13 The appearance of hydrogen

13.1 Overview

Hydrogen is arguably the most important of the elements and still the most mysterious, for it has always been a bit of an oddity. It has been placed at the top of Group I in the Periodic Table, but there has been considerable argument over the years as to whether or not it actually belongs there. Its similarity to the elements in this group are based solely on the fact that it has a single electron in its (only) outer shell, but in some ways, it also resembles Group VII elements as well - as it can gain an electron by combining with the alkali metals to form ionic hydrides. It doesn't stop here either, as it has also been argued that hydrogen belongs in Group IV because it has a half filled shell like carbon and the other elements in that group. Hydrogen is the only naturally occurring element that does not include neutrons in its basic form and perhaps this tells us something. In this chapter of *The Dimensional Boundary Chord Model Of The Nucleus,* it will be argued that hydrogen's uniqueness within the Periodic Table, points to an origin that is somewhat removed from that of all the other elements. It will also try to illustrate that hydrogen was actually formed in a fundamentally different way to all the others and how it is thus a remnant from an earlier evolutionary stage within a young, relatively hot, embryonic universe.

Hydrogen would seem to be the most abundant substance in the universe but here on earth, it is not really that common at all, existing only as a component part of the thin blanket of water that covers something like 70% of the earth's surface and making up only a small percentage (some 0.127% by weight) of the lithosphere[1]. It also occurs in small amounts within the hydrocarbons and other organic materials - and it is just present in the air around us (5×10^{-05} percent by volume at near mean sea level), although it does become more common at higher altitude, where its abundance rises to about 1% near the upper limits of our gaseous atmospheric envelope. The hydrogen atoms found at these very high altitudes may in part be the result of the solar wind, as well as atoms that have risen from nearer the surface because of their buoyancy. This hydrogen is gradually lost to space, as earth's gravity is not sufficiently strong enough to hold on to it. Hydrogen gas is present in small amounts within volcanic gases too, where it is produced by chemical reactions, although more of it appears combined as hydrogen sulphide and nascent water. There are no practical sources of 'free' hydrogen gas here on earth and in order to fulfil our own requirements, this must be 'manufactured' - usually by way of expensive conversion processes using various hydrogen compounds.

The hydrogen atom itself [2], is composed of a single negatively charged electron and a positively charged proton. The weight of a proton is 1.00758 atomic mass units (about 1.672×10^{-27} *kg*) and the electron weighs in at only about $^{1}/_{1837}{}^{th}$ as much as this (or around 9.108×10^{-31} *kg*). The proton has a diameter that is usually defined as 1.6×10^{-13} *cm*, while the diameter of the hydrogen atom itself (while in its ground state) is around 1×10^{-08} *cm*; so the ratio of the diameters is about 1.6×10^{-05}, which consequently makes the ratio of the volumes 4.1×10^{-15}. The volume occupied by the electron is but a tiny fraction of hydrogen's overall volume, while 99.95% of the atom's mass lies in the proton.

13.2 Early environment & density

The electron shell (or the *e-shell* as it is now called in this model); would seem to be a natural evolution of the proton where the processes within, resulted in the emission of dimensional boundary surface waves that would further define its fundamental character. The previous chapter in this submission set the stage for the appearance of this model's almost abstract version of the electron shell, but it would be the interaction of the proton, remnant independent boundary chords and the embryonic environment in which they all found themselves, that would govern and dictate the next episode in the growth of the universe we see around us today. Perhaps the most important of these unfolding events, would be the eventual appearance of what could be described as the ancestor of the first elements proper - the familiarly abundant, but certainly still underrated atomic hydrogen. With the configuration of the proton's e-shell, kick-started as it were by the rotation of the 2D face membranes; it has almost become a system in perfect equilibrium - with the exception of just one characteristic. The emission of its two types of dimensional boundary surface waves has resulted in a 'mirror charge' that would seem to balance the in-built positive charge of the proton itself. There is *still* imbalance however and this is caused by the *energy-spike* in the fabric of the four-dimensional expansive medium (described in the previous chapter). Before the final reaction in this saga can take place - and is described in more detail - it may be advantageous to look at the environment in which these young protons would now find themselves buoyed.

At the moment of the big-ping which in this model, coincides with the appearance of three-dimensional material in what we would regard as *our* space; the four-dimensional medium in which it was contained, may have been no more than just over ten light years across (see again Chapter Seven). Assuming that the (estimated) baryon count has always been more or less the same as it appears now, this would put an awful lot of material into a comparatively tiny volume of (4D) space. This material would have inherited momentum from the big-snap and the consequential rebound of the boundary chords and its density would therefore be high; perhaps (as speculated earlier), as high as three times the density of water.

The pre-rebound, stretched size (or volume) of the tetrakaidecahedra that made up the 8D lattice, had previously been estimated to be in the region of *circa* $5.23 \times 10^{-25}\ cm^3$ (at the moment of the big-snap) - which multiplied by an estimated overall baryon count of say around 9.0×10^{80}, gives us the initial (big-ping) starting volume quoted earlier as *circa* $4.71 \times 10^{56}\ cm^3$. This equates to an embryonic universe with a radius of just over five or so light years, but one that is growing larger over time. This component of expansion would have begun as a *cellular* phenomenon, carried over from the vacuum collapse, which started off the fourth-dimension in the first place.

Density was shown to be a function of mass and volume (Chapter Eight) and this initial density at the moment of the big-ping was roughly estimated from the expression:

$$P = \frac{Nm}{V} \quad \text{then,}$$

$$\frac{(1.68 \times 10^{53}\ kg) + (1.34 \times 10^{54}\ kg)}{4.71 \times 10^{56}}$$

which provided a density of:

$$\mathbf{P = 0.003\ kg/cm^3} \quad (3.0\ gms/cm^3).$$

The inherited momentum from the big-snap would need to play a key role in the ensuing processes - which would no doubt involve an episode of very frequent particle-to-particle collisions in such an energetic, dynamic and extremely small volume of 4D space. This would also raise the temperature of this environment, which at this stage, would be somewhat difficult to judge. It should also be noted that these (estimated) results are based upon the assumption that the quoted baryon number used above and within Chapter Seven, is actually the correct one. Such an initial environment may not have been dense enough to allow for the kind of nucleosynthesis that we are accustomed to (like those processes which are believed to occur within the core of stars like our own). These current densities would be something like fifty-two times greater than that quoted above, although pressures within stellar cores are something like 10^{10} times greater than normal atmospheric pressure here on earth. This would clearly highlight a paradox as far as this argument is concerned and this question will need to be explored further.

The extent of the 8D lattice would determine the initial density at the moment of the big-ping and this is where the baryon count is important. This density result would obviously change, should the count be revised. Another way of looking at this quandary is to make comparisons with other known densities within for example, the interstellar medium.

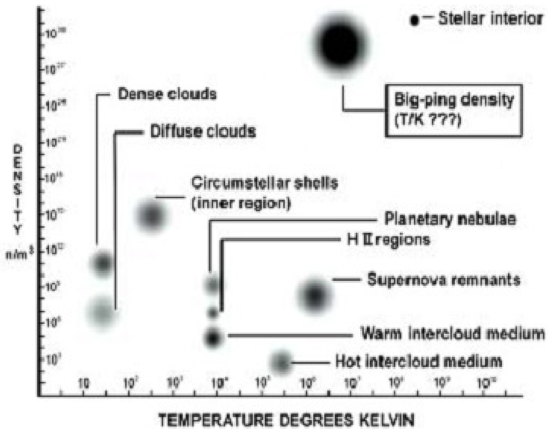

Figure 13.2.01 *A comparison of densities between that of the interstellar medium and the possible 'initial density' of the embryonic universe not long after the 'big-ping' episode.*

Figure 13.2.01 above, shows the number densities[3] (n/m^3), representing the number of hydrogen nuclei per cubic metre of space against the area's temperature (degrees Kelvin). Compared to the interstellar medium, the density of the big-ping would seem to have been many orders of magnitude greater, lying somewhere nearer the average density of a G-Type stellar core. Temperature however, would be somewhat more difficult to gauge than density at this stage, but may lie between that of the hot inter-cloud medium and that of the stellar interior. Obviously the larger the possible baryon count, the greater the initial big-ping density and thus its corresponding temperature. This does seem to infer that fusion processes as we would know them, would not necessarily seem to have taken place in such an environment, but this is again dependent on the ferocity of collision and thus temperature. The density of this embryonic universe would also be instantly *decreasing* from the moment of its appearance, suspended within the fabric of (expansional) four-dimensional space.

Were it not for the imparted momentum of the big-snap itself, the newly configured proton, complete with its e-shell, would be in a state of continual repulsion. In the previous chapter, it was argued that this evolved electron shell would gain a negative potential from the collective emission of the proton's negative dimensional boundary surface waves. This would produce a natural 'like-to-like' repulsive effect between neighbours, preventing protons from ever meeting each other. The momentum from the big-snap would overcome this however and collisions in this young, crowded environment would be commonplace. It would be these collisions, occurring all the time that would herald the next evolutionary stage of our 3D/4D universe.

13.3 Proto-hydrogen

It could be argued that conditions were just not ripe enough for even the simplest processes of nucleosynthesis to take place. This was not however, a universe we would be accustomed to. It would be full of evolving ***proto-hydrogen*** and this would form a *plasma* - but it would be a plasma with a difference. *Proto-hydrogen* could be described as fully evolved protons (after their *Stage 1* and *Stage 2* reconfiguration), now complete with their negatively charged electron shells. They would therefore, exhibit electronic neutrality within themselves and live within an environment with relatively high density (for a plasma) and a relatively high temperature. Collisions would be fleeting events when they occurred and the kinetic energy incurred as a result, would have an additive effect on this overall temperature. This universe may well have experienced an exponential rise in temperature for a short period of time after its three-dimensional birth. Instead of beginning to cool immediately, this version of the big bang would heat up. This additional heat may have brought this environment up to the threshold where nucleosynthesis proper could take place, but only for a very brief period of time.

The bonding of these early nuclei would be hampered by the energy of collision and by the repulsive effect of the protons' electron shell. There would however be help at hand, in the guise of the multi-polar 'H' face dim-wave field and the *energy-well* of the electron shell; both of which, would create an attractive influence. Under certain conditions, the energy-wells of two approaching protons could form an attraction and the alignment of north to south polar 'H' faces would do the rest. There could have been occasions where two or more protons became coupled within this super-heated plasma because of these two attractive forces, but this process would not have resembled the familiar ‘pp1’ chain reaction that occurs within the core of the sun[3]. This process will be dealt with in much more detail however, in a later chapter. More importantly for the proton (or proto-hydrogen as it has now become), would be the completion of its own evolution - its transition to atomic hydrogen proper. This would involve the almost forgotten independent boundary chords. Their role in the completion of this process would be paramount.

The natural reconfiguration of the whole surviving teddy after the big-ping, would culminate in its dim-wave produced e-shell and the consequential energy-well or 4D energy-spike as these waves disturb and influence the very fabric of expansional space (see the previous chapter). This phenomenon creates a *mass equivalence* at the 3D/4D boundary and this will have its own influence over what will happen next. In Chapter 12, this mass equivalence was sited as 9.116×10^{-31} *kg*, which coincidentally, is just slightly greater than the mass already attributed to the 'smaller' of the *Stage 2* reconfigured independent boundary chords (see again Chapter 11) and this will cause a reaction that completes the formation of the resulting proton's e-shell.

There would be a great many more of the independent boundary chords *(IBCs)* than there were whole surviving teddies (now the protons or *proto-hydrogen*) and as a consequence, these *IDBCs* would be involved in many more collisions than proto-hydrogen anyway. The effect of the proton's evolved energy-well would be to attract a similarly sized three-dimensional mass - and it will be argued in this chapter, that this will be exactly what will happen during these interactive collisions between these newly pinged three-dimensional objects (see *Figure 13.3.01* below).

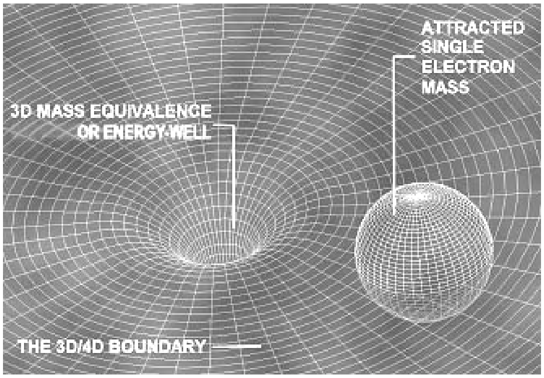

Figure 13.3.01 *The passive electron mass will fall into the energy-well that is produced by the 'e-shell'. There will however, still be a residual energy gradient or differential (see text).*

An approaching or colliding passive single electron mass (as shown in the figure), would be endowed with enough mass of its own, to be affected by an *energy gradient* or *differential* created by this energy-well. This well, is an area of *lower* three-dimensional mass potential and as we know, the universe would seem to have an in-built desire to strive towards a state of equilibrium. Just like your bathwater, where the soap, sponge or even your rubber duck will be carried towards the plug hole by the flow of water, three-dimensional matter with a mass approximating that of the *mass-equivalence*, will also be influenced by this four-dimensional *expansional* flow.

The mass of the smaller of the *Stage 2* reconfigured independent boundary chords (which is now actually the ‘passive’ single electron mass), is just slightly less than the apparent mass of the e-shell's *3D mass equivalence* (which has previously been calculated as 9.108×10^{-31} *kg*) and this is why this electron-mass capture occurs; the catalyst of which, is the *4D energy differential* of the energy spike (see again *Figure 11.08* in the previous chapter). As this occurs, the *negative* potential within this energy-well may well be transferred to this three-dimensional particle and the electron proper would thus be born (see *Figure 13.3.02* below).

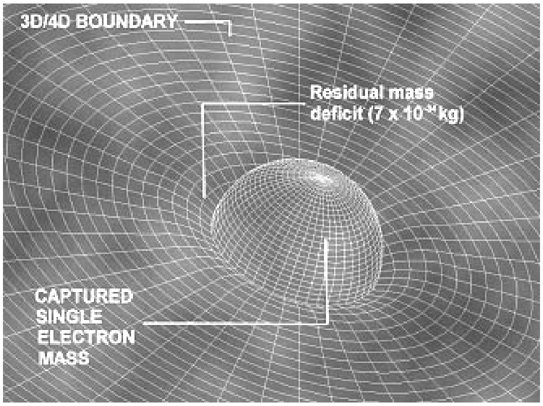

Figure 13.3.02 *The passive electron mass will fall into the energy-well produced by the 'e-shell' and potential will be transferred. There will however, still be a residual energy gradient or differential (see text).*

This captured mass (producing what is now an electron proper, because it is now responsible for its own negative charge), is not quite identical to the e-shell's 3D mass equivalence and therefore, there will still be a ***residual mass-deficit*** that amounts to the difference between the two. This equates to 7.0×10^{-34} *kg*. This *residual mass-deficit* will play what amounts to perhaps one of the most important of roles in the future evolution of the universe and this too will be explored in much greater detail in due course. It has already been mentioned (in the previous chapter), that the energy-well occurs at the 3D/4D boundary and as such, is purely abstract in our terms. This is *NOT* what we actually see.

Referring back to *Figure 12.3.02* in Chapter 12, (see again page 98), each of the proton's 'S' faces will produce an outwardly propagating dim-wave as a result of the frictional effect of its membrane against boundary chord (that produce vibration or resonance). These will take the form of expanding spherical wave fronts. The spatial separation of the proton's 'S' faces have already been established at around 10^{-14} *cm*, while the atomic radius of hydrogen (its electron radius), is many orders of magnitude greater. This factor has already been modelled (AutoCAD 2002)[4] and even at a scale amounting to only some ninety times that of the proton's radius, this difference in displacement becomes negligible. These 'S' face induced fields will actually be caged by the bi-polar effect of the 'H' face wave fronts, that one can imagine to be stretched in response to the expansive effect of the caged 'S' face monopoles within. The electron mass is captured by hydrogen's energy-well and may itself become trapped in what can be termed the ***repulsion zone*** lying between the 'S' and 'H' face wave fronts. Its motion here, at what would seem to us to be an orbital radius of *circa* 10^{-10} *cm*, can be deemed to be random in its characteristics (see *Figure 13.3.03* below).

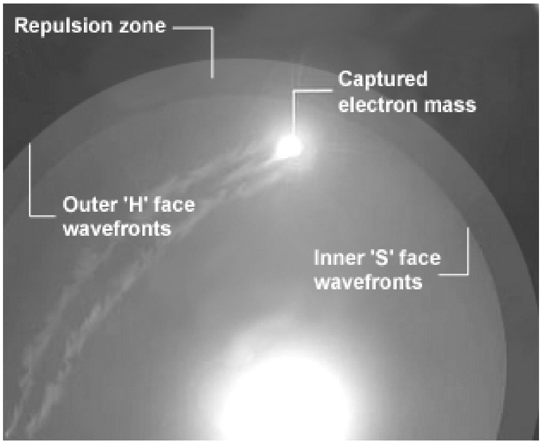

Figure 13.3.03 *The captured electron mass will behave as though it is trapped in a specific orbit around the nucleus, although it is caught within the 'energy-well' of proto-hydrogen's e-shell; between the 'H' and 'S' wave fronts in what has been termed the repulsion zone.*

This electron mass will not however, completely balance the equation, as there still exists a very small *residual mass deficit*. Theoretically, this should produce a short-range means of attraction between two (very) adjacent hydrogen atoms. This would not have anything to do with the gravitational attraction between two bodies, but it would still exist because of this very small deficit (which amounts to an equivalence of 7.0×10^{-34} *kg* at each adjacent energy-well). Two hydrogen atoms would need to be almost touching for this attractive force to take effect, but here lies a paradox. The repulsive effect of the atom's e-shell against another would be many times more powerful and collision may be the only way that such a phenomenon might have made itself felt.

13.4 Hydrogen-hydrogen bonding

This attractive feature could however, allow two colliding hydrogen atoms the possibility of bonding in their own right, especially if one has *yet* to capture its own electron mass. With an embryonic universe absolutely full of hydrogen and *proto-hydrogen* (sans electron mass), ***diatomic hydrogen*** may have been an inevitable evolutionary step forward.

This first molecule is a simple system, where two hydrogen nuclei share their electrons. Unlike atomic hydrogen, which is highly active, H_2 is pretty stable and there is little attractions between such molecules. If we imagine a scenario where two hydrogen atoms come into close contact - and where one of these systems is allowed to be without a captured electron mass; then *diatomic hydrogen* may result. Because this molecule 'shares' its electrons however, there should be a double or combined electron mass within this system and, because of its almost inert nature when in this form, it may be the *2e* electron mass that is trapped between their approaching energy-wells (see *Figure 13.4.01* in the column opposite). This curiosity of *1e* or *2e* masses will be explored further at a later date, but such bonds may be more difficult to separate than a conventional two-electron system and so aid this characteristic of inertness. It should be remembered that in this model, the hydrogen atom (now complete with its 'negative' e-shell), is already in electrical balance and the electron mass is the component that in this hydrogen-to-hydrogen scenario, is what actually promotes this bonding process. The incidence of electron capture by a single proton, would have heralded the evolution of a very special entity - namely hydrogen - and the stage would now be set - and able - for the continued evolution of the 3D universe we recognise today.

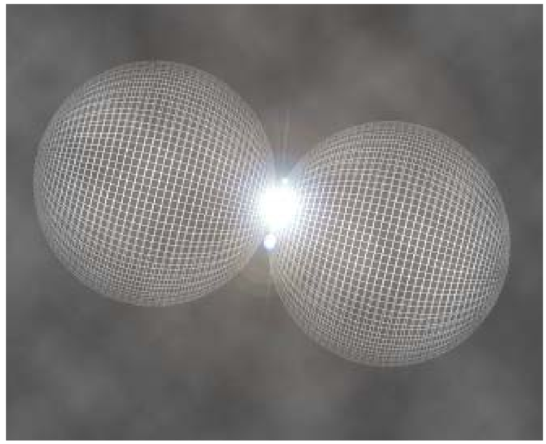

Figure 13.4.01 *The capture of the electron mass by the energy-well of both hydrogen atoms, allows diatomic hydrogen to form. Their e-shells are therefore coupled together and, because of its stability, this may involve a 2e electron mass.*

From an initial series of reconfigurations and adjustments, the consequences of stellar evolution would now soon be possible within a universe full of hydrogen and the process of nucleosynthesis would bring our own origins that much closer. However, before beginning to explore the processes of early nucleosynthesis in the context of this model, it may be prudent to look a little closer at the environment in which this, the next stage of our cosmological evolution occurs. The production of the first deuterium, helium and lithium atoms for example, will be dependent on the nature of the early 4D expanding universe that now seems to surround us *AND* the very nature of the whole surviving teddy that first appeared in what has been called here the *big-ping* - the beginning of our own three-dimensional part of the cosmos in which we now reside.