hans.vankessel@upbound.com

Crenel Physics

The heaviest possible elementary particle

Hans van Kessel
July 2015

hans.vankessel@upbound.com

1. Contents

© Hans van Kessel

hans.vankessel@upbound.com

Summary.

This manuscript explores the restrictions that light velocity imposes on orbiting objects. It then applies the findings to the 'entropy atom', a concept that was introduced in an earlier publication (see **http://vixra.org/abs/1408.0142**)

The key results are:

1. Proof that Gravity travels a light velocity.
2. Orbit diameters are subject to Lorentz *expansion* (as opposed to Lorentz contraction).
3. The smallest observable object (thus elementary particle) has an entropy value of 2 bits. It has been named 'entropy atom'.
4. There is a universal maximum limit to how much an entropy atom can contain: **228.97 GeV/c²**.
   Note: CERN found with high probability the lightest version of the Higgs boson at 125.3 ($\pm$ 0.6) GeV/c^2. Per standard model the heaviest possible particle should not exceed 1000 GeV/c^2. Therefore, the here found maximum possible energy contained within an 'entropy atom' is about one quarter of that.

Note:
Where concepts and their implications are addressed, calculations or examples do not always have to be very exact. To improve readability, the word 'approximately' can and will therefore be omitted in cases where numerical exactness is not relevant. For example it might be stated that the velocity of light is 300.000 km/s, where in fact it is *approximately* 300.000 km/s (it is closer to 299.792 km/s).

hans.vankessel@upbound.com

1. The orbiting of earth and moon.

An earthly observer doesn't see the moon where it actually is: from earth one sees the moon where it was 1.3 seconds ago. This is because it takes light 1.3 seconds to travel from the moon to an observer on earth. During those 1.3 seconds the moon progressed in its orbit.

> Every 27 days the moon completes a full circular orbit around the earth. The orbit radius is 384.000 km. The orbit length equals $2.\pi.\mathrm{r} = 2.\pi.384.000\, km$ ≈ 2.400.000 km. This gives an orbit velocity of 2.400.000 km / 27 days = 89.000 km/day or 1 km/s. Therefore, the distance between where we see the moon and where we must reckon it actually resides, equals 1.3 seconds x 1 km/s = 1.3 km further forward in its orbit.

Imagine –for simplicity of our model- that both earth and moon are not spatial spheres, but just points in space. And that from our earthly position we want to use a laser gun to fire a pulse of laser light to hit the moon. From the above we know that shooting in the direction in which we see the moon doesn't work: the moon isn't there anymore, but 1.3 km forward in its orbit. Aiming at that reckoned actual position isn't good either: during the 1.3 seconds between us pulling the trigger and our laser pulse reaching that position, the moon travelled another 1.3 km forward in its orbit. Therefore we must aim at a point that is two times 1.3 km (= 2.6 km) forward in the moon's orbit, relative to the point at which we actually see it.

hans.vankessel@upbound.com

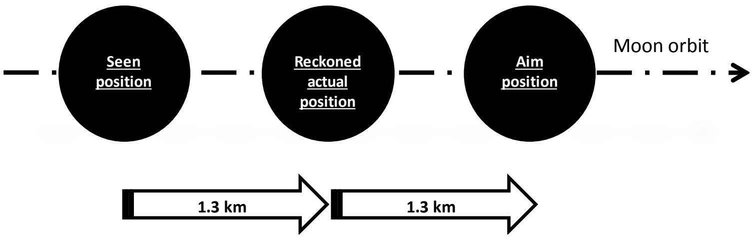

Figure 1.1: Definition of three points of interest.

All three points are located on the moon's orbit path, and therefore from an earthly perspective all are at an exact equal distance from earth: 384.000 km.

Now we install a flat mirror on the moon. Our objective is to point this mirror so, that it reflects the incoming laser pulse back to earth. From our position on the moon, we observe in turn that it is the earth that is orbiting around, every 27 days, at a radius of 384.000 km. The incoming laser pulse comes from the 'seen position' of the earth. This is because both the laser pulse as well as the light that the earth itself emits (and that we continuously see) travel along: both follow the same path at equal speed. Again we reckon that the position at which we see the earth (and where the laser pulse appears to come from) is not where the earth actually resides: again we reckon it is actually 1.3 km further in its orbit. The incoming laser pulse should not be reflected towards that 'reckoned actual position', but at the 'aim position' which is yet another 1.3 km forward in the earth's orbit path. Again, the 'seen position', the 'reckoned actual position' and 'aim position' all are located exactly on the orbit path of the earth around the moon, at 384.000 km away. For our flat mirror the incoming light beam angle equals the outgoing beam angle. To bounce the laser pulse back to earth, we therefore must point our moon mirror exactly towards the 'reckoned actual position' of the earth, as shown in the next Figure.

hans.vankessel@upbound.com

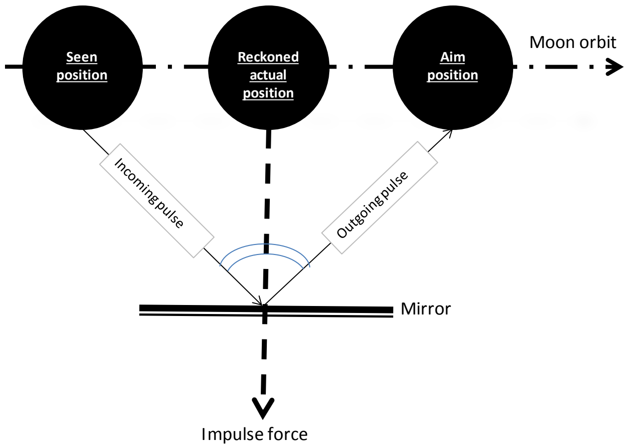

Figure 1.2: The impulse force.

Note: for clarity Figure (1.2) is not according to scale. At scale, the mirror should be shown much farther away.

Figure (1.2) shows that the impulse force is directed away from the 'Reckoned Actual Position' of the opposite object.

With the mirror on the moon in place, after pulling the trigger of our laser gun on earth, we now replace this gun by a mirror, and point it towards the 'reckoned actual position' of the moon. The reflected laser pulse that returns from the moon will thus be reflected back towards it. With both mirrors in place, the laser pulse will continuously bounce back and forth between the mirrors on earth and moon. The associated –repelling- impulse forces on both mirrors are thereby pointing away from the respective 'Reckoned Actual Position' of the opposite orbiting object. Because the 'reckoned actual positions' *are* the positions that the objects have at the moment of impact with the opposite object, it only so appears as if the impulse force interaction is instantaneous between the actual positions. A key consequence is that the impulse force associated with our bouncing laser pulse has no accelerating or decelerating component in the direction of the orbit path.

Despite the earth and moon have different masses (the earth is 6

hans.vankessel@upbound.com

times heavier than the moon) and therefore have a different orbit radius relative to their shared centre of mass, the observations from either moon or earth perspective are completely symmetrical.

Instead of a laser pulse, we now shoot a fast ping-pong ball (e.g. at half the light velocity) to bounce back and forth between the two mirrors. To make sure that the opposite target is hit, we must point both our mirrors towards points further forward on the opposite orbit path (relative to 'the reckoned actual position'). Consequently the impulse forces on both mirrors would not point away from the 'reckoned actual positions' anymore, but each force would get a forward –thus orbit object accelerating- component. Our ping-pong ball would lose kinetic energy at each bounce. Thereby the mirrors would need continuous adjustment due to velocity loss of the ping-pong ball, until finally all of the kinetic energy of the ping-pong ball is absorbed by the orbiting objects.

One can also imagine an opposite scenario, using some hypothetical 'super ball' which would travel faster than light. In such hypothetical case the mirrors would have to be pointed towards a location somewhere between the 'seen position' and the 'reckoned actual position'. In such hypothetical case the impulse force on the mirrors would have a backward –orbit object decelerating- component. Our super ball would now gain energy at each bounce, at the cost of the forward kinetic energy of the orbiting objects. Thus, in due time, all forward orbiting movement would ultimately stop, whereby the super ball would have absorbed the kinetic energy that is associated with the forward orbit velocity. Only in the extreme case of infinite ball velocity (the scenario that represents true instantaneous interaction), one would have to aim both mirrors at the 'seen position' of the opposite object, whereby the deceleration effect would be largest.

Stable orbiting systems demand an equilibrium between centrifugal force (which is a local force, therefore acting instantaneous upon both orbiting objects), and some attracting force such as gravity or electromagnetic force. Our considerations above thereby revealed that such attracting forces must travel exactly at light velocity, no more, and no less.

> Finding 1:
> *Attracting forces in stable orbiting systems, such as gravitational force and electromagnetic force, travel at light*

hans.vankessel@upbound.com

> *velocity.*

As discussed, in circular orbit systems these attracting forces only appear to come instantaneously from the respective ‘Reckoned Actual Positions’.

One conceptual consequence is that the *centre of gravity* of the orbiting system is found on the straight line connecting the ‘Reckoned Actual Positions’. The centre of gravity therefore is not wobbling relative to these.

There is an enhancement applicable to the above described model. When the photons that together shape our laser pulse depart from a mirror, e.g. the mirror on earth, these photons need to escape from the earth’s gravitational field, and thereby loose energy. This will not go at the cost of their velocity, but at the cost of their frequency, and thereby of their impulse power. This by itself would not affect their direction of propagation. However, these photons will also feel the gravitational pull of the moon. And they will not ‘see’ the moon straight in front of them during their orbit crossing. This will only be so at the moment of impact. Even though it would be a very minor effect, from a conceptual viewpoint the moon’s gravitational field would therefore slightly bend the path of these photons. And this in turn would relocate the position of the earth away from the initial direction of photon propagation, adding to the photons path’s bending. At the same time these photons would re-gain some of the earlier lost impulse power (and thereby frequency, not velocity), but not all of it, while approaching the moon: the moon has less mass relative to earth. All in all and conceptually, the incoming beam on the moon (and thereby the ‘seen position of the earth) will arrive at a very slightly steeper angle than our model suggests. We would need to slightly compensate our mirror aim position forward for that, causing the photons to gradually loose impulse power at each bounce, and ultimately dampen out. Therefore, our model using photons (embedded in a laser pulse) tells something more on top of finding 1.

> Finding 2:
> *‘Whatever’ is traveling at light speed between objects to generate an attracting force between stable orbiting objects, that ‘whatever’ does not interact with the force it induces.*

hans.vankessel@upbound.com

For example: let's assume 'gravitons' to travel back and forth between two orbiting objects, thereby inducing the gravitational pull. Per finding 1 these gravitons travel at light velocity. Per finding 2, these gravitons cannot interact with the force they induce, that is: with gravity.

Finding 2 is supported by the general observation that gravitational forces are cumulative: one can add up all vectors that represent gravitational forces, whereby the resulting vector represents the total impact. Should there be interaction, such would not be the case.

hans.vankessel@upbound.com

2. A remote position.

By looking at the orbiting objects from a remote position, we can gain insight in relativity. Let's first simplify the model by assuming two *equal* point masses 'A' and 'B', orbiting clockwise around their shared centre of gravity 'X'. And let's position ourselves remotely, straight above that centre of gravity at some unspecified large and fixed distance. This is what we see:

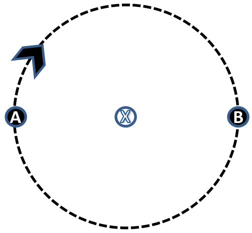

Figure 2.1: equal objects 'A' and 'B' orbiting clockwise around their central point of mass 'X'.

Because of our position straight above 'X', the distances from us towards both 'A' and 'B' are equal and also constant in time. Therefore, our seen observations of the objects 'A' and 'B' are equally time delayed, and we can ignore the time delay in the dynamics of our observations.

As Figure 2.1 shows, at any moment in time we see 'A' and 'B' at opposite positions in their shared orbiting path. We can reckon where in space their shared centre of gravity 'X' resides. Relative to us, this 'X' doesn't move. Because it is a 'reckoned' point, it has been marked with a white background in the Figure.

Note: in the following figures, a white background of a position indicates that this point is not taken by some physical object: it is a mathematical location, reckoned to be located at that point.

hans.vankessel@upbound.com

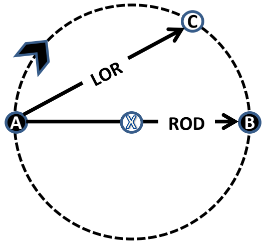

Figure 2.2: the Remotely Observed orbit Diameter 'ROD' and a reckoned Locally Observed orbit Radius 'LOR'.

From our remote location we reconcile where an observer on 'A' must locate 'B' at some given point in time. This reckoning starts by measuring the Remotely Observed orbit Diameter ('ROD') as indicated in Figure (2.2). We reckon that it takes light (at light velocity '*c*') ROD/c seconds to cross that distance. Therefore we must back-track object 'B' on its orbit path to a point 'C', a location where it resided ROD/c seconds ago. Given some yet unknown orbit velocity '*v*', the length of the back-track orbit section BC equals $v.ROD/c$ meters.

Figure (2.2) shows that the distance between 'A' and 'C' (indicated as Locally Observed orbit Radius 'LOR') will –for any orbit velocity- be shorter relative to the distance that we ourselves are observing between the orbiting objects (the 'ROD'). The higher the orbit velocity '*v*' will be, the further we have to back-track to find point 'C', and the shorter the 'LOR' will be. There is however a hard constraint: the observed orbit velocity 'v' cannot exceed light velocity 'c'. In that ultimate case (e.g. when it is photons which are orbiting), the length of the back-track path (calculated as $v.ROD/c$) would then be at its maximum length: $c.\frac{ROD}{c} = ROD$. Figure (2.3) shows this extreme case.

hans.vankessel@upbound.com

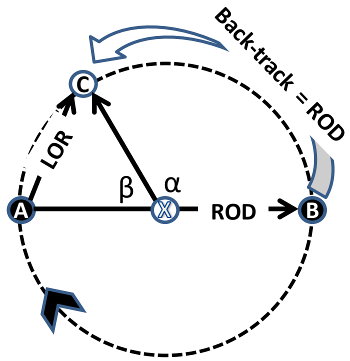

Figure 2.3: the 'LOR' in the maximum orbit velocity case, whereby *v* = *c*.

For two equal orbiting objects 'A' and 'B' this gives a fixed and well defined minimum value for the ratio LOR/ROD:

The length of the entire remotely observed orbit equals: $\pi.ROD$. This corresponds to a full revolution of $2.\pi$ radials around centre of gravity 'X'. The angle marked 'α' therefore equals $\left(\frac{ROD}{\pi.ROD}\right) \times 2.\pi = 2\,radials$. This is valid for any orbit diameter, as long as the orbit velocity equals light velocity *c*. The angle marked 'β' then equals $\pi - 2$ radials. The sinus of half the angle 'β', (= $\left(\frac{\pi-2}{2}\right)$ radials) equals half of the 'LOR', divided by half the 'ROD'. Using goniometry, the length of LOR is now calculated as:

$$\frac{LOR/2}{ROD/2} = \frac{LOR}{ROD} = \sin\left(\frac{\pi-2}{2}\right) = \cos(1) \approx 0.5403 \times ROD$$

Thus in general:

$$\frac{LOR}{ROD} \leq \cos(1) \qquad (\approx 0.5403\,) \qquad (2.1)$$

The following Figure (2.4) is used to find this ratio for lower orbit velocities:

hans.vankessel@upbound.com

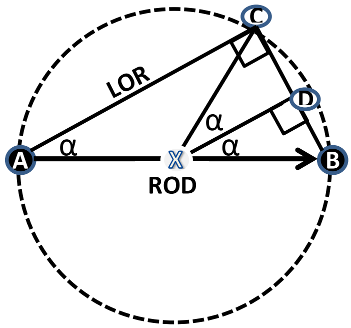

Figure 2.4: LOR/ROD for lower orbit velocities.

There are two goniometric properties that are relevant to this figure:

1. For any point 'C' on the circular orbit path, and thus for any viable orbit velocity, the angle ACB equals 90^0, as indicated.
2. All three angles marked 'α' are equal because the three sides of triangle XBD are exactly half the length of the corresponding sides of triangle ABC.

As already found, the length of circle segment 'BC' on the orbit path equals $v.ROD/c$, while entire orbit path length equals $\pi.ROD$. Therefore, angle BXC (shown as 2.α) equals:

$$2.\alpha = \frac{v.ROD/c}{\pi.ROD} \times 2.\pi\ (radials) = \frac{2.v}{c}\ (radials)$$

Angle BAC is half of that, thus is equal to $\frac{v}{c}\ (radials)$. From Figure (2.4) it can be seen that cos(α) = LOR/ROD. Therefore:

$$\frac{LOR}{ROD} = \cos\left(\frac{v}{c}\right) = \sqrt{1 - \left(\sin\left(\frac{v}{c}\right)\right)^2} \qquad (2.2)$$

In conclusion: where forward moving objects are subject to 'Lorentz contraction' (the remote observer sees objects smaller than the local observer), in case of orbiting the remote observer sees a *larger* orbit diameter, thus a 'Lorentz *expansion*' per Equation (2.2).

hans.vankessel@upbound.com

3. The entropy atom.

An earlier publication (see **http://vixra.org/abs/1408.0142**) introduced a model named 'Crenel Physics'. It defines the smallest possible observable particle in terms of minimum required complexity/entropy: the 'entropy atom'. Its entropy equals 2 bits (or ln(4) 'nat'). The 'bit' is a universal measure for information. Single bit entities might exist, but these are not detectable because the conservation law does prevent these from exchanging information with some external sensor. Without exchange of information, there can be no measurement. However, a *two* bit particle has an internal degree of freedom to compensate such external exchange, and therefore it is detectable as an isolated particle in an otherwise empty space.

Information (expressed in 'bits') has no mass or energy. It just seems to exists. A star radiates light in all directions. That light is composed of photons that contain 'mass/energy' by themselves, and their leaving drains energy from their source. But a star also spreads information about itself in all directions. 'Information' however is composed of bits that are weightless and without embedded energy. Nevertheless that information represents 'content' of its source.

The Crenel Physics model expresses content in 'Packages'. Thereby 'mass', 'energy' and 'information' are modelled as three different and mutually independent (orthogonal) dimensions of the Package. The aforementioned publication derives the following universal conversion factors:

$$\mathbf{1\ Package} = \sqrt{\frac{h.c^5}{G}}\ \ (\boldsymbol{energy}) \tag{3.1}$$

$$\mathbf{1\ Package} = \sqrt{\frac{h.c}{G}}\ \ (\boldsymbol{mass}) \tag{3.2}$$

$$\mathbf{1\ Package} = \sqrt{\frac{c^5}{h.G}}\ \ (\boldsymbol{frequency}) \tag{3.3}$$

These conversion factors are 'universal' because they are composed of universal natural constants only. They match the well-known

hans.vankessel@upbound.com

'Planck natural units of measurement', albeit that the above equations hold Planck's constant '*h*', whereas Planck's units of measurement hold the 'reduced Planck constant 'h/2.π', for which symbol '$\hbar$' is typically used. This difference is explained in that the Crenel Physics model is *frequency* based, rather than *angular frequency* based.

If one substitutes the natural constants in Metric units of measurement in the above equations, this leads to Joule, kg and Hertz respectively. These are the Metric units of measurement for energy, mass and frequency. But the above conversion factors are valid in any other consistent system of units of measurement that embeds the aforementioned dimensions of the Package.

Equation (3.3), converts the Package into the 'frequency' dimension. Frequency is related to 'information'. We do not know what exactly is oscillating at some frequency. It is just that we measure a certain periodicity which mathematically can be represented by a bit-stream with a bandwidth of one bit: '101010101…etcetera'. That stream comes at a certain pace, which connects it to the 'time' dimension. That pace tells something about the source: the higher it is the more Packages are associated with it. Planck's equation $E = h.\nu$ quantifies how much energy –and thereby Packages- is associated.

There is no conservation principle when it comes to the distributed information as such. For this reason we can manipulate information without changing the world. For example if we let a computer do a multiplication, that in itself doesn't cause a change of the world. Therefore this calculation doesn't demand some form of compensation. Of course in case of a computer calculation the status of physical memories changes, but that's not related to the underlying process at hand: that's related to the tool. One might alternatively do that multiplication on top of his head, with a totally different impact on the tool (the human brains).

With the above non-typical information related properties in mind we now further explore the entropy atom within the framework of the Crenel Physics model.

As a starting point, assume a single 'bit' (of information) traveling through an otherwise empty space. It propagates at light velocity. Now assume that due to some encounter our 'bit' changes direction:

hans.vankessel@upbound.com

it makes a course change of angle $d\alpha$. After that directional change, its velocity relative to its original path is below light velocity: the velocity component along the original direction equals $\cos(d\alpha)$.

To evaluate the implications thereof: envisioning a boat cruising at a straight course on an endless and completely quiet lake. Assume its velocity is equal to the velocity of the waves that it produces. This boat will never engage these waves. However, if the rudder is only temporarily turned whereby the course changes permanently, the boat will now be overtaken by its own –very recently produced-waves. This will have some disturbing impact on its new course: it will change again, this time due to interaction with its own waves. And that very complex process will from here onwards repeat itself.

The traveling 'bit' is much simpler object than a boat. It is an information 'wave' by itself, propagating at light velocity. After its directional change $d\alpha$ it will be overtaken by the wave it *was* just before this directional change. In other words: it will be overtaken by a recent (yet historic) image of itself. And that image is not found straight behind it, but resides at an angle $d\alpha$ relative to its current path.

Prior to further analyzing the consequences thereof, imagine a piece of rock that is propagating through an empty space at some velocity. We now catch it with a rope that is tightened to a fixed point in space. The rope tightened immediately and forces the rock to start circling, whereby its orbit velocity supposedly is equal to its original velocity. From a classical mechanical point of view, that's it. However, according to Planck the orbiting rock is producing a frequency now, and the 'orbiting energy' associated with that frequency equals: $E = h.\nu$. Planck's constant '*h*' equals only $6.62606957 \times 10^{-34}$ J.s, and with our frequency being pretty low, one can say that in this example the impact will not be noticed. Nevertheless, the conservation principle demands an infinitesimal amount of the kinetic energy of the rock to be transferred to '*orbiting energy*'.

This would not exactly be so with our propagating 'bit': it has no kinetic energy to start with. Yet, the traveling bit will –after its course change- be confronted with a trailing (thus historical) image of itself, being the wave it generated (or better: the wave it *was*) some time ago. As if it suddenly got a trailing twin brother. Let's

hans.vankessel@upbound.com

assume the original 'bit' traveled a distance Δx during which this interaction materializes. The associated impact of being overtaken by its past image –whatever that impact will be- is going to be repeated again and again at each distance Δx that is traveled. The reason is that this initial impact cannot be compensated elsewhere to disappear from the scenery. Furthermore, this impact can only be induced via interaction with the trailing twin image: there is nothing else around. Consequently, at each traveling of a distance Δx, the initial course change of angle $d\alpha$ will be repeated. Thus in our model we now have an orbiting bit, continuously trailed at some distance by a twin brother: they keep each other captured in their shared orbit. This envisioning meets the definition of the earlier introduced 'entropy atom': the model appears to consist of two bits (the original one, and its historic twin) which individually and by themselves have no mass or energy, but as an orbiting pair they are a container of tangible Package content per Planck's equation: $E = h.\nu$. And also this entropy atom is residing in some restricted spatial area: it could be boxed.

Let's explore in more detail the interaction between the original bit and its trailing twin, using Figure (3.1). We start prior to the course change with a forward propagating 'bit', passing points A1, A2, A3 and A4. Due to some interaction, at point X our bit is subject to a course change $d\alpha$. When it thereafter reaches point B1, it interacts with its trailing twin at A1, when B2 is reached the twin reached A2, etcetera. Thereby the distances A1-B1, A2-B2 etc. are all of some yet unknown equal length Δx.

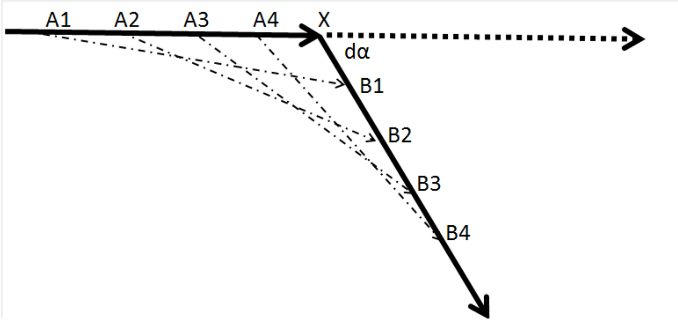

Figure 3.1: Force directions after a course change.

hans.vankessel@upbound.com

As the leading bit is progressing along its path, the angle α_x will shrink to 0.

We know find the orbit radius R using the following equation:

$$\Delta x = R.d\alpha \tag{3.4}$$

We now have an orbit, an orbit velocity ('c') and thereby a frequency. Per Planck's equation this unavoidably represents measurable 'orbit energy' in the Package dimensions 'energy' or 'mass'. The orbiting of a 'mass' –as we now have it- demands the presence of some force F. This force can only be between the leading 'bit' and its trailing twin (there is nothing else around), and it was applied over a path length Δx. It can be thought to be composed of a backward component F_b, and a tangential (centripetal) component F_t.

At any point on the shown path section X,B1,B2,B3,B4 a backward force component is felt:

$$F_b = F.\cos(\alpha_x) \tag{3.5}$$

The Package containment P_E , measured in the 'energy' dimension of the Package, is associated with applying this F_b per equation (3.5) along path Δx. then equals:

$$P_E = \int_{\alpha=0}^{\alpha=\alpha} \cos(\alpha) \times F \times \Delta x \tag{3.6}$$

Which is equal to:

$$P_E = \sin(\alpha) \times F \times \Delta x \tag{3.7}$$

Because tangential force $F_t = \sin(\alpha) \times F$ equation (3.7) can be rewritten as:

$$P_E = F_t \times \Delta x \tag{3.8}$$

We now have an orbiting 'bit', and we know that due to the orbiting some quantity of 'energy' (per Planck) and thereby 'mass' (per Einstein) is associated with it.

One might wonder why the tangent force F_T is apparent and needed

hans.vankessel@upbound.com

in our orbiting model, while at the same time we completely ignore the impact of the backward force component F_B, which acts along the line of (actual) propagation of the 'bit'. Such difference is however not unique in physics.

> Consider a metal ring positioned in a homogeneous magnetic field. Moving the ring back and forth, up or down, without changing its orientation within the magnetic field, has no impact other than simple Newton mechanics. However, if one *rotates* the ring from e.g. a horizontal plane into a vertical plane, the magnetic flux through the ring changes, and as a consequence this will generate an electric current through the ring, demanding an extra force that is associated with the thus generated electrical energy: the ring now acts as a dynamo and without any further interactions it would accumulate energy.

This example illustrates, that forward progression can indeed have a totally different outcome than rotation, as we also and exactly likewise see in our 'entropy atom' model. A 'bit' moves straight forward without any 'mass' or 'energy' content, but as soon as we make it orbit it contains Planck's 'orbiting energy'.

In general, the equation for centripetal force (equal to F_t here) is:

$$F_t = \frac{m.v^2}{R} \qquad (3.9)$$

And because in our case v equals light velocity c:

$$F_t = \frac{m.c^2}{R} \qquad (3.10)$$

Substituted into equation (3.8) this gives:

$$P_E = F_t \times \Delta x = \frac{m.c^2}{R} \times \Delta x \qquad (3.11)$$

Per equation (3.4): $\Delta x = R.d\alpha$, we now replace Δx in equation (3.11):

$$P_E = m.c^2.d\alpha \qquad (3.12)$$

Equation (3.12) has Einstein's equation $E = m.c^2$ embedded. At bottom line this comes forth from applying the general equation (3.9) for centripetal force to our 'entropy atom' model(!). For any given value of $d\alpha$ (the initial 'course change kick' that our 'bit' underwent), Einstein's equation gives the conversion between the 'energy' dimension of the Package, and its 'mass' dimension. This outcome is consistent with main stream physics, and therefore a strong argument to give credit to the current model.

But to our model it perhaps is even more more relevant that equation (3.12) also makes the 'mass' dimension of the Package consistent with the 'frequency' dimension: both 'mass' as well as 'frequency' of the 'entropy atom' are proportional to the initial course change $d\alpha$.

We now postulate that the attracting force between the 'leading 'bit' and its 'trailing twin brother' is based on gravitational interaction only. At this point it will be postulated, but after closer examination of the consequences it will become clear that this is the only valid possibility.

When two equal masses (such as contained in our 'bits') keep each other in a stable gravitational orbit at a mutual distance *D*, the gravitational attracting force F_G must match the centripetal force F_{CP}:

$$F_G = G.\frac{m^2}{D^2} \equiv F_{CP} = \frac{m.v^2}{R} = \frac{2.m.v^2}{D} \qquad (3.13)$$

Thus the orbit velocity '*v*' must be:

$$v = \sqrt{\frac{G.m}{2.D}} \qquad (3.14)$$

The mass *m* of a an orbiting 'bit' (based on $E = m.c^2 = h.\nu$) equals:

$$m_{bit} = \frac{h.\nu}{c^2} = \frac{h}{c^2} \times \frac{c}{\pi.D} = \frac{h}{\pi.c.D} \qquad (3.15)$$

With the orbit velocity being equal to c, we can substitute (3.15) into (3.14):

$$v = c = \sqrt{\frac{G.m_{bit}}{2.D}} = \sqrt{\frac{G.h}{2.\pi.D^2.c}} \qquad (3.16)$$

hans.vankessel@upbound.com

Or:

$$D = \sqrt{\frac{G.h}{2.\pi.c^3}} = \sqrt{\frac{1}{2.\pi}}.\sqrt{\frac{G.h}{c^3}} = \sqrt{\frac{G.\hbar}{c^3}} \quad (3.17)$$

This value of *D* is equal to one Planck distance, or $\sqrt{\frac{1}{2.\pi}}$ 'Crenel', the distance unit per Crenel Physics model (see the aforementioned publication **http://vixra.org/abs/1408.0142**).

Thus, when we postulated the gravitational force to be the single cause for keeping our two bits in orbit, their mutual distance *D* is universally constant, equal to one Planck length.

We can now envision the entropy atom as a circle section whereby the chord length equals one Planck unit. Let's name it as 'string'. That string can be virtually straight, representing an entropy atom at very low frequency and thereby Package containment. But it can also 'curl up', such that the entire orbit length is shortened, thereby representing a shorter orbit length and subsequent higher frequency and thereby Package containment.

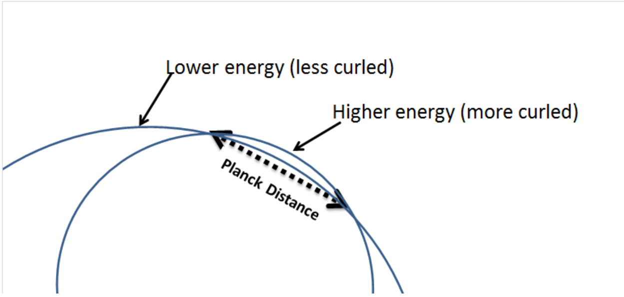

Figure 3.1: the chord length of all entropy atoms is constant, and equals 1 Planck length.

The interaction between both bits being gravitational (as postulated) demonstrates here to be of an exclusive relevance: as orbit frequency goes up, the associated mass of the 'bits' goes up per Planck, and thereby the mutual gravitational force. But simultaneously the orbit diameter is reduced such that the equilibrium conditions for stable orbiting are maintained no matter

hans.vankessel@upbound.com

what frequency (and thereby ‘energy’ or ‘mass’) is associated with the entropy atom.

In chapter 2 we have seen however that –with the distance between both bits being fixed- there is a restriction in how far our entropy atom string can curl up, see Figure (2.3): a maximum of two radials. This restriction is shown below in Figure (3.2):

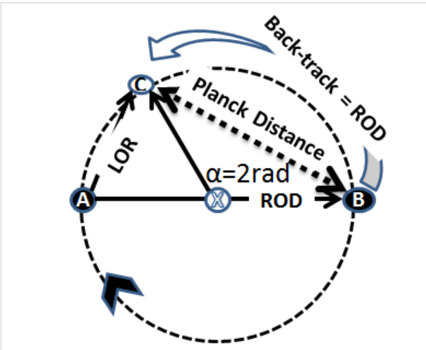

Figure 3.2: the ‘Back-track’ path associated with a maximum string curl equals the ‘Remotely Observed Diameter’.

In Figure (3.1) angle α is equal to 2 radials. The associated chord length then is:

$$Chord\ length = Planck\ length = ROD\,.\sin\left(\frac{2}{2}\right) \qquad (3.18)$$

The with this minimum associated Remotely Observed orbit Diameter (‘ROD’) then equals:

$$ROD = \frac{(Planck\ length)}{\sin\left(\frac{2}{2}\right)} = \frac{(Planck\ length)}{\sin(1)} \qquad (3.19)$$

Such that the orbit length equals:

$$Orbit\ length = \pi.ROD = \pi.\frac{(Planck\ length)}{\sin(1)} \qquad (3.20)$$

And because the ‘bit’ travels at light velocity *c* the maximum possible entropy atom frequency f_{max} equals:

hans.vankessel@upbound.com

$$f_{max} = \frac{c}{orbit\ length} = \frac{c}{\pi.\frac{(Planck\ length)}{\sin(1)}} = \frac{c.\sin(1)}{\pi.(Planck\ length)} \qquad (3.21)$$

Substituting equation (3.17) for the Planck length:

$$f_{max} = \frac{c.\sin(1)}{\pi.\sqrt{\frac{G.\hbar}{c^3}}} = c^2 \times \sqrt{\frac{c}{G.\hbar}} \times \frac{\sin(1)}{\pi} = c^2 \times \sqrt{\frac{c.2\pi}{G.h}} \times \frac{\sin(1)}{\pi} \qquad (3.22)$$

Or:

$$\boldsymbol{f_{max} = \sqrt{\frac{2.c^5}{G.h.\pi}} \times \sin(1)} \qquad (3.23)$$

When metric units are entered, this gives a maximum entropy atom frequency of 4.9684 * 10^{42} Hertz = 4.9684 * 10^{30} THz, which corresponds to 2.0548*10^{28} eV which corresponds to 2.2863* 10^{11} eV/c^2 which corresponds to **228.63 GeV/c^2**.

It should be noted that per Crenel Physics model, the gravitational constant G equals:

$$G = \frac{h}{k_B} \times \ln(4) \qquad (3.24)$$

Thereby 'k_B' is to be expressed in energy units of measurement divided by temperature units of measurements (in the Metric system that would be J/K). This results in a slightly lower value for G, applicable to elementary particles like the entropy atom. If we substitute (3.24) into (3.23) the corrected result is:

$$f_{max} = \sqrt{\frac{2.c^5}{G.h.\pi}} \times \sin(1) = \sqrt{\frac{2.c^5}{\frac{h}{k_B} \times \ln(4).h.\pi}} \times \sin(1)$$

Or:

$$\boldsymbol{f_{max} = \sqrt{\frac{2.c^5.k_B}{h^2\ln(4).\pi}} \times \sin(1)} \qquad (3.25)$$

hans.vankessel@upbound.com

When metric units are entered, this gives a maximum entropy atom frequency of $4.9761 * 10^{42}$ Hertz = $4.9761 * 10^{30}$ THz, which corresponds to $2.0579*10^{28}$ eV which corresponds to $2.2897* 10^{11}$ eV/c^2 which corresponds to **228.97 GeV/c^2**.

CERN found with high probability the lightest version of the Higgs boson at 125.3 ($\pm$ 0.6) GeV/c^2. Per standard model the heaviest possible particle should not exceed 1000 GeV/c^2. Therefore, the here found maximum possible energy contained within an ‘entropy atom’ is about one quarter of that.