

## A matter of energy and space

This document presents a set of ideas on how matter, energy and space could be interpreted. It also touches on related concepts like force, fields, quantization, entropy and cosmology.

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This document does not pretend to present 'the truth', but tries to initiate discussions.

**Feel free to discuss!**

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## 1. Context

My name is Jacob Mulder. In my daily life I am an IT Security & Enterprise Architect and I do things in healthcare, but years ago I studied astronomy and computer science. Although working in a commercial environment has its advantages, science always remained in the back of my mind. Some 10 years ago I started working on intelligent swarms of robots and partly returned to the university. In 2002 I wrote down a set of ideas on how to describe matter and force and in 2006 I updated it. I visited a symposium on the Quantum Universe and one on the Information Universe and met Erik Verlinde. To my surprise his theories on emergent gravity and entropy have some similarities on the things I had written down. This document that you are reading now is a new and completely rewritten version. The document tries to present my ideas in words that are reminiscent of his theories. I realize that some ideas in this document are somewhat provocative. Moreover, as a whole it resembles a "house of cards" – it might not look nice, it certainly might appear strange here and there, but it's quite an elaborate and internally reasonably consistent entirety. The document is very much not meant to describe "the truth", instead it tries to present a number of views and interpretations and tries to do using logical reasoning. The intention of this document is to start discussions, so feel free to react!

## 2. Text formatting

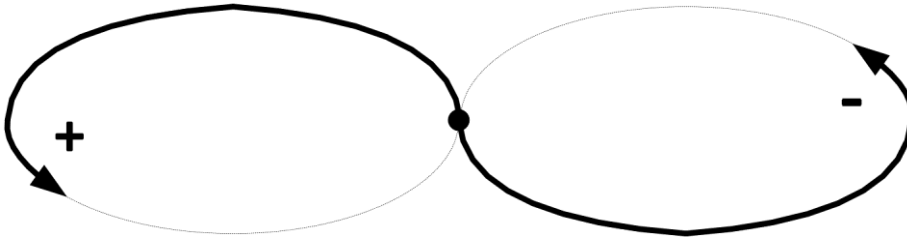
In the text I regularly define new concepts and phrases. Such a new concept is written in "**bold**" and to make clear that it is a definition, the word definition is underlined.

## 3. Starting points

The idea is to present concepts and thoughts that are understandable, logical and comprehensive, without having the need for ad-hoc formulas or constants for finetuning. The idea is not to try to present 'the truth', but instead to present definitions, views and interpretations. The document describes concepts and does not provide mathematical proof. My hope is that discussions will lead to help in trying to design a mathematical foundation under the "architecture" described in the document.

#### 4. Taps

Heisenberg's uncertainty principle gives rise to the idea that pairs of virtual particles can be created "out of nothing".



After a while, the pair joins again and the combination disappears again, it is "annihilated". The above defines the phrases "**creation**" and "**annihilation**".

One could say (define) that both parts of the pair are "**entangled**".

Definition: I call each of both parts of the pair a **Tap**.

By drawing (defining) the pair in the way it is above, space and time are defined as well:

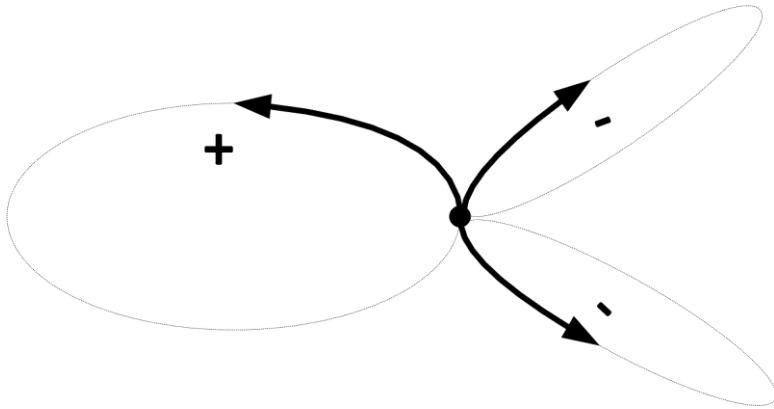
- the Taps appear as two *separate* entities, as a result, a *distance* arises; "distance" can be seen as the starting point of the definition of **space**;  
as humans we observe that we live in a three-dimensional space;
- the Taps appear and after a while they disappear again; this word "while" can be seen as the starting point of the definition of **time**.

A logical conclusion of the above is that the definition of space and time **emerge** from the concept of virtual particles (that's a definition).

The statements so far have not specified how "large" the Tap-pair is, that is, what the maximum amount of distance is during the time the pair exists and how much time it exists. This is the definition of the **Magnitude** of a Tap-pair. Since so far in this discussion no limitations were stated on Magnitude, a logical conclusion is that Tap-pairs may arise with many different Magnitudes.

Since a Tap-pair is defined as a pair of Taps that annihilate after some time, it is logical to define that one Tap is the "**opposite**" of the other, within the pair. One could for example define that one Tap is "**positive**" and one is "**negative**". To be able to fully annihilate, it is necessary that the (absolute) amount of "positive" is equal to the (absolute) amount of "negative". This defines "**amount**".

However, mathematical alternatives are also possible. It is for example also conceivable that one part is a certain amount “positive” and that there are two “negative” parts, each with half of that (absolute) amount.



One can come up with many more combinations. This is an example of “something is possible, there's no good reason why it should not or cannot happen, so it will (eventually) happen”. So effectively all possible combinations could theoretically arise (and after a while annihilate again).

To make future discussions in this document easier, “**Tap-combination**” is defined as a combination of Taps that arise and are annihilated as such a group.

The above definition makes one search for a word for the “amounts”, since the sum of the “amounts” within a Tap-combination should be zero, since the combination as a whole needs to eventually annihilate. I define the word “**energy**” as these “amounts”: a Tap-combination consists of a combination of “amounts of energy”. What this “energy” is exactly, is not defined yet here. At this point of this document, it is not yet relevant to define what it is.

The term ‘tap’ was chosen for a number of reasons. The first is that when a Tap-combination arises (appears), it is “tapped from nothingness” and after a while, it annihilates, it “taps into annihilation”. A Tap-combination always has some symmetry in it, since its “total value” has to be zero. That symmetry has an association with drumming – tapping to produce “symmetric” sounds (I have lead the djembe group Nugara for 15 years). Later in this document, in the chapter on interaction and the chapter on Spikes, I will introduce a few more reasons to call it “Taps”.

## 5. Probability

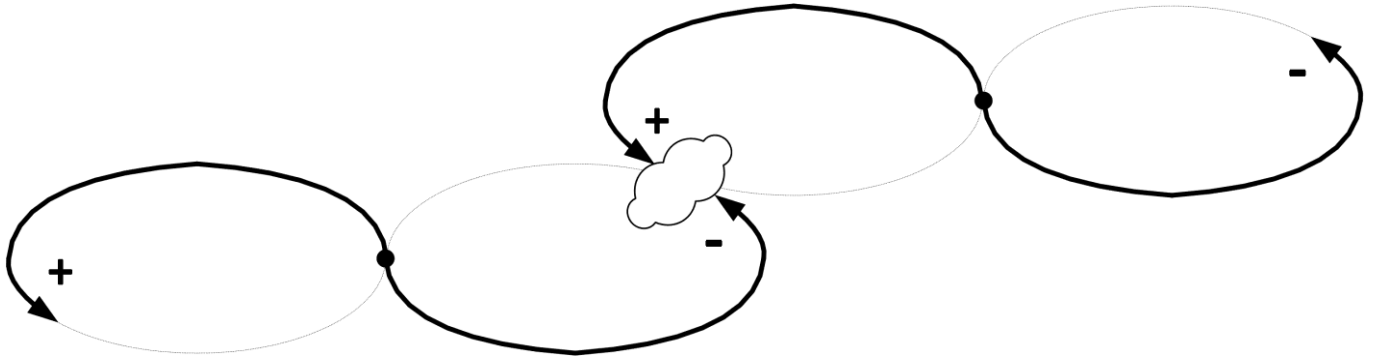
The pair of Taps described in the previous chapter arise at a given moment and a while later the pair disappears again. The pair “annihilates”. The same holds for Tap-combinations, such a combination also annihilates eventually.

It is not true that Tap-pairs appear continuously, on every point in space, in every point in time (otherwise all space and time would be fully packed and that does not correspond with the observation that we, humans, have). So a Tap-pair appears “somewhere” and “some time”. This can be defined as: there is a **probability** that a Tap-pair appears.

In a previous chapter it was stated that a Tap-combination has a Magnitude. The maximum amount of distance between the Taps (during the time the pair exists) and how much time it exists, vary per Tap- combination. It sounds reasonable to assume that there should be a (mathematical) relationship between the Magnitude of the Tap-combination and the probability that it arises. It sounds reasonable to assume that the larger the Magnitude, the smaller the probability is: “you can get more, but you’ll have to return it quicker”. I realize that this may sound as a simplification – it’s true that I’m not striving for complexity, but I am striving for logical deductions. I think that it is logical to assume that there is some relation between the Magnitude of a Tap-combination and the probability that it arises (from nothingness).

## 6. Interaction

Since Tap-combinations can arise at any point in space and time, there is a probability that two of them arise quite close to each other. Then the following can occur:

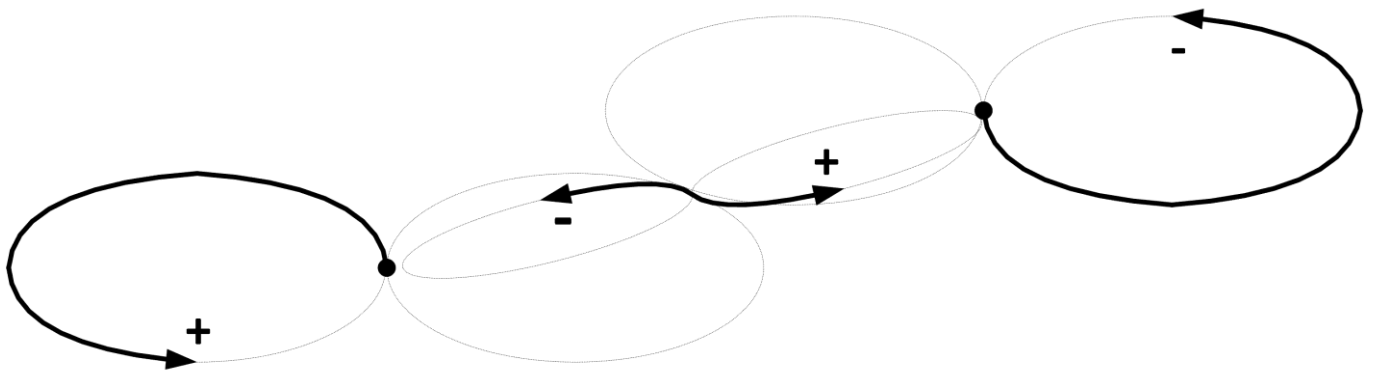


Two equal Tap-pairs arise at the same point in time and almost at the same point in space. One part of one Tap-pair interacts with a Tap of another Tap-pair, and those two Taps annihilate. I define that annihilation a "**Bash**" (a sort of large "tap sound") and I define this as an "**Oops**" moment.

The resulting situation is a problem: when they arose, the intention was that both original Tap-pairs should annihilate after a certain time, but now that is not possible anymore, since both original Tap-pairs miss one of their Taps.

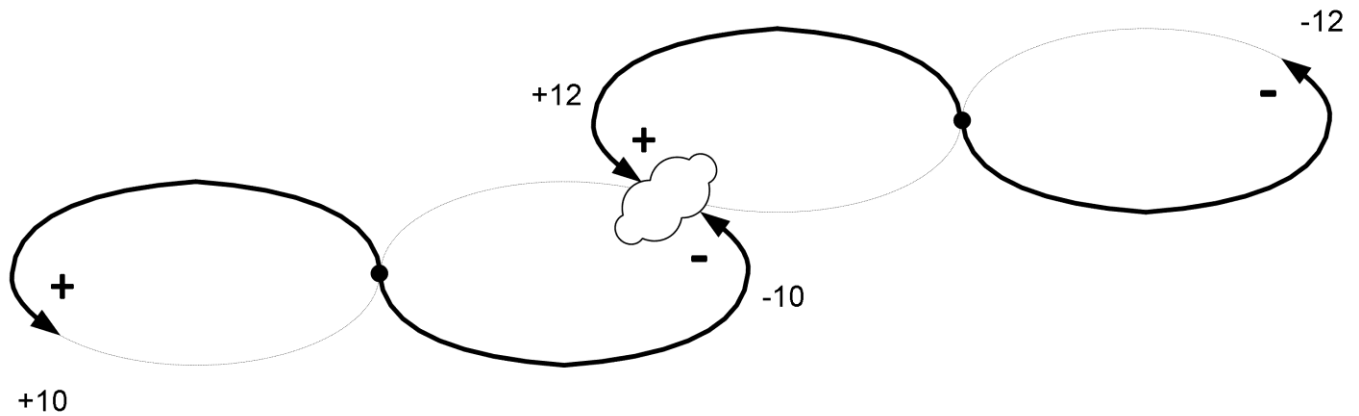
I define this situation as "**Panic**".

A solution is to create a new Tap-pair in the middle, to solve the problem:

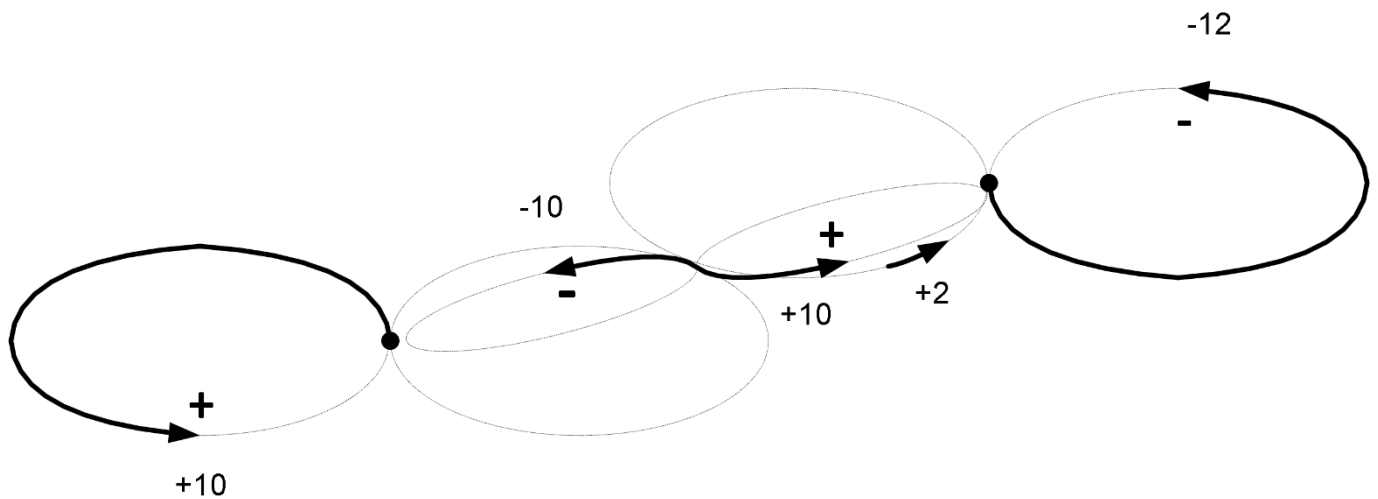


Note that the rescuing Tap-pair is not exactly equal to the original Tap-pairs. It needs "extra speed" to be able to rescue the problem. On the other hand, it needs to have exactly the same "+" and "-" as the annihilated Taps. Effectively, the rescue Tap-pair is "different, but matching".

When the original Tap-pairs were unequal, then the "Panic" would be more complex, since the "rescue was not complete" and there is a "remainder", a "leftover". An example:



A Tap-pair of Magnitude +10/-10 bashes with a +12/-12 Tap-pair.



The rescue Tap-pair has Magnitude +10/-10, leaving a reminder of +2 behind, a leftover of the almost-annihilated Tap of the original +12/-12 Tap-pair. The -10 Tap of the rescuing Tap-pair eventually annihilates with the +10 Tap of the original +10/-10 Tap-pair. The +10 Tap of the rescuing Tap-pair adds up with the +2 remnant and together they eventually annihilate with the +12 Tap of the original +12/-12 Tap-pair.

One can imagine that this "+2 remnant" is a sort of a "**free radical**" (a definition). The fact that it is there adds to the complexity of the situation. It adds to the "panic in the room".



## 7. Panic

The difference between the rescue Tap-pair and the original Tap-pairs lies in the "speed" of its Taps. The definition of "**speed**" is "amount of difference in space-location per time". One could state that the Taps of the rescue Tap-pair have a higher speed than the Taps of the original Tap-pairs. Another way of describing that "rescue", is that time and space are different for the rescuing Tap-pair. That alternative description could be defined as "**relativity**". Based on the discussion, definitions and interpretations stated so far in this document, there is no logical reason to prohibit this alternative description, so effectively the descriptions can be defined as equally valid and none of the two descriptions should to be preferred above the other. They could be called "alternative views".

When we continue of that concept of "relativity", the implication is that time and/or space are modified in such a way, that the rescuing Tap-pair is able to "solve the problem" within the necessary time (actually, not "within", but "exactly on time").

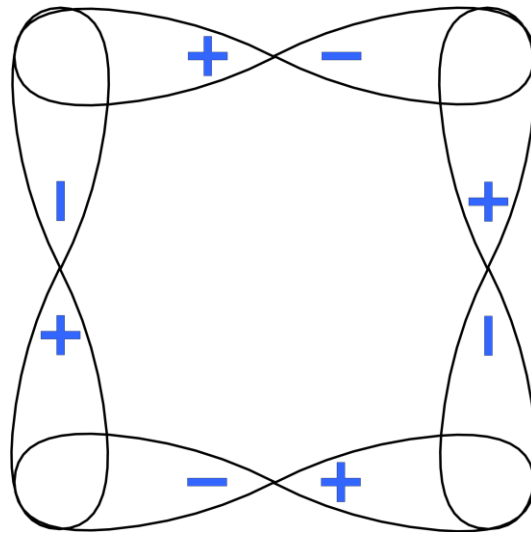
One could conclude that the earlier defined "Panic" is equal that "deformation" of space and time (which could for example also be called "bending", "curvature" or "warping").

Such "bending of space and time" has an association with gravitational waves. When "space and time" is defined as "**spacetime**", "Panic" can thus be interpreted as "warped spacetime".

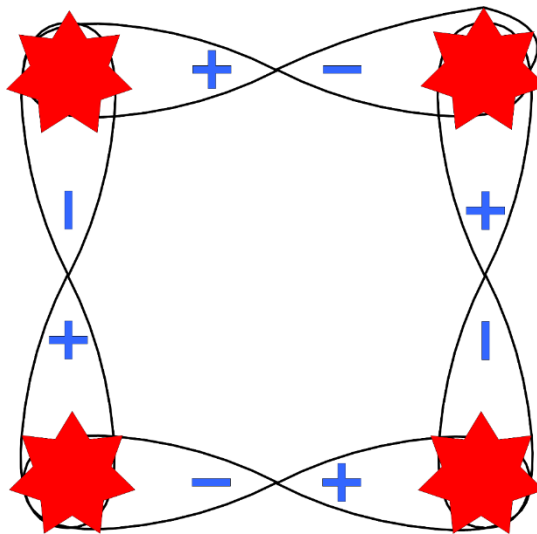
A region where spacetime is warped is defined as a "**Spike**". That "region" is four dimensional: three space dimensions plus a time dimension.

## 8. Stability

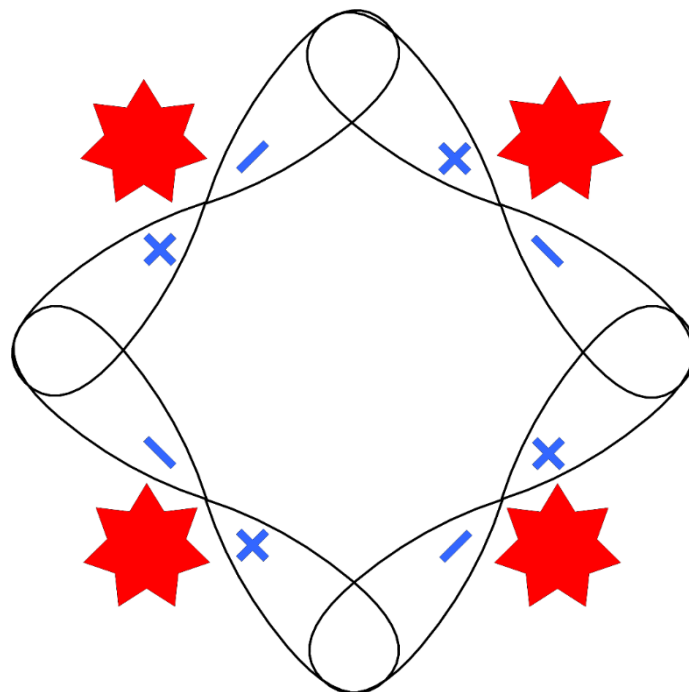
As argued above, Tap-pairs can arise relatively close to each other. Where and when they arise is governed by probabilities. Below is an example how four identical Tap-pairs arise at the same point in time at very specific points in space. The probability that this occurs is quite slim, however, given enough time, it will eventually happen.



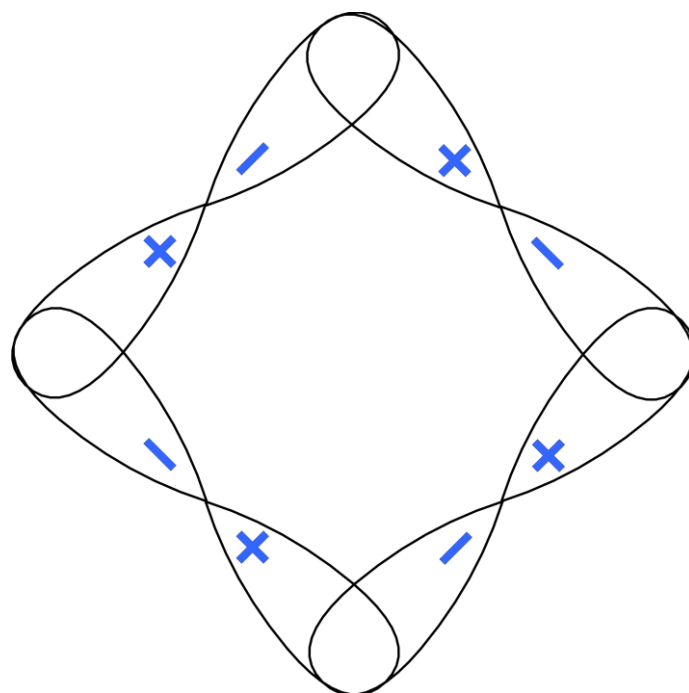
When such a configuration arises, the corners experience "Oops":



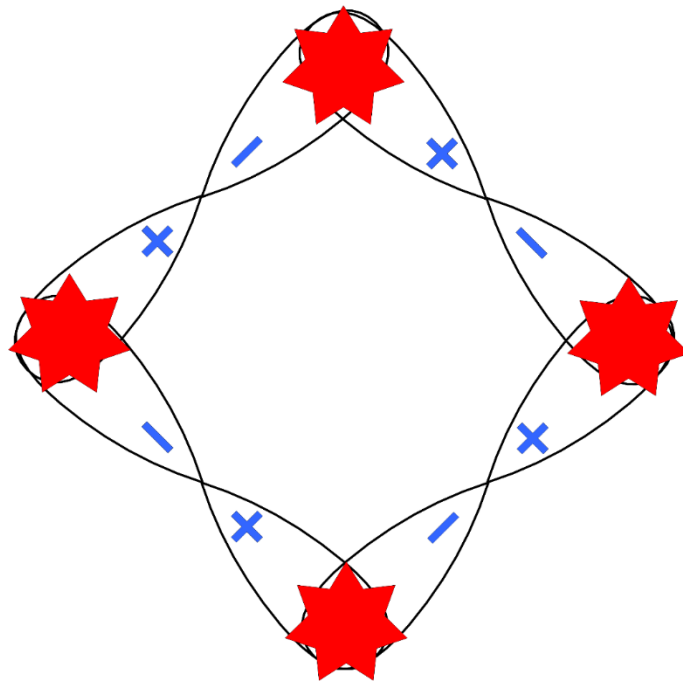
In those corners the Panic will create new Tap-pairs:



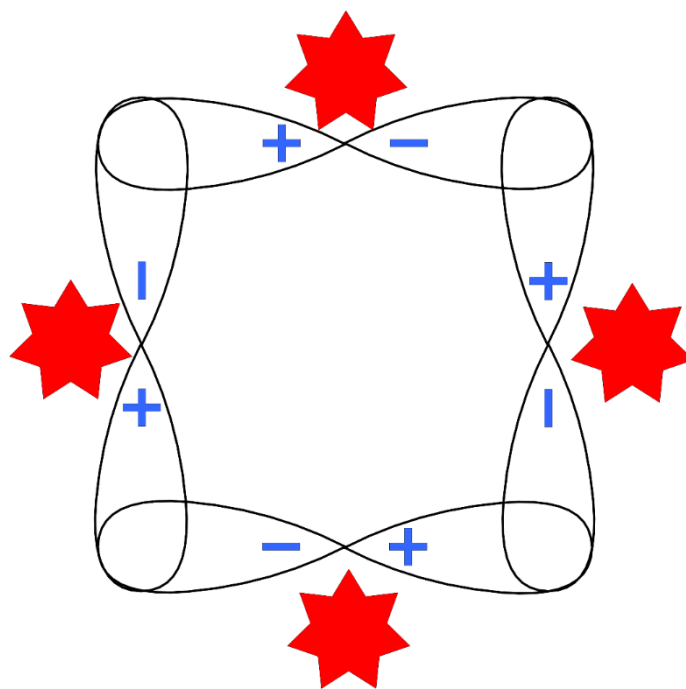
Thus, we have the same square configuration, but then tilted:



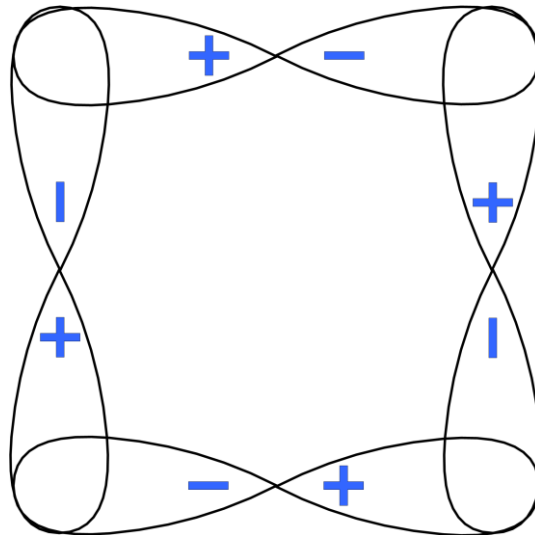
This will again create Oops-situations in the corners,



and the resulting Panic will result in new Tap-pairs:



And thus, we have our original square configuration back,



which makes the process start over again.

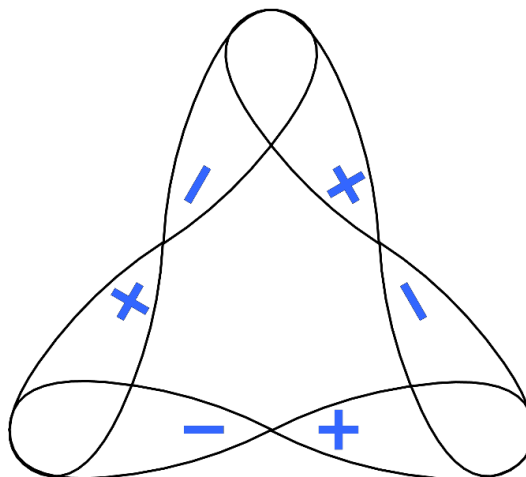
Such a continuous circular process is defined as a "**Tap-loop**".

That term "loop" gives an association with quantum loop theory.

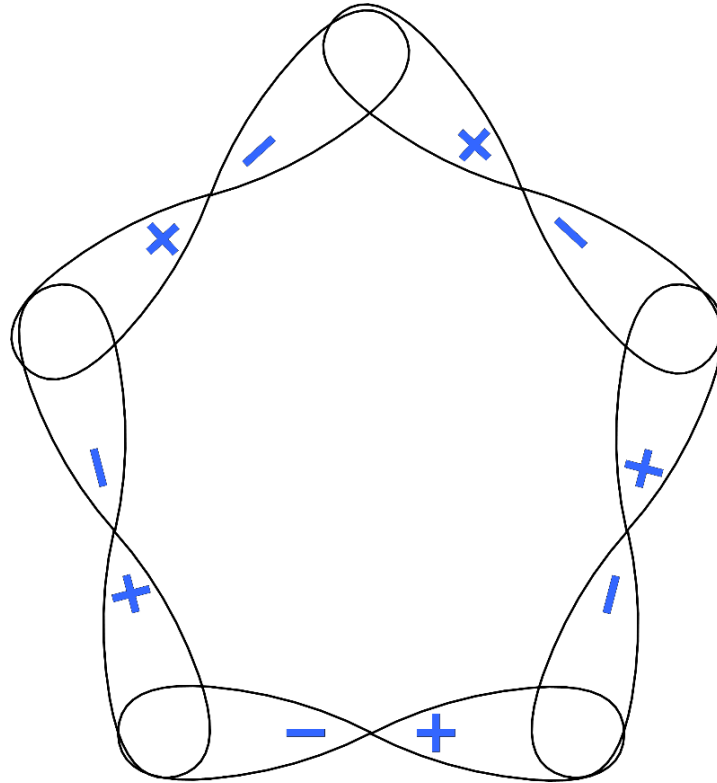
A Tap-loop is a stable entity, that is, as long as no destabilizing interruption occurs (more on that later in the chapter on decay).

Such a (semi-)stable Tap-loop is defined as a "**Particle**".

One can come up with many more forms of Tap-loops, like



and



and obviously three-dimensional configurations are also possible. It is also conceivable to configure large "planes" of interacting Tap-pairs in such a way that the whole "plane" is stable, except for the edges. Those planes don't need to be flat, they can also be curved in space. When the whole configuration is "closed" in three dimensions, e.g. forming a sphere or torus, then "edges" disappear and the whole configuration can become stable. One can envision that in such a way, large Particles may exist in all kind of forms, like tubes closed in a three-dimensional "8" form or warped planes in a closed helix. This discussion gives an association with branes of string theory.

To make it even more complex, a configuration of a Particle could also contain Tap-combinations, not only Tap-pairs. It looks less likely that a stable configuration can be built that way, but so far, this document presents no other reason why such "exotic" configurations should not exist.

## 9. Evolution

Since so far in this document no limitation is specified for the Magnitude of Tap-pairs, stable configurations (Particles) can vary in size too. The configurations drawn so far in this document all contain exactly the same Tap-pairs. Configurations consisting of Tap-pairs with different Magnitudes are of course also possible, however, it sounds reasonable that it is considerably more likely that they are stable when all Tap-pairs are equal or when there is symmetry in the Magnitudes of the Tap-pairs that build up the configuration. It sounds logical that some form of symmetry in the spatial configuration also helps to make it more stable.

In other words, Particles with higher internal symmetry will most probably be more stable. Mathematics is needed to support this statement.

The loop of the Tap-loop takes an amount of time. Since it is a "closed loop" (that is, the initial configuration reappears after one loop), a "**frequency**" can be defined for a Particle. Complex Particles (that is, Particles with a complex configuration) may even have multiple frequencies. One could say that each Particle has its own rhythm.

The "oscillation" of a Particle could also be called its "temperature". However, in its regular definition, "temperature" can raise and drop. When that is translated in the definition of a Particle, as a stable loop of conversions of Tap-pairs, that would imply that the Magnitude of those Tap-pairs would increase or decrease (either gradually or in steps). It is not trivial how such an increase or decrease would occur within a Particle, while at the same time keeping the configuration as a whole stable. Because of this I will not pursue this particular interpretation/definition of "temperature" here any further.

The idea of somehow increasing the Magnitude of Taps within a Particle gives an association to the "excited state" of an atom. There, an atom absorbs an amount of energy and this is stored in the fact that one of its electrons is in a higher orbit (or in some other comparable way). One could "translate" this into the configuration of a Particle, but whereas an atom usually stays whole upon absorbing a bit of energy, it is quite likely that the configuration of a Particle will become unstable (more on that later, in the chapter on decay). It might be that a Particle can be "excited" in such a way (increasing the Magnitude of its Taps), but it sounds logical that the probability that the configuration of the Particle remains stable is very slim.

## 10. Mass, charge, and the like

A Tap-pair has a Magnitude and since a Particle consists of a number of Tap-combinations, a Particle itself also has some sort of "total value". That's not simply the addition of those Magnitudes, but it is some average over time, e.g. mathematically some integral over time of all the Magnitudes.

This "total value" of a Particle could be defined as its "**mass**" or "**charge**" or similar description. A Particle with a more complex configuration might even have more of such descriptions, e.g. both a mass and a charge.

## 11. Actualities

Within a Tap-loop there is a continuous arising and annihilation of Taps and a regular appearance of Panic and Spikes. One could say that a Particle is a complex of a wave-like alternating points in spacetime.

Within the Particle there is a continuous alternation between Taps and Spikes and a continuous process of arising and annihilation, creating a complex that is both stable and vibrant.

One could say that there is a "Tap-world" and a "Spike-world" and that there is a continuous "exchange" between these two "worlds". When one would observe only one of these "worlds", one would regularly have the impression that there is a local "void", but when both "worlds" are observed as a "composite", then one realizes that "things" are simply temporarily "in the other world". The "presence" or "realization" is temporarily in the other "world".

The word "world" can give rise to confusion, so the word "**actuality**" is defined in this context. There is a "Tap-actuality" and a "Spike-actuality".

One could say that Taps and Spikes are "entangled", that the "Tap-actuality" and a "Spike-actuality" are "entangled" and that "Tap and Spike are Actuality-entangled".

The continuous "exchange" between the two Actualities can be described as "things are tapped out of one and tapped into the other", as in "communicating vessels".

## 12. Energy and Being

In the definition of Taps the word "energy" was defined as an "amount". Given the discussions in the previous chapters, this definition can now be extended: "**energy**" is "an (amount of) exchange (between Actualities), a movement, something that happens".

This definition also refers to the word "Tap" – it's about the effect, about the "slap sound".

On the one hand, "energy" is "moving", on the other hand, a Particle is something stable. One could say that a Particle "is", whereas "energy" is "transit". This "is" is the definition of "**being**".

The idea that a Particle is a stable form of a configuration of a set of Tap-combination, implies that "being" is "emerging" from "transit". It implies that Particles "emerge" from energy.

A quick interlude. One could extrapolate this concept to life itself: life "is" as long as it's self-sustaining. It can be described as an emerging phenomenon – as soon as there is flow (blood, nerve activity and so on) and there is the possibility of interaction and procreation, there is life.

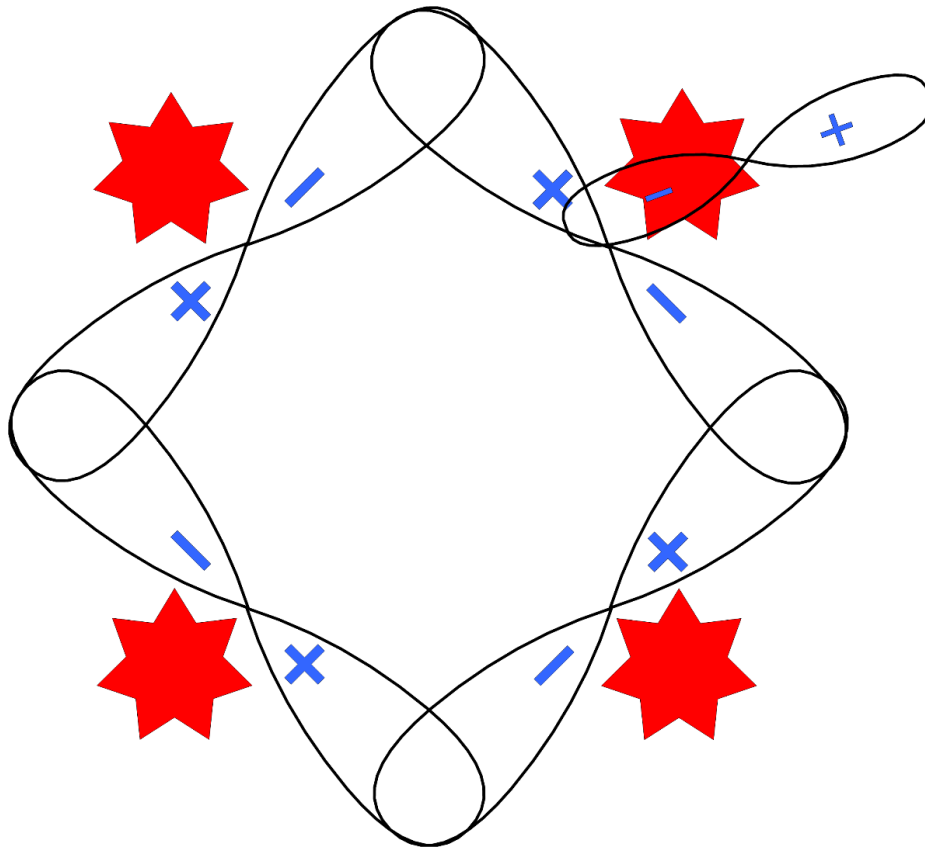
In the chapter on mass, charge and the like it was stated that Tap-combinations have a Magnitude and that Particles have mass, charge and/or other properties. When this is combined with the statement that "energy" is exchange, this implies that mass, charge and the like are representations of energy.

Similarly, Spikes also represent energy, since they are continuously exchanged with Taps within a Particle. Continuing on that, the warping of spacetime also represents energy.



### 13. Decay

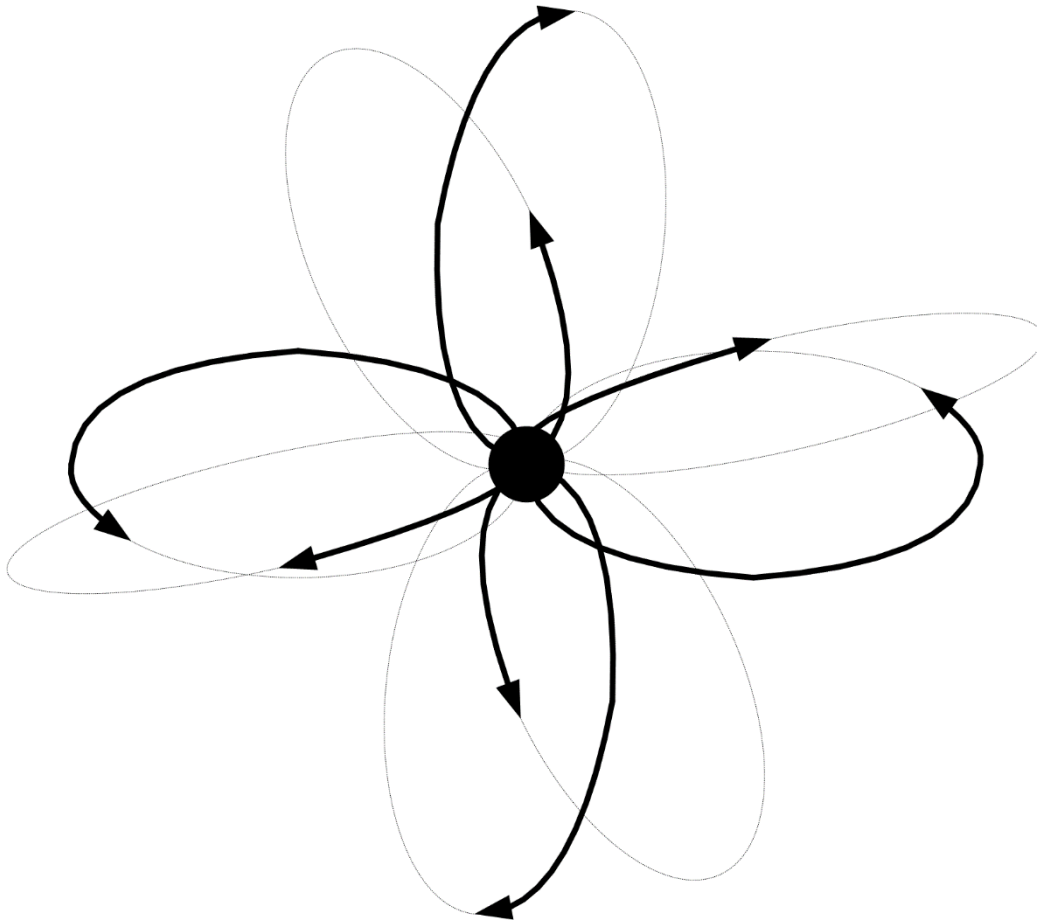
As discussed earlier, when there is Panic, the probability is large that a Tap-combination arises. In a Particle, Panic appears regularly. It is thus possible that for example the following happens, during the Tap-loop of a Particle with a square configuration:



In one of the four Panic-areas, an additional Tap-pair arises (in drawing above: perpendicular to the plane of the four Tap-pairs). When such an additional Tap-pair has a low Magnitude, much lower than the Tap-pairs of the stable configuration, then the probability is quite high that the combination can remain stable, despite of the arise of the additional tap-pair.

This implies that additional Tap-pairs can arise “around” a Particle.

When it's a Particle with a more complex configuration, then there might even be a "cloud" of additional Tap-pairs around it:



The black sphere in the middle is the Particle.

When another, independent Tap-pair arises in the neighborhood of a Particle, there is a possibility that this Tap-pair interacts with one of the Tap-pairs of the cloud surrounding the Particle. This results in Panic, which results in a new Tap-pair. As was discussed earlier, this "rescuing Tap-pair" is different than the original ones. The possibility exists that the annihilation at the Particle realm might disrupt the stability of the Particle.

As a result, the Particle might change, for example due to the appearance of additional rescuing Tap-combinations, but it might also happen that the resulting combination is not stable enough. As a result, the original Particle will "disintegrate". It is possible that the resulting fragments will form new stable Particles, e.g. with the help of additional rescuing Tap-pairs, but some fragments could also eventually annihilate completely.

The net effect of this whole process can be defined as the "**decay**" of a Particle.

The fragments of a decayed Particle eventually either disappear (due to annihilation) or form new stable Particles. One could state that "the whole strives for stable Particles". Here "the whole" is the definition of "all spacetime with all Taps and Spikes", one could say: "the whole" is the definition of the "**universe**".

#### 14. More evolution

When two Particles come near to each other, similar things may happen. Each Particle has its own cloud of Tap-pairs and an "Oops" moment can appear upon such a close encounter, namely when Taps of two of those cloud-pairs annihilate.

The result does not have to be that both Particles decay. The next chapter discusses a less catastrophic outcome – "force". However, when a large group of complex Particles come close to each other, the probability on decay becomes larger (mathematics is required to support this statement).

An extrapolation of this idea gives an association with nuclear fission: a high density of complex Particles leads to catastrophic results. Similarly, nuclear fusion can be explained by forcing many Particles to become very close to each other and in this high density their configurations "fuse" to create new configurations. Here "**density**" is defined by having many Particles and accompanying Tap-pairs per volume.

Tap-pairs can arise in any Magnitude, but in the earlier chapter on evolution it was stated that it is likely that a Particle exists of identical Tap-pairs, because that gives the best probability on a stable configuration. Continuing along this line it looks logical that close encounters of Particles are more likely to "survive" (and not result in decay or catastrophe), when the Particles are similar or at least are built on similar Tap-pairs (mathematics is required to support this statement). Elaborating further on this, it can be stated that groups of Particles are likely to be more stable when they all are similar.

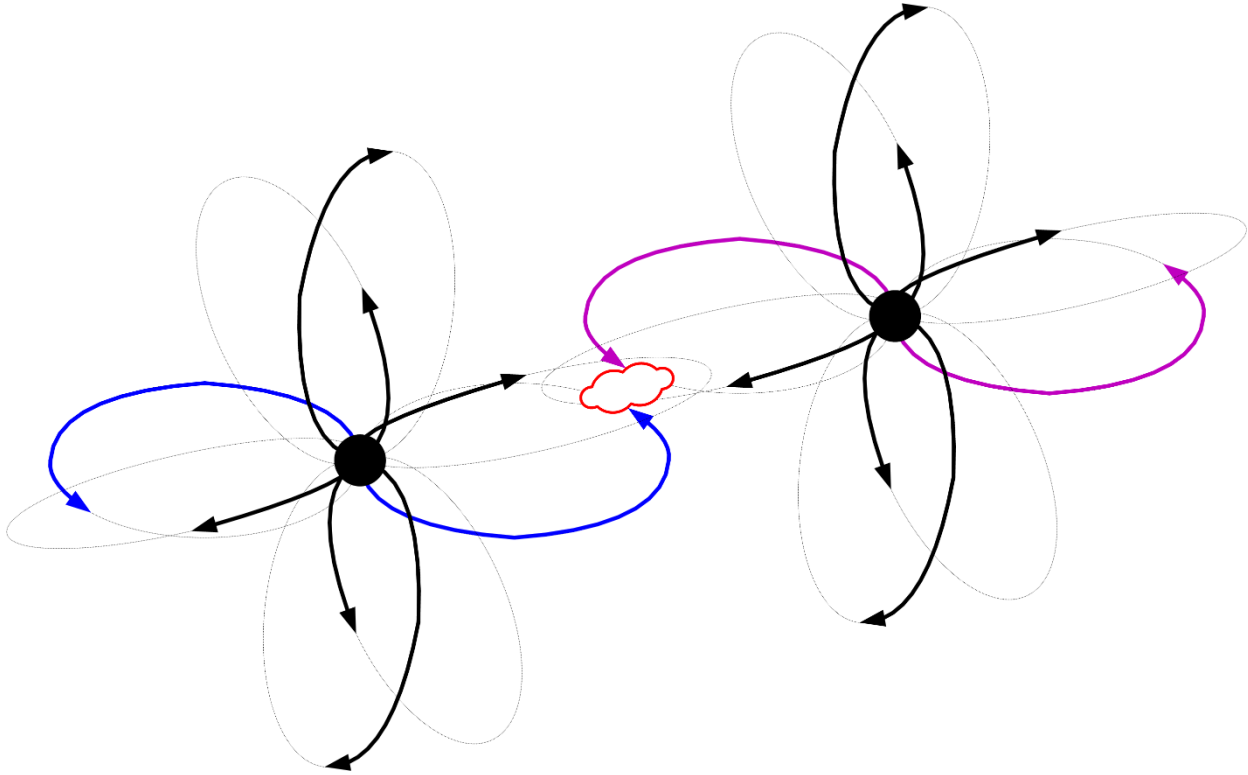
In the previous chapter it was stated that the universe "strives for" stable Particles. From the above it could be deduced that the universe also "strives for" not too many different Particles. After all, Particles that are different from the majority of Particles, are likely to decay, due to the fact that they are "less compatible" and thus cause more Panic upon close encounters.

It can thus be stated that the universe "supports" an evolution towards a limited number of Magnitudes of Tap-pairs and a limited number of Particles.

Divergent Magnitudes and aberrant Particles are of course very much possible, since there is no real reason why they should not occur or arise, but those "anomalies" have a higher probability to become outcasts upon encounters (literally). So it sounds logical that the universe favors the average and "discriminates against" the peculiar ones.

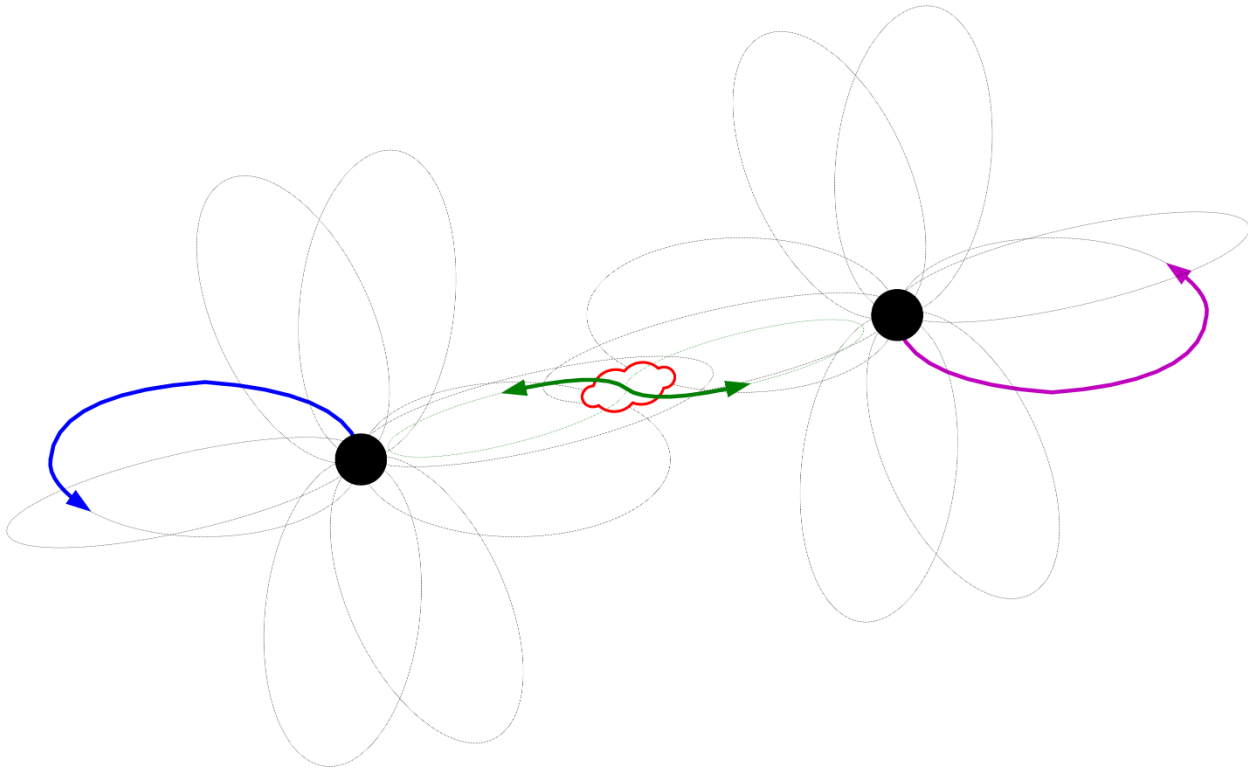
## 15. Force

As discussed earlier, a close encounter between two Particles may lead to disintegration of one or both Particles, but it is also possible that the encounter has a less devastating result.



The black spheres are two equal Particles, with clouds of Tap-pairs surrounding them. One of the Taps of the blue Tap-pair interacts with one of the Taps of the purple Tap-pair. To make the example not too complex, I assume that the blue and purple Tap-pairs are equal.

The resulting Panic leads to the arising of a Tap-pair that intends to rescue the Oops situation.



The green rescue Tap-pair is unequal to the blue and purple ones, since it has to solve the Panic situation rather quickly. It is obvious that the annihilation of the blue Tap with the left green Tap will be different than when that blue Tap would have annihilated with its original sibling. The same holds for the purple Tap.

It is logical to deduce that both different-than-expected annihilations have an impact on the Particles. This is the definition of "**impact**".

The situation drawn in the figure above is nicely symmetrical. There is of course also the possibility that for example the blue Tap-pair was more closer the point of its own annihilation, while at the same point in time the purple Tap-pair had only just arisen. In such a situation, the impact on the left Particle will be different than that on the right one.

Similarly, when the blue Tap-pair was unequal to the purple one, the impact both Particles will also be different.

So effectively a non-catastrophic interaction between two Particles leads to an impact on both Particles. This is defined as "**force**".

The effect of the "impact" can be that the distance between the Particles decreases or increases. Those are defined as "**attraction**" and "**repulsion**". Moreover, a combination of both can cause the original speed-vector of the Particles changes (the deltas, over time, in the three dimensions, with respect to each other).

As was discussed in the previous chapter, it is likely that the universe will mostly contain only a limited number of types of Particles (plus a tiny portion of different ones). This implies that there effectively will only be a limited number of types of force.

Earlier “speed” and “density” were defined. When, at a given moment, there is a large group of Particles in a certain space, then the average speed of the Particles with respect to each other can be calculated. Such an average can be defined as “**temperature**”.

When the temperature is high, the speeds of the Particles relative to each other is large. It is logical that in such a situation, the probability of close encounters increases. As a result, the likelihood of a wide spread Panic also increases. This in turn makes it more likely that more complex Particles tend to decay. The “evolution” mentioned earlier then makes it logical that in regions of high temperature, fewer different types of Particles remain (that is, on average, exceptions of course always remain possible). As a result, also the number of different types of force also is reduced. This gives an association with unification theories.

## 16. Field

When there is a group of Particles and this group is some distance away from another Particle, then it is likely that this Particle will interact with a number of the Particles of that group. When the separate Particle moves relative to the group, passing it from a distance, the probability of those interactions changes over time.

Effectively, the probability that force-events happen, changes over time. One can derive a mathematical formula for the change of this probability. That probability will then be dependent of the distance between the Particle and all the Particles of the group. When the group is close together, relative to the (larger) distance to the Particle, then the mathematical formula can be reduced in complexity, replacing the group with the approximation that it acts as if it is one large particle. The resulting formula will then describe the average force interacting with the Particle at a given distance. This is the definition of a “**field**”.

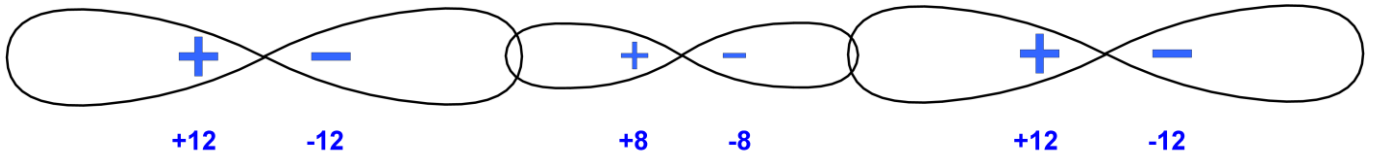
When the group is small, but the distance between the group and the Particle is still large, then the approximation is not really valid anymore. In such a situation one could use the definition of a “**pulsating field**”. This of course is not really a field anymore, it’s simply the addition of individual interactions.

## 17. Bridge

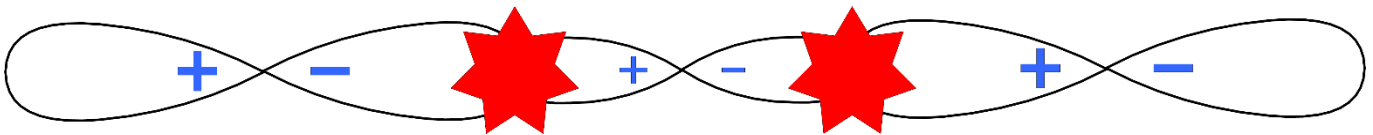
Interaction at a relatively large distance, as described in the previous chapter, is not trivial.



In the figure above, the “-” of the left Tap-pair will not likely annihilate the “+” Tap of the Tap-pair on the right. It is however possible that exactly in between a new Tap-pair arises:



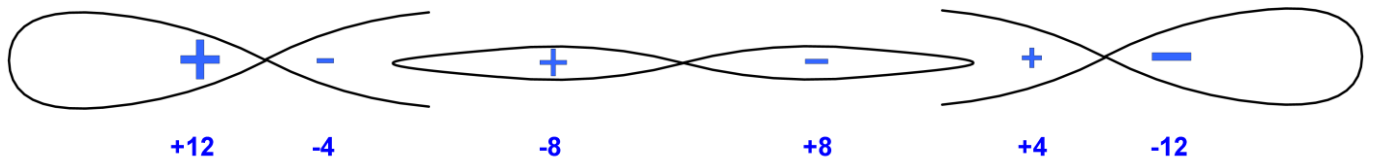
In this example, the original Tap-pairs on the left and right are equal, but the middle one is unequal to them. As a result of the arising of the middle Tap-pair, an Oops situation appears:



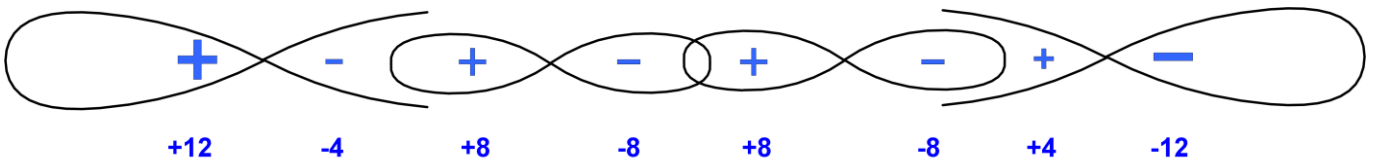
This results in Panic, with “leftovers” on both sides:



A logical solution would be that a rescuing Tap-pair appears:



However, this is very similar to the situation that caused the Oops situation in the first place. Moreover, the rescuing Tap-pair will have to be very quick, given the distance. A better solution would be the following:



(note that mathematical support would be very useful here).

This is defined as a “**bridge**”.

The net effect is that the original Tap-pairs can still interact, despite their relatively large distance. It is even likely that the interaction will have a larger "impact" than when the original Tap-pairs would have interacted directly (in a close encounter), because the "bridging Tap-pairs" will have to arise and interact very quickly. Moreover, in the example drawn here, there is a bit of "remnant" on both sides, which acts as a "free radical" (as described earlier) and which increases the Panic and its effect. A mathematical elaboration of the above would be great to support this concept.

So effectively it looks logical that the impact of interaction does not simply decrease with distance, as one might expect, but due to the bridges, interaction on a relatively large distance can have a larger impact than expected, possibly even a larger impact than a regular interaction in a close encounter.

The probability of the "bridge effect" taking place is not that large, since it requires intermediary Tap-pairs and a substantial "quick rescue action". It is clear however, that the bridge effect is likely to result in an increase of the effective net force / field on large distances. Supporting mathematics is required of course, but it looks logical that a force and a field do not simply reduce with distance, but remain stronger than e.g. a standard  $1/R^2$  law for quite some distance.

This somewhat counter intuitive effect has association with one of the results of the theory of Erik Verlinde, namely that gravity differs from the regular Newtonian formula on larger distances (with which he also removes the need for "dark matter" and "dark energy").

The "bridge effect" also has an association with quantum tunneling effect. On the one hand the bridge acts as a sort of temporary tunnel in spacetime, making interaction possible that would normally not be possible. On the other hand, the above discussion does not require a bridge to form a straight line in spacetime. As described earlier, it is possible anyway that spacetime itself is warped, leading to a warped bridge, but it would theoretically even be possible to have multiple bridges, sort of parallel, and this kind of constructions could (literally) bypass Particles that are "in the way". Due to this effect, the resulting interaction ( / force / field) would appear to "go through" the entities that lie in between.



## 18. Spontaneous creation

Since Tap-combinations can appear on any point in spacetime, it is likely that once in a while there will be some activity at any point in spacetime.

As a result, spacetime itself will be somewhat "restless". Especially in and around Particles, but also in denser groups of Particles, there will be more activity (Panic / conversions / ...) than in average spacetime. This is defined as an "**agitation**" level (of spacetime).

Among others due to interactions, force and fields, Particles and groups of Particles will be moving (relative to each other). As a result, the agitation level of spacetime might vary considerably in time. Moreover, agitation levels may add up or counteract, which is defined as "**interference**" of spacetime agitation.

It sounds logical that a higher agitation level implies a locally higher level of Panic, which in turn increases the probability of the arise of new Tap-pairs.

The higher the agitation level, the higher the Panic and the more likely multiple Tap-pairs will arise. When multiple similar or even equal Tap-pairs arise, the probability increases that a stable configuration occurs, resulting in a new Particle. This is defined as "**spontaneous creation**" of Tap-pairs and of Particles.

## 19. Re-creation

When a region of spacetime close to an existing Particle becomes highly agitated, there is a probability that the arising Tap-pairs cause decay of the Particle. It is theoretically possible that in that high agitation region, quite a few Tap-pairs arise that are equal to the Tap-pairs that made up the original Particle. In such a (rare) situation, it is conceivable that in the resulting multi-Panic situation, a new stable configuration of Tap-pairs evolves, next to the location of the original Particle, while at the same time the original Particle is unfortunate to get disintegrated in the process.

In such a situation, effectively a new Particle arises next to an original Particle, whereby the original Particle vanishes. To an outside observer this would appear as if a Particle suddenly as a whole moved a bit in space. Obviously this is not really true – the original Particle does not exist anymore and a new Particle has been created nearby.

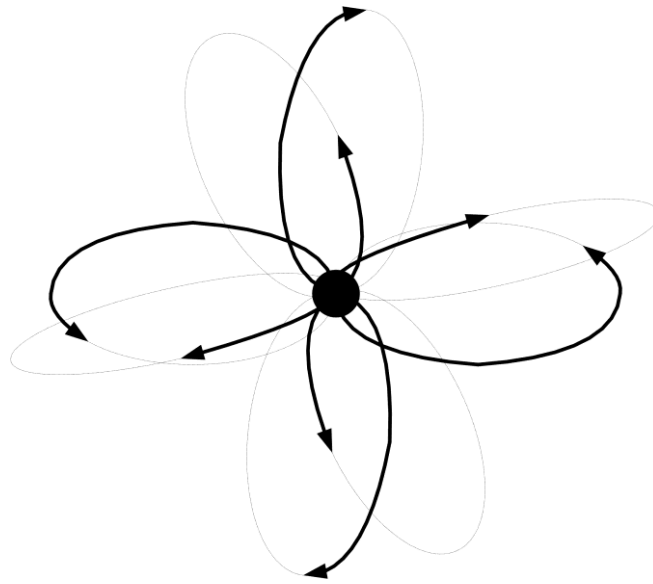
This kind of re-creation effectively "taps" energy from the agitation of the underlying spacetime and that energy is used for a net movement of a Particle in space.

This process of "net movement" of a Particle has an association with the "teleporting" concept of science fiction series like Star Trek ("beam me up, Scotty").

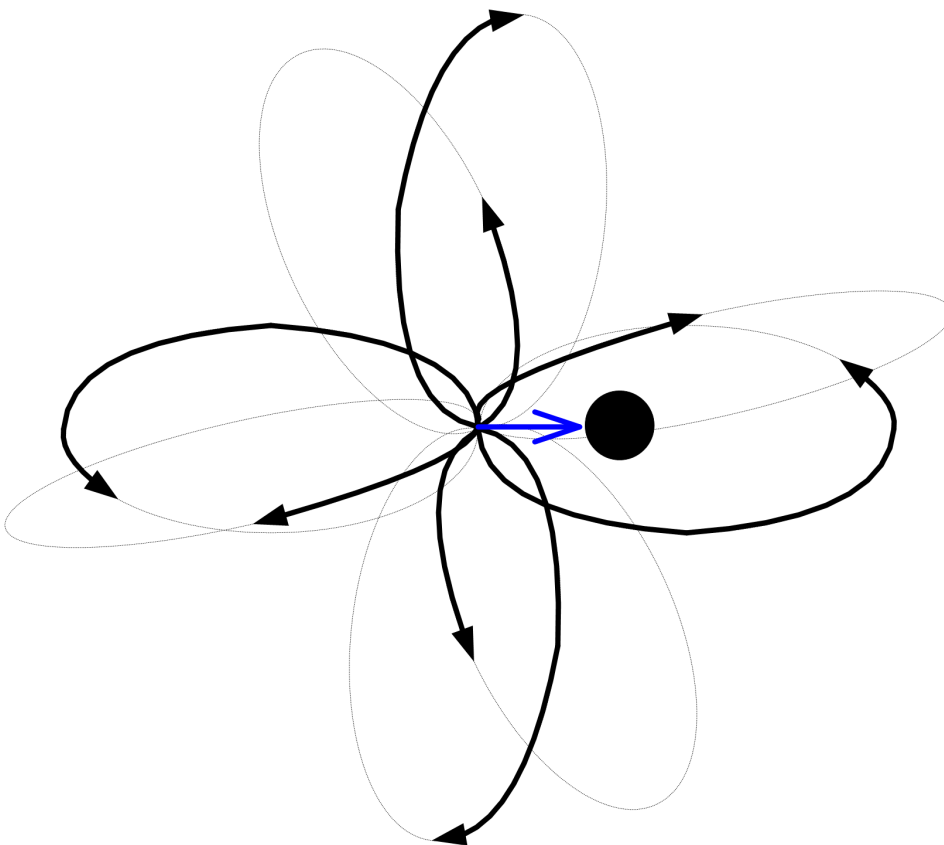
One could extrapolate this concept: if such a "transfer" from energy to "net movement" is possible, then the opposite might also be possible. That is, converting Tap-pairs and even whole Particles into an increase of the agitation level of the local spacetime. Since "everything is always in motion", it is not likely that such a transfer would be permanent, but to an outside observer it might appear as if a Particle is temporarily "cloacked". Since it is quite likely that the original Particle is moving relative to other Particles, the Particle could "uncloack" at a different point in space. This process of "cloacking" and "uncloacking" has an association with the same science fiction series.

20. Drag

It was stated earlier that it is likely that a Particle is surrounded by Tap-pairs.



When this Particle moves,



then the result is a lot of Panic, since the Taps that have trajectories in the direction of the movement of the Particle, will not find their twins at the expected spacetime points (I have twin daughters).

The multi-Panic is followed by a set of rescuing Tap-pairs, which in turn interact with the Particle. This generates a force and it looks reasonable that this force is "pulling" the Particle in exactly the other direction than which it is moving (mathematics is required to support this). This effect slows down the Particle and is defined as "**drag**".

## 21. The speed limit

It looks logical that the drag will increase substantially when the speed of the Particle increases, that is, when the Particle accelerates. Mathematics will have to confirm, but it seems logical that the drag effect resembles the concept of "slow mass" in Relativity Theory.

The higher the speed and especially the higher the acceleration, the more Panic will happen in the cloud around the Particle. It was stated earlier that the higher the amount of Panic, the higher the amount of energy / mass / charge /... A logical implication is: the higher the speed, the "heavier" the Particle will be (in terms of energy, mass, charge,...).

When the speed of the Particle approaches the speed of the Taps of the Tap-pairs in its cloud, then a Tap that moves in the direction of the Particle will almost not be able to break free and its twin on the other side will have lots of difficulties to catch up for its annihilation. A logical conclusion seems to state that the maximum speed of the Particle is the speed of the Taps.

Another solution to this issue is to change time and space. That is, time will "tick slower" and space will "become shorter" when the speed of the Particle increases towards the speed of Taps. Mathematics is very much needed here, but it seems logical that there is a limit to this "slowing down" and "shortening": eventually the time difference is zero and distance becomes zero (that is, "time stops" and "distances disappear", or "time and distance are not relevant anymore", or "spacetime is not relevant anymore").

Both solutions might be true, depending on how the situation is observed. It sounds logical that when the mathematics of the Relativity Theory is used, then both the maximum speed and the other solution could be valid. When observing as a relatively slowly moving observer, there seems to be a maximum speed for a Particle (namely the speed of the Taps), and when observing things from the viewpoint of a Tap, time and distance do not seem to exist – when a Tap leaves, it immediately arrives. Effectively it does not "travel", it is a "transition", time and distance are not relevant for it (it looks like a "tap sound").

The statement that time and distance are not relevant for a Tap (when observed from itself), implies that this holds for all Taps. Similarly, the statement that there is a maximum speed for a Particle, namely the speed of a Tap, implies that this maximum speed is equal for all Particles. This maximum speed is defined as "**c**". This has an association with the speed of light.

Note that above are statements about the speed of Taps. It was discussed earlier that not all Taps are equal, so the Magnitude of a Tap-pair (and therefore the energy in a Tap) is not related to its speed – all Taps move with speed  $c$ .

The association with the speed of light implies that it seems logical that the "fotons" that we humans observe, could well be Taps.

From the statement that  $c$  is equal for all Taps and  $c$  is the "speed limit" for Particles, one could use  $c$  as the basis for a measurement definition of spacetime.

## 22. Space and Time

In the previous chapter it was stated that from the viewpoint of the Tap itself, time and distance are not relevant – for a Tap they do not exist. To itself it is simply a “transfer”, from one to another, in a similar way that for the essence of the calculation “1+2” time is not relevant and “1+2” is simply a different representation of “3”. It is true that “1+2” can be “transferred” into “3”, but the word “transfer” is not really a good word for that, since in the mind of a human some amount of time is linked to a “transfer”, while that actually is not relevant here. A better definition would be the word “**transpose**”.

So according to that definition, the only thing a Tap does, is transpose. That is, from its own viewpoint. An observer that is not moving (or very slow, relative to c) does see the Tap moving: this observer sees a Tap-pair arising, sees a stable configuration forming a Particle, observes Panic and Spikes, and so on.

From the viewpoint of this slowly moving observer, Particles “are”, they “exist”, they interact, and so on. In that viewpoint time and distance are relevant. In that viewpoint, “being” is relevant – it was discussed earlier that the definition of “being” is based on the stable state of a Particle.

Time and space are only relevant from a non-Tap viewpoint. One could argue that spacetime emerges in that non-Tap viewpoint, since only then it becomes relevant – to be able to define Tap-pairs, interaction, Particles and so on.

One could argue that the concept of “stable”, necessary for a Particle to “be”, is an emerging phenomenon, arising from the spacetime-less realm of Taps.

As was state earlier, this “being” defines distance and time. One could turn this statement around: when there's no energy, no Taps, no “transposing”, then there cannot be Particles, but also, it is not relevant to talk about distance and time. Stated differently: without energy, there is no spacetime.

The fact that we humans exist as (slowly moving) observers, implies that there “are” things. This implies that energy, spacetime and all the other things exist as well (from our point of view). And as was stated earlier, it is thus logical that spacetime is “vibrant” and that energy and transposing is possible everywhere in the universe.

It was stated earlier that spacetime is warped, at least locally. As a result, it is possible that the universe as a whole is also warped. The universe might, as a whole, even have a “closed” form, we'll come back on that in a later chapter. It was stated earlier that spontaneous creation might be possible, so it could be possible that even a “closed universe” can expand. Or shrink, due to annihilations.

### 23. Quantization

Quite a few things that were described so far in this document are “fixed amounts” and as such could be defined as “**quanta**” or similar words. Tap-combinations consist of fixed amounts. Interaction was described as the exchange of fixed amounts. It was described that it sounds logical that some “evolutionary process” eventually leads to a limited number of Taps and Particles forming the majority of the universe. It was described that a field could act as pulsating at large distances. All these things could be described with words and phrases with “quantum” in it.

However, the concepts and discussions in this document have not yet provided a reason to talk about space quanta or time quanta. It is quite likely that the mathematical descriptions will contain a substantial amount of formulas that are quantum-like, that is, with a step-wise characteristic and not a continuous spectrum of possibilities. As a result, there might be formulas that contain time and space and that also contain this quantization (e.g. in the form of the Planck Length). However, an argumentation in that direction (so from concepts to the world of mathematics) does not “prove” that time and space have a quantum structure.

It is similar to using mathematics with Imaginary Numbers. The square root of minus one has no meaning in “real world mathematics”, but it is defined as “**i**”. Using that “imaginary number”, one can use mathematics in quite an elegant way to make complex calculations in trigonometry substantially easier. This is an example of using “out of the box thinking” to solve complex things. However, the fact that this works and is elegant, does not imply that the number  $i$  becomes real. It does remain an Imaginary Number. Similarly, all kind of things and concept of this document might have a “quantum nature” (it certainly looks logical to describe them in that way), but when this is done in a mathematical way and formulas appear that contain both quantization and spacetime, that does not imply that spacetime is quantized. One might discuss that quantization of spacetime emerges from the mathematics under the conceptual and logical reasoning, and it might even turn out to be consistent with results from experiments, but it might also simply be an interpretation, a way of looking at things. In fact, the latter might be true for many parts of this document.

## 24. Entropy

There are various definitions of the word "**entropy**", but many of them are related to the number of different states (or possibilities) a system can have.

During the first part of this document it looked as if there were an endless number of Taps and Particles and the like, which would result in a sheer endless entropy of whatever we're observing. Fortunately, in the discussion on "evolution", it became likely that most of the Taps and Particles and so on in the universe will eventually converge into a limited number of types. This limits the entropy considerably, although it still can be very large, because Tap-pairs arise and annihilate all the time. Moreover, entropy will be likely to grow over time, since it was argued that the universe is warped, changing and maybe even expanding, and during that extra Tap-pairs and the like are likely to arise, e.g. due to "bridges". It seems logical to state that when spacetime grows, the total amount of Taps grows, the total amount of interaction grows, the total amount of Panic grows, and so on, and effectively also entropy grows. It sounds logical to state that the amount of entropy is related to the amount of spacetime and of the "things and activity" in it (like Taps and force).

Verlinde focuses a lot on entropy in his theory. If I understood correctly, one of his statements is that a moving Particle is a displacement of entropy content of four-dimensional space. That sounds consistent to what was stated in the previous paragraph.

The idea of an expanding universe leading to a growth of spacetime, of "things and activity" within it and of entropy, gives an association with the Dreamtime, the sacred narrative of Creation that is seen as a continuous process that links traditional Aboriginal people (I have lead the didgeridoo group Yirr-ma for some 5 years).

## 25. Cosmology and inflation

In the theory of cosmological inflation, there is an exponential expansion of space in the early universe, immediately after the Big Bang. Quite a few theories exist that try to explain this. One of the challenges in this context is the word "exponential".

One of the first chapters stated that a Tap-combination can arise "from nothingness" and that they have a Magnitude. Associated with a larger Magnitude is a larger Panic. It was also stated that the larger the Panic, the higher the probability that a Tap-combination will arise.

The probability that a Tap-combination with a really very high Magnitude arises is not very high, but it's not zero. Such arising is associated with a local environment with a really very high Panic level. In such a situation, the probability is quite high that additional Tap-combinations arise and since the local Panic is really high, there's a reasonable probability that those new Tap-combinations also have a very high Magnitude.

The probability that the Taps of such Tap-combinations of really very high Magnitude reach a relatively high inter-Tap distance are quite slim, since they will have to "return their energy" very quickly (and as was stated earlier, all Taps have the same speed,  $c$ ). This implies that in a small area of very high Panic there will quite probably be a very high density of Tap-combinations of very high Magnitude.

As a result, the local Panic increases even more, which in turn increases the probability that really very high Magnitude Tap-combinations arise. It seems likely that within a very short time, a huge density of very high energy Taps arise within a very small space.

Due to this huge density, the probability of interaction will also become huge. Given the very high Magnitudes, the resulting forces and fields will also be huge. The accompanying impact of these interactions will also be very high. It sounds logical that these impacts slowly increase the size of the small space in which all of this is happening. An increasing volume with a really very high level of Panic, energy and activity, implies a high probability of an increase of the arising of even more Tap-combinations.

Besides Tap-combinations of very high Magnitude it is logical that also other Tap-combinations arise, with lower Magnitudes. The Taps of these will have more time to cover more space, that is, if they don't interact with other Taps in the hugely dense environment. So effectively, the "diameter" of the environment will increase somewhat. In outer regions the density will be less high and so will be the Panic level. The "edge" of the region will expand with a speed of at most  $c$ , since that is the speed of the Taps.

Mathematics is needed to support this, but it seems logical that there will be a point in time where the "impacts" within the center of the region have more effect than the arising of new Tap-combinations. It sounds likely that by that time, those impacts will have such a substantial influence in the region, that the "really very high Panic" part of the region will slowly expand. This will result in a slightly lower density and a slightly lower overall Panic level, which in turn will lead to a slight decrease in the rate of arising of new Tap-combinations.

It was stated earlier that force is an emerging phenomenon, it only happens when certain prerequisites are met (e.g. there have to be some Taps around) and even then, there only is a probability that it happens. So "force" happens after "arising". Continuing on this, "impact" is a result of "force", so "impact" happens after "force". This implies that when the amount of "arising" is slightly decreasing, the amount of "impact" will also slightly decrease, but only a little bit later. It sounds logical that this little bit of time will cause a slight expansion of the "very high Panic region".

It sounds logical that this expansion will slowly continue and as a result, the overall density and the overall Panic level will slowly decrease. That in turn will decrease the possibility of "arising" (in general), which will enhance the process of expansion and "cooling down". After a while, the overall Panic will gradually disappear and the "central region of high agitation" will slowly fade away. The net result is a large amount of Tap-combinations that is expanding, with a huge total Magnitude. Hereby, the "edge" of this "cloud" is expanding with  $c$ , the speed of Taps. After a while, the density and the agitation will become low enough to allow for the forming of stable configurations – Particles "condensate" in spacetime, and in turn Particles may form groups of Particles.

The process described here started off with only one Tap-combination, with a really very high Magnitude, a "perturbation" out of nothingness, one hugely intense "flash of light", it could be described as an almost Biblical event.

This whole story sounds like a Big Bang, with a short but very fierce period of arising of new energy, Taps, activity, and spacetime, followed by a period where Taps "rule" (which can be translated as a "period of only light"), next followed by a period where Particles "condensate", eventually followed the grouping of those Particles (which could be translated as "recombination epoch").

Mathematics will have to show whether or not this short period of really very high Panic indeed leads to an exponential expansion. It is very likely, however, that relativistic effects will be very important during this epoch. It does not look relevant to talk about "faster than c expansion", but given the huge energy levels it is very likely that spacetime is very heavily distorted during this period. From a standpoint of a virtual observer that is (almost) not moving, the time-lag will very likely be enormous, which has the net effect for this virtual observer that an enormous amount energy, activity, and with that, spacetime, is arising in a very short period. It sounds logical that it looks like a huge expansion plus a huge "creation" in a very short time, to this non-moving virtual observer. Mathematics will have to show whether the net result is indeed equal to or comparable to an exponential expansion.

## 26. Universe(s)

As was discussed earlier, it is likely that spacetime is warped. Continuing along that line, it is reasonable to assume that the universe as a whole is also warped. With the Big Bang process as described in the previous chapter, it is possible that the whole universe as we observe it, has arisen during that Big Bang. When that it the case, it is not relevant what was "outside" that expanding region. It seems logical to state that it is even not relevant to talk about "spacetime" outside that region. It seems logical that spacetime itself has arisen at the moment of the Big Bang.

This would imply that the universe as we observe it, "our spacetime", has an "edge", is "limited", one could say, "is closed". According to the described process after the Big Bang, it is expanding, but it remains "limited" and "measurable" (but also "variable", since Tap-combinations arise and annihilate throughout the whole spacetime).

It seems reasonable that a logical explanation for this very high level of Panic at the moment of the Big Bang, is that it was caused by some high level of "agitation" just before the Big Bang. That would imply that there was "something" before the Big Bang. However, it sounds logical that all information and evidence on that "something" has been erased by the process of "arising" directly after the Big Bang. That is a bit unfortunate.

Moreover, the universe as we observe it has arisen at the Big Bang, as a combination of energy, interaction, spacetime and so on. From our standpoint as observers, spacetime started there and thus from our view, it is not relevant to discuss experiments that might shed light on what was before the Big Bang. That is also quite unfortunate.

This discussion is an example of a theory for which one can prove, that it cannot be proven. However, it is of course still possible to discuss and use "thought experiments" to come up with logical deductions. And that is exactly what was the intention of this document.



## 27. Next steps

This document presents a lot of ideas and concepts and tried to specify them in a logical manner. As stated in the beginning, it is not the intention of writing down "the truth", the goal is to initiate discussions. My hope is to make the whole more robust and thorough. Even then it might still look like a "house of cards", by then it might be quite a solid one and hopefully also an elegant one.

An important prerequisite for this is the supporting mathematics. It would be great if assistance could be obtained from people that both have sufficient knowledge of mathematics and have a sufficiently "open mind" to help taking this document to a higher level. When substantial steps are taken in that direction, it seems logical to eventually create scientific articles on that (together). Until that time:

Feel free to react and discuss...!