

3

From first event to two-dimensional universe

3.1 Setting the dimensional scene

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. In order to allow this evolutionary process to take place, one will require a starting block from which to begin, but there exists here a very clear danger and this is one of *speculation*. Probably the first problem to overcome (and there will be a few), involves credibility, as any hypothesis with its foundations based on speculative ideas is on very shaky ground indeed. The solution then, must be to try and minimise this problem and to strengthen these foundations in such a way as to allow a reasonable degree of acceptable 'educated guess-work' into the equation. This can only be based on possibilities, or preferably *probabilities* - all gleaned from present day knowledge and considering what this model is setting out to achieve in the first place, this solution could involve those *branes* currently believed to exist within *M-Theory*. If one is prepared to consider these extra (or ultra) dimensional entities within the realms of possibility (or probability), then they *could* provide the starting blocks that this model is looking for.

With this in mind, we could find ourselves in the position of being able to accept the possibility of a dynamic, higher dimensional environment, where processes and interactions between, or within these entities occur on a regular basis. Their physics, origin and nature need not concern us here, merely the fact that for the purposes of this exercise, their existence is regarded as a feasible possibility. This could strengthen slightly, this model's shaky foundations and hopefully allow us to continue with a little more confidence.

What do we need from this environment? In order for this model to work, we will require multiple dimensions and to be more specific, we require

slightly more than eight. Why eight? Well, it will be argued that the evolution of this model progresses in dimensional stages that include the eighth dimension, although this will not be just a straightforward progression from A to B, B to C, and C to D etcetera.

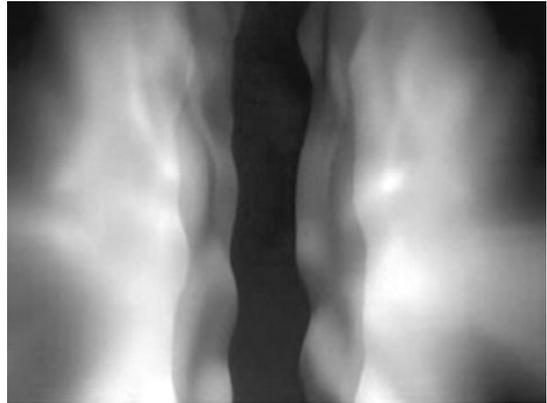


Figure 3.1.01 Ultra-dimensional branes?

At this stage, it would be helpful (if not rather necessary) to be able to keep track of what will be a purely abstract, dimensional picture (that will also include a series of built-up similarly abstract components) and perhaps the best way of achieving this in the short-term at least, will be to make use of the existing notion of the *SET*¹.

As a starting point, one would need to define a universe that has not as yet, experienced any dimensional activity or event and one could logically begin this description with the concept of what can be labelled a *null-universe* scenario, which in these terms, corresponds to a *null-set* or *empty-set* - usually represented by \emptyset in current convention. This null-universe can therefore be expressed as:

$$\emptyset = \{ \}, \text{ or just } \emptyset$$

As sets have the ability to be 'built-up' in order to represent natural numbers, the *empty set* shown above, equates to '0' (zero). This is useful here,

because it has the obvious ability of being able to provide a descriptive element for that awful term *nothingness*; where logic, either correctly or incorrectly, calls for a universe that has yet to experience even a single event. This element can only be a purely abstract concept in our terms simply because it is difficult to comprehend an 'eventless' situation in the first place. If we bring into play our possibility of ultra-dimensional membranes, we could equate our '0' (zero) to these branes themselves.

However, returning to the concept of the set, as we *DO* witness a fully active and eventful universe around us (of which we are of course, an integral part), we can guess that an event *DID* occur in this hypothetical *null-universe* scenario and again, utilising the set, we can describe this as the first in a series of progressions that in this case, can be represented by the natural number '1' (one) thus:

$$\emptyset_1 = \{\emptyset\},$$

Whilst our *null-universe* can be described as \emptyset , the first event (ever) can now be described in terms of the statement \emptyset_1 shown above and in this sequence of events, will be related to the appearance - or indeed the evolution of what we can logically visualise as a single-dimensional universe. We are therefore presented with the superimposition of \emptyset over $\{ \}$, which allows us to describe the evolution (or at least the appearance) of a single-dimensional event in what are patently very simplistic terms. What though, would be meant or inferred by a *single-dimensional event*?

This is again entering an unsafe realm of speculative logic and we need to continue to tread carefully. It was pondered over earlier however, that time itself, could be considered as (originally) being single-dimensional in nature, as it seems to have all the right attributes. It has direction and it can be used to measure distance and it will be argued here that as a *single-dimensional* component, time could be seen to be very useful in the further evolution of this particular model. This would not however, be a definition of time that we would necessarily recognize. As a purely abstract exercise, let's look at a *null-dimensional*

universe for a moment.

Such an animal *DOESN'T* obviously exist within such a setting, but the very act of 'looking for it', suddenly seems to bring it into being. It's that old adage about the observer's influence on his surroundings again. We have already changed this hypothetical null universe scenario, by forcing a dimension of time upon it, for in the space of reading this last sentence; this apparent nothingness can now be described as $(\emptyset + t)$ where 't' is the time that has elapsed since we began looking for it in the first place. This is no longer a *null-universe*, but a simple, evolved version, that comprises only time.

We have however, already played with another abstract concept and this was defined as *dimensional energy*. This will be no different to any other form of energy that we recognise as such and could perhaps, be better defined as the heading under which *all* energy should really be categorised. All energy also involves a wave motion of one kind or another - and this may be a clue as to how a hypothetical universe may originally come into being. Whatever the true definition of this *first-dimensional level*, it seems logical to assume that such an event would most likely involve a transfer or exchange of energy, but *how* would this transfer manifest itself within a null-universe setting?

It is perhaps our heritage that we observe modern day phenomena the way we do, simple because that's how physics has evolved in the first place. Energy carried on wave motion, manifests itself throughout our everyday lives from the sounds of the bustling crowds around us, to the images that reach our eyes and the often violent movement of the earth at our feet. A more detailed examination of the 'waves' will be attempted in a later chapter, but for the time being, we need to explore the possibility of how the propagation of a single-dimensional environment may be used as the origin or starting point of a whole series of evolutionary stages that will result in the formation of the universe we witness today. It must also provide the means for the evolution of the *dimensional boundary chords* that are central

to this particular perspective. We should turn our attention to what the *M-Theory* membranes can offer us and we need to adopt a *many-worlds* philosophy that can provide us with a logically acceptable *first event*.

What are membranes? Well, they could be defined as boundaries in their own right, as a cell membrane for example separates the cell body from the outside world while allowing usually a two-way flow of filtered material through its structure. Filters themselves could also be defined as membranes too. Ultra-dimensional branes or membranes are more commonly visualised as curtain-like structures that flutter in the wind and where contact between folds or separate entities cause reactions of some form or another (refer again to *Figure 3.1.01* as an example). What about their structure; is there a three-dimensional analogy we could use to illustrate some possibilities

We are pretty certain that our universe appears less than homogeneous and thanks to COBE and WMAP, we see irregularities within the cosmic background radiation that seems to suggest imperfection. Using this as the canvas on which to paint our picture of what we might imagine this possible 3D analogy to be; we can make use of this concept of inequality in our own universe and transpose these irregular regions to our ultra-dimensional brane model and let them represent ‘null-universe’ values. We are therefore, slowly building a three-dimensional picture of a ‘many-worlds’ environment that will contain pockets, spaces or gaps in its fabric that we can consider as areas (or indeed volumes) of lower or null-dimensional energies. We will call these irregularities *inequalities*. Perhaps the best earthly-bound example of such a fabric (and one that exhibits the kind of structure we are looking for), is a *foam*.

Our central theme in this early evolutionary process involves *dimensional differentiation* and this hypothetical concept has many ‘natural-world’ equivalents such as fractional crystallization discussed earlier in this chapter. It can again be argued that there exists a provenance

or a connection between processes here in the present and those in the distant past, including those that were around at the dawn of our own cosmic history. We have begun to try and visualise a hypothetical, three-dimensional equivalent structure (or matrix) for our many-worlds environment, but should bear in mind that this is still a multi-dimensional entity. We have

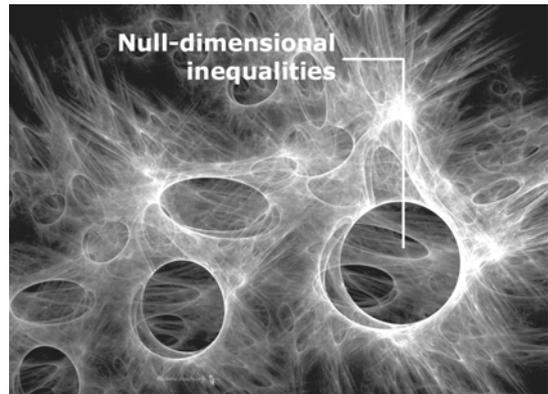


Figure 3.1.02 An ultra-dimensional brane visualised up close with a foam-like structure and areas of null-dimensional inequalities.

also been able to incorporate irregular areas or volumes into this structure and it may now be possible to hypothesise as to what may happen within an environment that contains such irregular volumes, devoid of the ‘stuff’ that makes up the majority of this surrounding fabric. A natural process called *de-gassing* may be able to help here.

3.2 Dimensional de-gassing

De-gassing is what happens when you open your bottle of pop and the contents fizz out over the top. This occurs because there is a drop in pressure and the carbon dioxide comes out of solution. In fact, it’s really just a subtle kind of fractional crystallization and there are many similar examples around us. Let us consider our multi-dimensional matrix, complete with its own foamy version of irregular, null-dimensional value inequalities. These can be regarded as low

or zero pressure volumes (or pores) and the trick will be to imagine what happens around the matrix surface area that surrounds them. In your bottle of pop, the CO₂ has a much lower density than the liquid in which it is suspended, but under pressure, this is contained in solution. Our multi-dimensional matrix can be thought of in a similar way and the de-pressurised area that is a null-dimensional pore, may sometimes induce a *de-gassing event* at the boundary of pore space and matrix. We are however talking dimensions here and not liquids and gasses, but as we have already introduced the concept of dimensional energy, it is not difficult to imagine a de-gassing event that involves the release of lesser dimensional energy from a conglomeration of multi-dimensional energy (equivalent in this respect to the CO₂ degassing from the pop). This matrix is a *complex surface*.

Similarly, *diagenesis* is the process of changing one mineral for another, usually under pressure and this affects sedimentary rocks deep under ground and in the deeper parts of the oceans and seas. It is associated with precipitation (not the atmospheric kind though), but again minerals can be brought out of suspension and accumulate in pore spaces and voids once taken up by softer minerals such as the calcareous remains of animal life (fossils are actually a good example of diagenesis). This is allied to such processes as replacement and maturation, but we won't dwell on this here. Under other conditions, crystalline forms that are predominantly of quartz derivatives can grow within voids as replacements and some of these are referred to as *lepispheres* (see *Figure 3.2.01* opposite).

The formation of *lepispheres* is somewhat complex and depends on solubility differences and chemical composition and their sphericity that is evident in the figure, is attributed to the replacement of the tiny skeletal remains of animals called *radiolarians*. Their stringy structure is just down to the way that these crystals grow and accumulate, but the point that is being made here is that these processes of diagenesis and de-gassing occur *everywhere* in nature and have been for many millions of years.

With these examples in mind, it becomes even easier to allow a hypothetical de-gassing event to occur within our foamy, higher-dimensional environment, where simple, but fundamental differences between matrix and pore space densities (differences in dimensional energy values), may be all that is required to induce our much-needed *first event*.

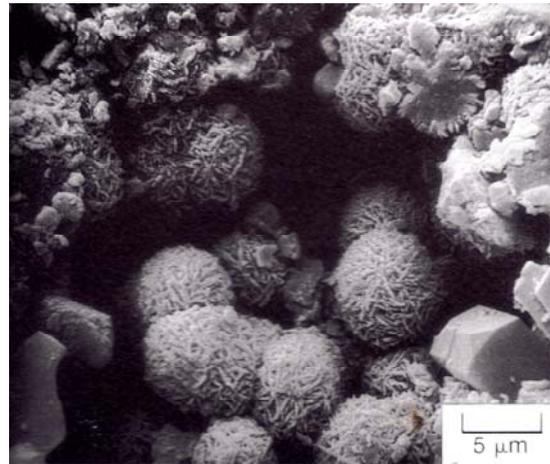


Figure 3.2.01 *Lepispheres of opal-CT growing in voids within silicified Eocene chalk from some 630m below the Arabian seafloor⁴.*

We are now presented with a possibility that may allow an event to occur within our ultra-dimensional brane that will have a profound effect on the future inhabitants of any universe in our many-worlds scenario. One should continue to bear in mind however, that this is still hypothetical, but we have nonetheless provided a starting point from which to commence our evolutionary journey, coupled to processes that could very easily play their part. In what could be considered to be a *multi* or *higher* dimensional environment, *dimensional de-gassing* can be expected to involve less dense components or in this scenario, components that can be expected to comprise lower – or less dimensional energy. Logically speaking, our lowest form of dimensional energy was given the value of 10¹ in Section 2.3 above and this related to single-dimensional energy. We could therefore, fairly

expect any form of dimensional de-gassing to at least comprise this particular component and this has been illustrated in three-dimensional form within *Figure 3.2.02* below.

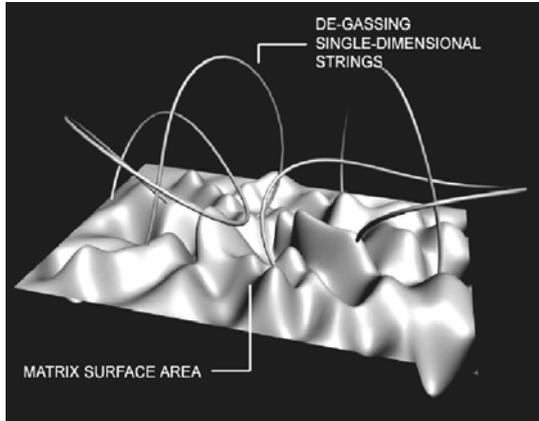


Figure 3.2.02 The matrix surface area in contact with 'null-universe' value pores will tend to de-gas its lowest dimensional components into the void.

Continued de-gassing will fill the matrix inequality or 'null-universe' void with more and more single-dimensional material as this propagates over time. Whether or not this

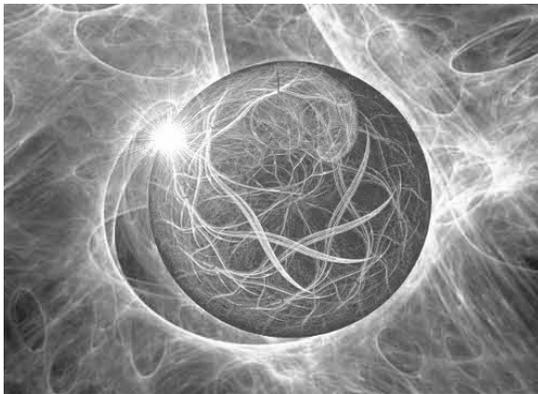


Figure 3.2.03 As more and more dimensional de-gassing occurs; the null-universe value inequality will fill with more and more single-dimensional strings.

material remains attached to the originating dimensional fabric its host matrix is of course,

debateable, but one can imagine a time when the inequality will be close to its limit of these de-gassed, dimensionally differentiated components and, as they each comprise just a single dimensional thread, it would be difficult *NOT* to call them *strings*.

There are no obvious reasons why these pore spaces or inequalities need to be anything like spherical and may instead be more akin to a network of connected tubes or pipes. For simplicities sake however, we will assume that *our* universe just happened to evolve spherically and this continuing conglomeration of de-gassing, single-dimensional (differentiated) material, eventually resulted in this void being completely and tightly filled. Its sphericity would thus give us a mental picture somewhat resembling a tangled ball of string – or indeed one of those balls of rubber bands that my son would build over the summer holidays after they were discarded by the postman during his daily rounds (see *Figure 3.2.04* below).

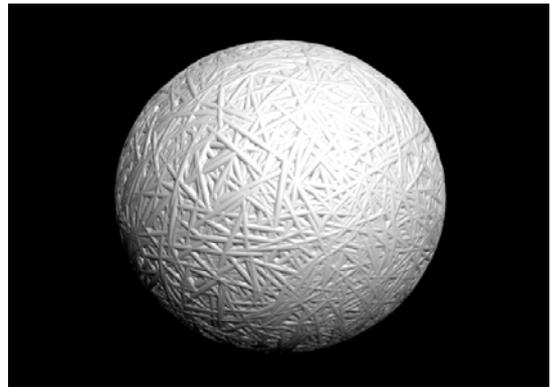


Figure 3.2.04 The result of de-gassing of matrix material that surrounds and enclosed what would become our 'null-universe' void, will paint a mental picture of a structure that resembles the proverbial 'ball of string'.

The matrix that surrounds this now differentiated single dimensional 'ball of string' has been given a multi or *trans*-dimensional characteristic and thus our *single*-dimensional jumble of strings would consider themselves alone in a dark,

single-dimensional universe. Before we start to look at this in a little more detail, it may be helpful to explore a little further, what was meant earlier by the *concept of time* in Chapter 2. These early events that have evolved into what is now a multiple single-dimensional setting, may not have included the kind of timeline that we are more accustomed to experiencing and in this context, time itself should be considered as having all the properties of a single-dimensional string.

3.3 The string of time

Referring to *Figure 3.2.04*, our timeline would consist of a series of independent (de-gassed) single-dimensional vectors, each with its own continuous or imposed direction; which in our terms, may not necessarily have been the same as we experience today. We can picture the start of any particular timeline as consisting of what can be called an *entry point* and this would coincide with the start of that particular de-gassing event. One should bear in mind that this is dimensional differentiation at work and as far as any hypothetical single dimensional observer was concerned; there would appear to be nothing whatsoever behind this entry point because this is the start of that particular string's single-dimensional existence.

Those very human definitions we call past, present and future may have actually been intertwined or connected along the entire length of this particular vector (see *Figure 3.3.01* opposite). As a single-dimensional entity, this timeline would show neither width nor depth, or indeed any relative position in space (there is no space whatsoever at this stage), but just a single connective time span from the moment of its origin (entry point) to any particular moment thereafter. Being straight, or curved, or even spiral would not have been part of the equation, as this assumes a higher dimensional value that is able to make the distinction between them. Our universe (forgetting now the trans-dimensional matrix that surrounds it) would comprise nothing more than a hypothetical, otherwise dimensionless network of uni-directional vectors, where

any single point along any particular path - in either connective direction - could be past, present or future depending on one's point of view (see again *Figure 3.3.01* below). Consider the properties of any particular single-dimensional string to be analogous with a section of recorded video tape that theoretically, one could play, rewind or fast-forward at will to any moment in that particular tape's recorded time span.

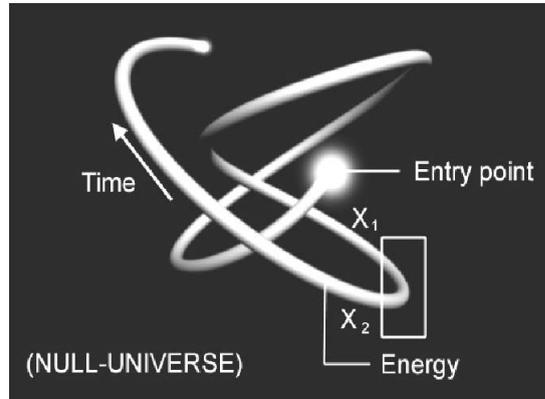


Figure 3.3.01 The connective time span of a single-dimensional vector would mean that the area enclosed by the box would be both the 'future' of point X_1 and the 'past' of point X_2 . Past, present and future would depend on your point of view.

Such a *connected* concept of time could mean that an event such as this string's dimensional differentiation may evolve either immediately, (in no time at all), or infinitely slowly. Either way, it would be meaningless in terms of our own three-dimensional experience, where this connective concept of time has disappeared or has been changed considerably by subsequent evolutionary events within this embryonic universe. So why would this now be the case? We seem to be able to ponder this single-dimensional environment, all be it in a three-dimensional way, but we need to establish what are basically a series of evolutionary stages leading right up to the present day. Something clearly happened to our ball of string and it has most definitely evolved over time, so what was the 'catalyst' that prompted further change to occur? An initial *single-dimensional* event has been chosen over a multi-

dimensional one because it is the 'lesser of the two evils', although we have of course cheated a little and invoked a multi or trans-dimensional concept with which to start these proceedings. As a *null-universe* scenario has been chosen as the backdrop to our own evolution, and looking again at the concept of the *SET*, it is easier to build our many-dimensional universe one step at a time. In addition, if one is attempting to illustrate a chain of events that propound *dimensional evolution*, it seems more logical to climb this evolutionary ladder from lesser to greater complexity and this is what will be attempted here. This is not to say that *devolutionary* episodes will not be encountered along the way and these curiosities will be illustrated in due course.

Our (assumed) original, trans-dimensional matrix need only be considered as the *source* of the energy that provided the impetus for our first event ever and can now be discarded. It will no longer play any further part in our own evolutionary processes and it should be stressed again, that this exercise has been simply a tool with which to 'set the scene' for the appearance of our own particular universe. We now need to look at what happens next.

3.4 Two-dimensionality

Single dimensionality always seems to imply a single vector, string or line and I will continue to use this as our starting block. As pondered earlier, we could endow these vectors with loose or fixed ends, depending whether or not we wish to continue considering the original (hypothetical) matrix as part of the equation, but this is not really important or necessary. These vectors though, would have propagated into a *null-universe* and because we have described them as vectors, their direction and orientation could only be random. We can still picture the (hypothetical) matrix surrounding and enclosing this null-universe in a three-dimensional kind of way and we would thus end up with a series of intersecting vectors resulting from this spherical de-gassing event (or series of events). Our ball of string *isn't* just string however; it's actually energy and thus

single-dimensional energy. Just like our three-dimensional example in *Figure 3.2.04*, string would be touching string – or more correctly, *single-dimensional* string would ultimately be making contact with *single dimensional* string and this would have a profound effect on coming evolutionary events.

With our (hypothetical) single-dimensional scenario now in place, we can look towards what would need to be the next progression of the set series as we try to keep track of what is going on. This progression can be applied to the next natural number - or two. This combines the two previously defined components thus:

$$\{ \emptyset, \{\emptyset\} \},$$

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

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

An evolving two-dimensional element of the universe could thus be defined as including those of the null-universe *AND* the single-dimensional entry event. These simple terms do not provide any insight into just what could have expanded a single-dimensional event into a two-dimensional one, but in this context this *MUST* have involved a further and somewhat *subtle* evolution of \emptyset_1 . Such a progression would not be able to change the nature of the single-dimensional event itself, but the result of dimensional differentiation and de-gassing may have had a consequential effect on later evolutionary processes. These changes could themselves, *only* be single-dimensional in origin and this poses the question - how would such changes spark the formation of a two-dimensional component – and what is more to the point – what exactly are these changes? This all appears to be a matter of orientation, as the very fact that string segments are touching other string segments within our ball of string, with the introduction of what are termed *loop dependent traces*, or '*loop variables*' we are actually presented with a pretty good method of evolving two-dimensional being from this single-dimensional world. The de-gassed or differentiated structure of

this original single-dimensional event could quite logically be seen to result in a *uniform spreading of weaves*⁵, as the necessary loops and knots in this structure (where string segment touches string segment) produce enclosed areas (the loops), bounded by the original (touching) single-dimensional string. This would allow a 'crossing of paths' and the original time-line (that determined the *length* of the string in the first place), would obviously become jumbled. The transition to a *TWO*-dimensional universe would need to involve the formation of specific *loop areas* caused by this 'intertwining' of single dimensional strings and would appear almost spaghetti-like in our terms (see *Figure 3.4.01* below).

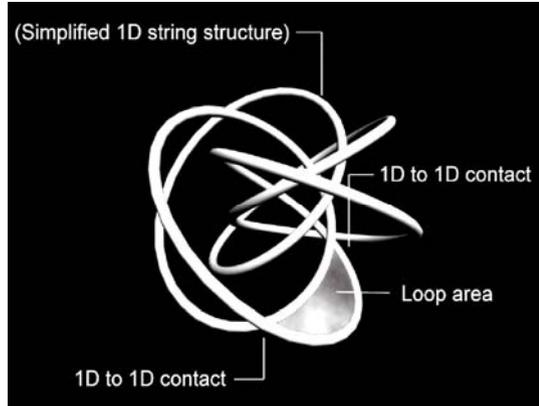


Figure 3.4.01 As the single-dimensional string propagates, it will cross under and over its previous self or others, creating loop areas that herald the next stage in its evolution.

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 two dimensional values within these areas; or *membrane values*; each of which, would need to possess a similar value right across the board. While this could actually take the form of a familiar *delta-function* this area measure (for example where $\mathcal{O}_2(\text{value}) = d\Delta$); it may not be necessary because of the resultant structure of this single-dimensional world anyway. 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 also provide both a definitive value and a two-part component to each particular resultant loop area (see *Figure 3.4.02* below). This value is already well established in mathematics, but

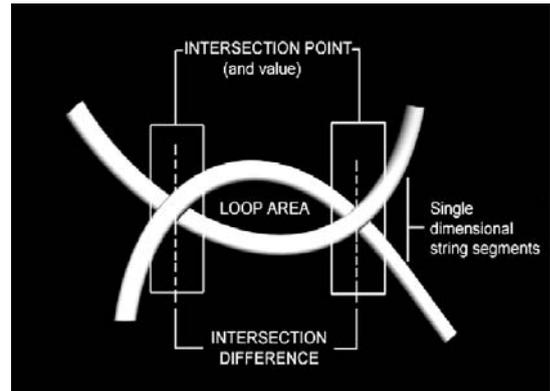


Figure 3.4.02 The anatomy of the loop area and its formation.

includes constants such as G and \hbar , which at this (very early) stage in this model's evolution, would not be expected to perform any true function as yet. Gravity especially, will not play any part in this evolution, but will be found to come into its own at a much later date. Therefore, although the loop itself can be thought of as constructing a true, two-dimensional area within the bounds of what effectively becomes a single-dimensional circumference, it is in reality, actually comprised of *TWO* independent intersecting components, each of which provides *part* of a two-dimensional value to the overall area. At this stage, these intersection points (or cross-over points) are separated by what can be termed an *intersection difference*.

Contact between the single-dimensional string components at each of the intersection points would by default, create the desired two-dimensional membrane value (i.e. 1D + 1D) and these would need to use energy (or in this context, dimensional energy) and would thus require an energy *input* that would need to come from

somewhere. Those loop segments *between* the intersection points that bind the loop area together, will tend to lose energy and therefore 'shrink' in what is effectively their single dimension of length (or indeed 'time'). This will also shorten the *intersection difference*, bringing the two otherwise independent 2D membrane values closer and closer together see *Figure 3.4.03* below).

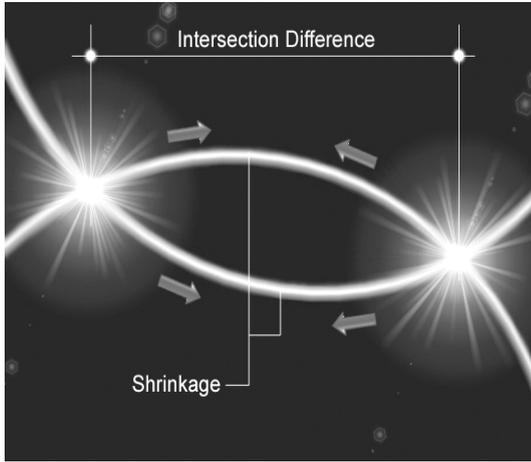


Figure 3.4.03 *The intersection points require energy and this can only come from the single-dimensional strings from which they are made. As a consequence, these strings will shrink in length between the intersection difference (shown by the arrows).*

Referring back to our proverbial ball of string, we have evolved from a single isolated 'first event' to a conglomeration of subsequent events that cross-over and intertwine. At this stage, *ALL* two-dimensional membrane values are now composed of what are effectively similar dimensional

values, so their *intersection points* will all be of similar values too. They have however, evolved into two-dimensional entities and will need to be defined as such. Therefore, we can again look at our definition of dimensional energy in Chapter 2 where, with the assistance of the humble cube (see again *Figure 2.3.01*), we can apply a dimensional energy value of 10^2 to these intersection points - fed as it were, by the resultant contraction of their *intersection difference* as single-dimensional energy is translated into two-dimensional **membrane energy** (which by the way, should also satisfy the conservation laws) while at the same time providing a mechanism for what will be the next stage in this dimensional evolution of the early universe.

Thus far, we have been keeping track of our progress by labelling this series of events after the sequencing of the 'set', but things start to change slightly - because within this scenario, we will soon arrive at a *doubling-up* of the \emptyset_2 value, in order to provide the necessary energy that will describe what will be the next step in this model's evolution. This step will thus need to be described as:

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

where \emptyset_4 will represent what in our terms will be equivalent to a 'fourth-dimensional' state, which will perhaps be the most important as far as we are concerned. This takes us into the realm of 'expansion' and it will be argued that this too, is an inevitable progression from a two-dimensional (membrane) stage. This is dealt with in detail within the next chapter of this submission.