Subject: Science

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Broken Symmetry

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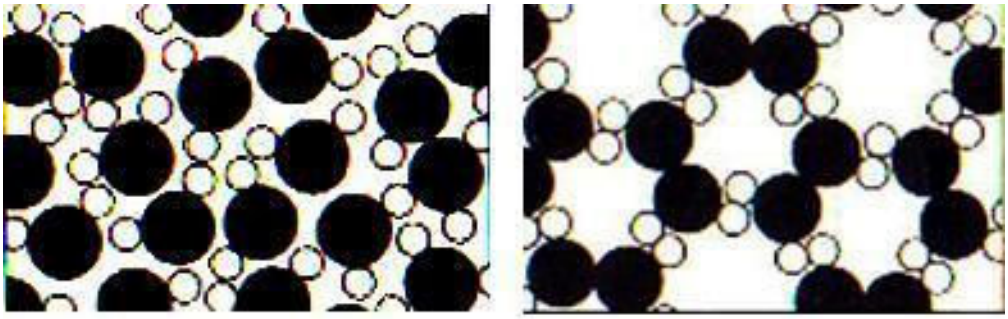
Symmetry can be either explicit, meaning obvious and exact, or implicit, meaning approximate and hidden. Explicit symmetry can be seen easily in systems created by the human mind, such as geometry, mathematics, music, architecture, poetry, language and painting. Examples of explicit symmetry in nature are rather few. If we look closely to such objects we will find irregularities that will break the exact symmetry. Examples are; stellar objects such as the sun and the moon as well as the pupil of the eye have circular symmetry. The atomic formations within crystals have a translational symmetry and snowflakes have a 60 degree rotational symmetry.



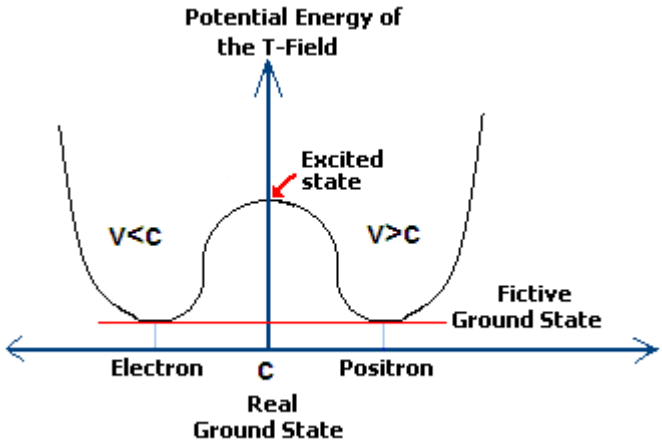
Water Ice

At first glance water seems to be irregular and chaotic while ice has an apparent symmetrical structure. Although water has no explicit symmetry it has a hidden translational and rotational symmetry. You can shift your attention in any direction and you will find self similar patterns of water (H_2O) molecules. The symmetry of water is implicit or rather hidden.

Almost all natural systems, structures and formations contain a hidden exact symmetry. The hidden exact symmetry of the universe is broken at all scales

because of infinitesimally small fluctuations exist inherently within its structure. These fluctuations have been discussed in the previous chapter. Although it is counterintuitive we have to accept that disorder is more symmetric than order. This is because small variations in disorder do not change the overall structure. But when small variations reach a **critical point**, then suddenly a new order appears. We can say that at the critical point the hidden symmetry suddenly becomes apparent and disorder transforms into order. This effect will be discussed in the next chapter.

The T-field discussed in the present universe model can be defined as T(**û**), where **û** is a 4-dimentional vector attached at each point of the field and points in a given direction. At its lowest energy state (ground state) the T-field is **chaotic** and contains a **hidden symmetry**, in the sense that the chaotic structure does not change from one region to the other. The quantum fluctuations are homogenous all over the field. At the critical point a sudden change happens and the symmetry of the T-field is suddenly broken. This sudden quantum jump is called in physics "**Spontaneous Symmetry Breaking**".



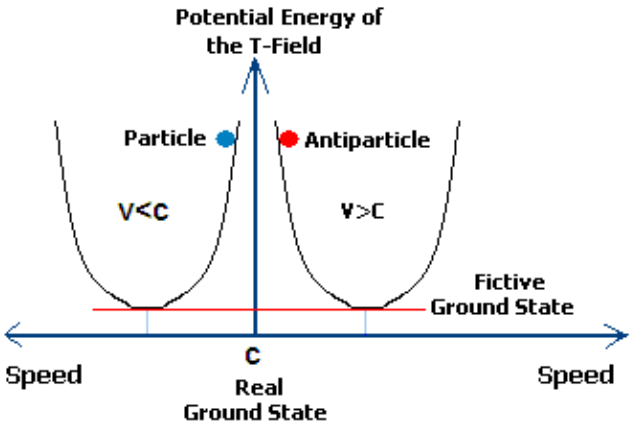
In the graph above, the potential energy of the electron-positron pair becomes excited and reaches a critical point, which is unstable. Under the effect of an infinitesimal quantum fluctuation –a small perturbation- the symmetry is suddenly broken, and a stable electron as well as its antiparticle the positron, are created. Although both particles are stable their ground state energy is fictive due to their mass. The "**real**" ground state is at the origin, where the potential energy of the T-field is infinitesimally small, but not zero. At this "real-ground-state" the particle aspect disappears but the wave aspect prevails. This is why the electromagnetic waves have no mass but a quantized energy, given by the equation E = hf. The speed at this real ground state has to be the speed of light.

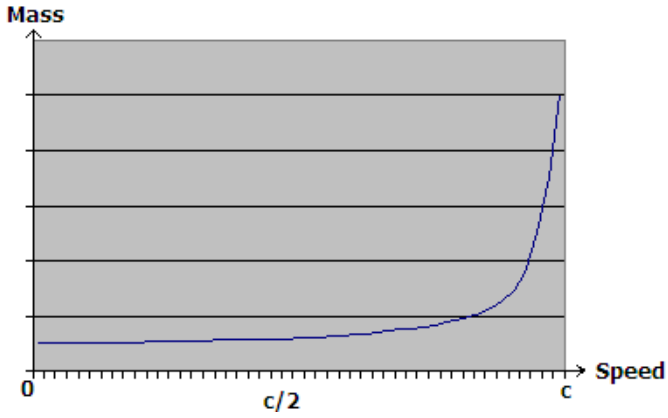
If we want to speed a massive particle we have to increase its energy. Since the particle and its antiparticle are linked through the intermediary of a T-wave we can only increase the energy of the common excited state. This will result in an increase of the mass of the particle -since mass and energy are equivalent- as

shown in the graph on the left side below. The graph on the right side is the plot of the relativistic mass as derived in the Special Theory of Relativity (STR).

In the equation below M is the relativistic mass and M_0 is the rest mass of the particle. The STR tells us that:

$$M = M_0 / (1-v^2/c^2)^{½}$$





We see that the speed of light c can never be attained but can only be approached asymptotically. This situation is valid in both models. When the particle and its antiparticle are close enough to the speed of light the antiparticle will cross over the boundary and will be observed in our universe. This effect is called the "**Tunneling Effect**". When this happens both particles will unite at the boundary and will disintegrate by transforming into photons.