' face to begin with – the *angular velocity of rotation* (ω) of 'one-sixth' an 'H' face circumference (one boundary chord), can be given the basic value of ***1.047 rad.*** $\boldsymbol{s^{-1}}$ (based on an overall 'H' face rotation of 2π or *6.283* rad. s^{-1} divided by six); which will have the advantage of providing the simplest of approaches to this question of comparison. This will also allow the ***angular momentum*** (L) to be calculated for each of these 'H' face 2D membranes; where:

$$\text{angular momentum } (L) \;=\; I\,\omega.$$

With a *moment of inertia* (I^H) already given on *page 17* as ***5.23 x 10***$^{-64}$ ***kg m***^{2} and an *angular velocity* (ω) of just ***1.047 rad.*** $\boldsymbol{s^{-1}}$**,** the *angular momentum* (L) of each 'H' face 2D membrane becomes:

$$5.23 \times 10^{-64}\ kg\ m^2 \ \times\ 1.047\ rad.\ s^{-1}$$

$$\boldsymbol{L^H \;=\; 5.47 \times 10^{-65}\ kg\ m^2\ s^{-1}}$$

As the teddy's boundary chords are split in two during *Stage 2* reconfiguration, part of the original angular momentum that was *face-spin bias* - would be transferred to the newly configured circular 'S' chords that now replace these (formerly) square faces. With its total of seven *rotational groups*, the teddy at this stage can be thought of as a tiny set of inter-locking 'cog-wheels' and the *points of convergence* (*POC's*) are the areas where these cogs mesh. Putting the *spin-conflict* to one side for the moment, the rotation of a larger 'H' face cog will directly influence the rotation of a smaller 'S' face cog and both must therefore exhibit the same ***linear speed*** at the *POC*. As *linear speed* is constant and is determined by the angular velocity multiplied by the radius, or:

$$\boldsymbol{v \;=\; \omega r}$$

then for the 'H' face, this will equate to:

$$v \;=\; 1.047\ rad.\ s^{-1} \ \times\ 8.66 \times 10^{-17}\ m.$$

So therefore, in this particular exercise:

$$\boldsymbol{v^H \;=\; 9.06 \times 10^{-18}\ m\ s^{-1}}$$

Similarly - the same can be said for the 'S' face and assuming the *same* linear speed at the *POC*, one will need to define its *angular velocity* in terms of that of the 'H' face so:

$$\frac{v}{r} \;=\; \omega, \quad \text{or} \quad \frac{9.06 \times 10^{-17}\ m\ s^{-1}}{5.00 \times 10^{-17}\ m} \;=\; 1.81\ s^{-1}$$

The *angular velocity* (ω) of the 'S' face thus becomes ***1.812 rad.*** $\boldsymbol{s^{-1}}$ as a consequence of having the same *linear speed* as that of the 'H' face (measured at the mutual *POC*) and the *angular momentum* of the 'S' face 2D membrane can now be calculated in a similar way - and this in turn will equate to:

$I\omega$, or $1.16 \times 10^{-64}\ kg\ m^2 \times 1.81\ rad.\ s^{-1}$

and therefore:

$$\boldsymbol{L^S = 2.10 \times 10^{-65}\ kg\ m^2\ s^{-1}}$$

The apparent difference in rotational speed between the 'H' face membrane and the 'S' face membrane at the *POC* can now be compared thus:

$'H' = 1.047\ rad.\ s^{-1} \times 6 = \boldsymbol{2\pi}$ and,

$'S' = 1.81\ rad.\ s^{-1} \times 6 = 1.74 \times 2\pi = \boldsymbol{3.48\pi}$

This will also give an estimated figure for the total original angular momentum of the teddy that would have been carried over from the *big-snap* as *face-spin bias* (bearing in mind that this value is solely based on our 'guesstimate' of the angular velocity of rotation) and within this particular exercise, this will amount to:

total 'H' face (L^H) $= 5.47 \times 10^{-65}\ kg\ m^2\ s^{-1} \times 8$,

plus

total 'S' face (L^S) $= 2.10 \times 10^{-65}\ kg\ m^2\ s^{-1} \times 6$

and this gives an original (hypothetical) angular momentum of:

$$\boldsymbol{L^O = 5.63 \times 10^{-64}\ kg\ m^2\ s^{-1}}$$

based on the assumption of an original *angular velocity of rotation* for the 'H' face membrane of a 2π rotation or *6.283* rad. s^{-1}.

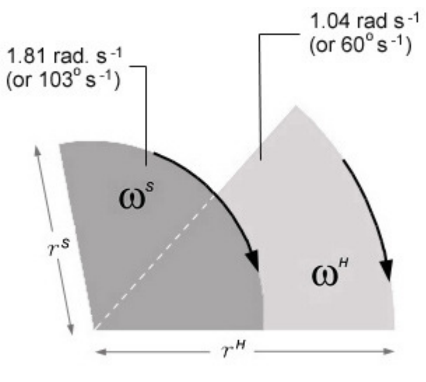

Figure 4.0.1 *A graphic comparison between the angular velocity of the 'S' face and 'H' face 2D membranes during the same unit of time.*

The difference between the two *angular velocities of rotation* (ω) of the 'H' and 'S' face membranes, can be used to provide a visual representation of these characteristics and this has been included as *Figure 2.01* above.

A direct comparison of the two linear speeds will show that any particular point on the circumference of the 'S' face membrane, will cover 1.74 times the distance of a comparable point on the circumference of the 'H' face membrane in the same unit of time, because:

$$\frac{\boldsymbol{\omega^S}}{\boldsymbol{\omega^H}} = \frac{1.81\ radians\ s^{-1}}{1.04\ radians\ s^{-1}} = \boldsymbol{1.74}$$

This ratio will not change, regardless of the value applied to one or other of the membranes and this also helps when considering the possibility that these membranes may act like *spinorial objects*. The intriguing thing about these abstract entities is of course, their ability to change their sign from positive to negative when they undergo a complete rotation (through 2π). There may also be a vague theoretical connection between *spinors* - and this model's 2D membranes in terms of their *quaternion axes* which in the case of this spinorial function, would seem to increase from two, to four dimensions (and not from two to *three* as one might expect). A *spinor* would also seem to require a 'real-time' attachment to some fixed object (for it to work) and in the case of these membranes, this may be provided by their origin as two-dimensional condensate from three-dimensional boundary chords. One is therefore presented then, with a two-dimensional object – rotating in four-dimensional space – but attached to a three-dimensional object (this being the membrane's parent boundary chords around its circumference).

The ***angular velocity ratio*** defined above, actually becomes perfectly suitable for describing the function of this 'H' and 'S' face difference in terms of *spinors*. If a (base) 2π rotation – such as that of the 'H' face 2D membrane – produces a positive value, a comparable measure of rotation for the 'S' face membrane (during the same period of time); will produce a *negative* value, because the speed of rotation must be 1.74 times greater. The sign change however, is only supposed to occur in (complete) multiples of 2π – but in this case, the 'S' face membrane will actually result in a comparable rotation of 2π x 1.74, which amounts to circa **3.5π** in this scenario (for a more detailed discussion, see again *Tregellen*[1]).

Returning to the question of charge itself, the surface areas of the (now) circular 'H' and 'S' faces can be provided with the (approximate) values:

$$\underset{(H)}{2.356 \times 10^{-28}\ cm^2} \quad \text{and} \quad \underset{(S)}{7.854 \times 10^{-29}\ cm^2}$$

which each relate to a radius of:

$$\underset{(H)}{8.660 \times 10^{-15}\ cm} \quad \text{and} \quad \underset{(S)}{5.000 \times 10^{-15}\ cm}$$

respectively and the physical relationship between face size, actually corresponds quite closely to the difference in rotational speed. The *area of influence* (Δ) however (from which these surface areas are derived), has been shown to have a direct bearing on the calculation of angular momentum and thus rotation. It is this action of rotation of the 2D membranes *against* the face's specific boundary chords, that would in this model – seem to produces the teddy's (or now technically the proton's) element of charge and because of the conservation of angular momentum, the faster spin of the 'S' face membranes - produce *negative* charge because of the *spinorial* implications.

The elemental charge – or the unit of charge produced by a single proton, would in this model, now seem to be provided by a total of *seven* distinct components – or seven distinct *rotational groups*. These integral groups would correspond to the 'H' face pairs (4No.) and the 'S' face pairs (3No.) mentioned earlier – and the rotation of each of these components would need to produce its own specific (*coulomb*) value thus:

$$\text{'H' pair component } (\uparrow) = +\,5.340 \times 10^{-20}\ C$$

$$\text{'S' pair component } (\downarrow) = -\ 1.780 \times 10^{-19}\ C.$$

As explored earlier, these values would seem to have a direct relationship to the *surface areas* of each of the faces (the 'H' pair component is three times greater than that for the 'S') *and* this relationship also extends to their *spin ratios*. These ratios and the 'S' and 'H' charge values indicated above, are all proportional to each other and there *IS* a common denominator that would seem to link the two together. This is best illustrated by dividing each of the above coulomb values by two - in order to arrive at a charge component that can be applied to *each* individual face – and this results in a *single face* coulomb value of:

$$2.670 \times 10^{-20}\ C\ (H) \quad \text{and} \quad 8.900 \times 10^{-21}\ C\ (S)$$

Each of these values can then be divided into the appropriate overall 'H' or 'S' face 2D membrane surface area (already provided above). The value for each 'H' face and 'S' face is an approximation at the moment and does not take into account any possible concavity or convexity in its structure, but does seem to be heading in the right direction. This common denominator can therefore be found thus:

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

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.

Before this apparent coincidence can be explored further, a final (possible) characteristic of the *Stage 2* reconfigured teddy should be considered. This has to do with the *shape* of the rotating 2D membranes themselves and what may be the result of both a *centripetal effect* because of rotation – and a distortion caused by the presence of an electric field in turn, produced by these moving 2D membranes against their parent boundary chords. This will be called ***membrane convexity***.

Apart from the obvious effects on shape, the *major* consequence of this would be an increase in the membrane's surface area due to this additional convexity. Considering the scale of the teddy, this would not amount to much, but may be sufficient however to change the value of the 'common denominator' described above. A change of just a very small percentage in this figure for both the (now slightly convex) 'H' and 'S' face 2D membranes will increase the apparent 'strangeness' of this coincidence.

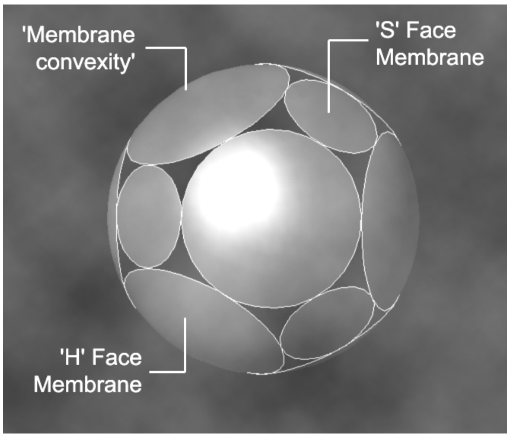

Figure 4.0.2 *Because of the centripetal effect of rotation and/or the influence of a resultant electric field, the teddy's 2D membranes may take on a characteristic very akin to convexity.*

This would almost (but not quite yet); allow this common denominator to correspond to the numerical value attributed in the 'real-world' to the ***permittivity of free space*** (ε_0) where originally 'ε' represented the ratio of electric displacement in a medium to the electric field intensity producing it. However, this is usually prescribed the value of $\boldsymbol{8.854 \times 10^{-12}\ F\ m^{-1}}$ which at the moment, is a full *THREE* orders of magnitude adrift from that of the common denominator arrived at on the previous page. Most linear measurements within this model have been given in *centimetres* and not in metres and this can adjust the above value by a magnitude of 10^2; but this would still leave a discrepancy of $\mathbf{10^1}$ because the value required for the common denominator is circa 8.854×10^{-09}. Can we assume however, 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). These rotating 2D membranes by definition, *are not* technically three-dimensional; 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 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 *Figure 3.06*); 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 it should be in our world, because of the simple cubic rule first described within *Paper 1* of this series. By the same token, three-dimensional effects, measurements (other than linear) and ratios, would be felt much more strongly by a *LESSER* 2D 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, first illustrated within *Figure 1.01*. 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:

$$\text{3D Value of '}\varepsilon_0\text{'} \quad = \quad \text{1000 units } (l \times b \times d)$$

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

$$\text{2D Value of '}\varepsilon_0\text{'} \quad = \quad \text{100 units } (l \times b)$$

and in order to balance both sides:

$$\frac{\text{1000 units (3D)}}{\mathbf{10}} \quad = \quad \text{3D Value of '}\varepsilon_0\text{'} \ \mathbf{x\ \ 10}$$

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

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

5.0 The Calculation Of Charge

This conversion will now give a value that will allow the completion of the charge expression for the 'boundary chord' proton, which in terms of the individual component face membranes, now becomes:

$$Q\,\varepsilon_0 \ = \ A$$

where Q represents the charge (Coulomb); ε_0 the (corrected) permittivity of free space value; and A the 2D membrane area - and this becomes:

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

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 debatable.

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-} the corresponding *negative* overall 'S' face Coulomb value. By using the original surface areas and ignoring for the moment the still debatable *membrane convexity*; we can calculate the resultant proton charge thus:

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

for the total 'H' face Coulomb value and,

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

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

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

where Q^{N+} represents here, the Coulomb value attributed to the proton *without* the component of *membrane convexity* taken into consideration.

6.0 Discussion

This (very) important concept of charge is dealt with in much more detail within *Tregellen*[1], but suffice to say that rotation; the transfer of angular momentum from 'H' to 'S' faces and the *spinorial* implications of differing angular velocities of rotation, play their part in the argument for *rotational group* spin and charge. The differences between proton and neutron are purely as a result of environmental conditions, brought about in the first place by the evolutionary stages experienced by the teddy itself, just after it made its first appearance in what was later to become our world.

This paper has also tried to illustrate (briefly), the possible origin of a simplistic geometry that provides both proton and neutron with a 'real-time' configuration that naturally provides a definition of (compound) 'spin' *and* an already inbuilt ability to furnish the proton with a very real component of charge.

Perhaps the main repercussion of considering this view, involves the current position of the *quark* in the scheme of things; as in this model, it become what can only be described as superfluous. This is quite obviously an extremely bold claim to make under any circumstances, but considering the geometry of what has affectionately been called the *teddy*, one can easily be drawn towards such a conclusion. There has always been a certain fascination with the quarks and they appear to be the most stubborn of individuals. They continue to defy examination and are perhaps the least responsive to probing of all the sub-atomic particles. In *'The Second Creation'* (Robert P. Crease and Charles C. Mann[8]) the authors include what is a rather poignant paragraph describing the nature of these animals and this would seem to be an appropriate quotation with which to finish this present discussion:

"One can speculate endlessly about whether there are particles that can be subdivided infinitely. Quantum chromodynamics does not pretend to answer the question. In the manner of science, however, it does provide a definite answer to what happens when you actually go out and try to do so with the basic components of our world, hadrons. Suppose you begin shooting electrons at a proton, trying to knock loose one of its constituent quarks. As the quark is kicked further away from its partners, something strange occurs; the virtual gluons whirling between the quarks begin exchanging gluons among themselves. The greater the separation, the more intricate and powerful the web of interactions. Eventually, the energy needed to separate the quarks still farther from the snarl of gluons becomes sufficiently great that a new quark-antiquark pair is created *ex nihilo* from the vacuum. The antiquark bonds to the quark separating from the proton to create a meson; the new quark meanwhile pops right back into the proton, leaving it with the same number of quarks as before."

7.0 References

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