Relativity in a Virtual Universe, a Simulation Hypothesis

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The Simulation Hypothesis proposes that all of reality is in fact an artificial simulation, analogous to a computer simulation, and as such our reality is an illusion. It is predicated upon the assumption that enormous amounts of computing power are available. In this paper I outline a geometrical approach to relativistic motion at the Planck level that maps virtual particles within a non-relativistic expanding 4-axis hyper-sphere (time and motion are constants) and then projects the particles onto the 3-axis hyper-sphere surface. As such it is not necessary to compute the relative position and motion of each particle with respect to each other. By using Lorentz formulas to translate between the hyper-sphere co-ordinates and the particle 3-axis surface, relativity resembles the mathematics of perspective.

Keywords: Simulation Hypothesis; Relativity; Virtual Universe.

The Simulation Hypothesis proposes that all of reality, including the earth and the universe, is in fact an artificial simulation, analogous to a computer simulation [1] and is predicated upon the assumption that enormous amounts of computing power are available. By assigning oscillating virtual particles a constant motion (the speed of light) within an expanding (in incremental steps) virtual hyper-sphere and then by simply projecting only 3 axis of the hyper-sphere, we can simulate relativistic 3-D space.

1. Premise

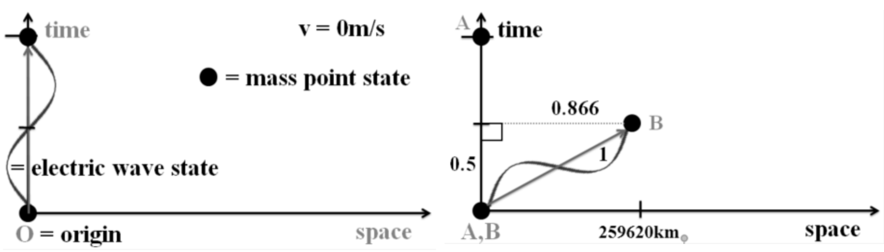
(1) A Virtual Universe is initialized as a 4-axis 'hyper-sphere' that also expands incrementally (n = 1, 2, 3…) [2]. This expansion gives the universe a time reference which can be translated into units of Planck time t_p. As this expansion is omni-directional (expanding outwards) the simulation has an 'arrow-of-time'.

(2) Particles are assigned mass, wavelength, frequency and an N-S spin axis. They oscillate between a Planck-size 'point' state (which occupies $1t_p$) and an electric 'wave' state (the particle frequency as measured in units of t_p). During the wave-state the particle expands into an area equivalent to the particle wavelength (it is stretched out by the hyper-sphere expansion). At the completion of 1 frequency cycle the particle collapses into the point-state which has a defined position within the hyper-sphere, represented as a Planck mass m_P black hole. The oscillation process then repeats, driven by the expansion of the hyper-sphere, particles do not have any inherent motion of their own [3].

2. Space-time

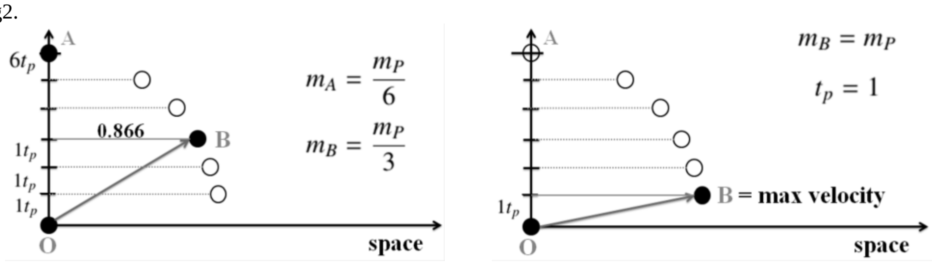
Here I place particle **A** onto a space-time graph. Although **A** does not move in space (v = 0), it does move in time (vertical axis). I then add a 2nd particle **B**, v = 0.866c. After 1s **B** will have travelled 0.866 × 299792458 = 259620km from **A** along the horizontal space axis.

fig1.



Particles **A** and **B** both have a frequency = 6 ($5t_p$ in the wave-state then $1t_p$ in the point-state). As the **A** point-state occurs once every $6t_p$, the mass of **A** = $m_P/6$, however the point-state of **B** occurs after $3t_p$ and so mass = $m_P/3$ (left). On the next diagram (right) **B** ($v = v_{max}$, mass = $m_P/1$). As each step on the time axis involves $1t_p$, there are 6 possible velocity solutions to **A** and **B**, this also means that **B** can reach Planck mass m_P (right), but **B** can never reach the (horizontal) speed of light *c*.

fig2.



Note: The vertical axis would be measured as $1/\gamma$. For a particle that has only 6 divisions (6 steps from point to point), the maximum $\boldsymbol{\gamma}$ = 6. To determine the maximum velocity that a particle can attain (y-axis = v/c) we simply calculate when that particle will have reached Planck mass, because from there it can go no faster. A small particle such as an electron has more possible divisions along the vertical axis and so a higher possible $\boldsymbol{\gamma}$ and so can go faster in 3-D space than a larger particle such as a proton with a smaller $\boldsymbol{\gamma}$ (a smaller number of divisions).

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

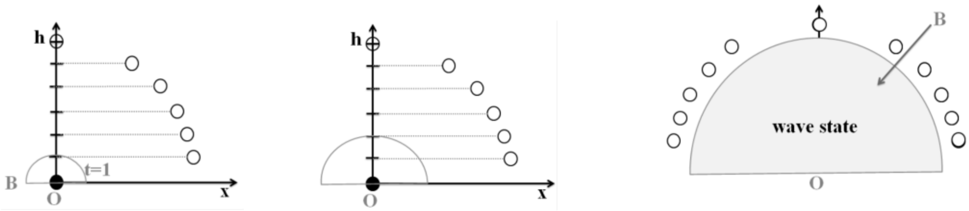
· If Planck mass = electron mass * gamma ($m_P = m_e * \gamma_{electron}$) then $\gamma_{electron} = m_P/m_e$

· If Planck mass = proton mass * gamma ($m_P = m_p * \gamma_{proton}$) then $\gamma_{proton} = m_P/m_p$

3. Virtual Universe

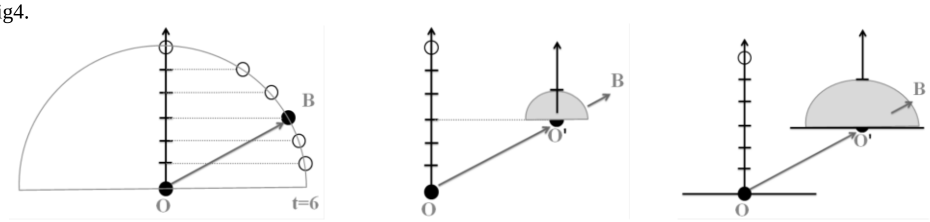
We now replace the space-time graph with a 4-axis co-ordinate system (*h*, *x*, *y*, *z*), for simplification are shown only the (*h*, *x*) axis. The semi-circle depicts particle **B** at some arbitrary universe time *t*. **B** begins at origin **O**, *t* = 1 (left) and then is pulled along by the virtual universe expansion; *t* = 2 (middle), *t* = 6 (right).

fig3.



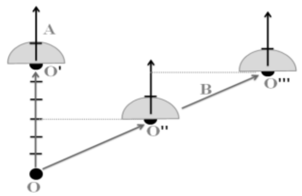
At *t* = 6, **B** collapses into the point state and now has a defined co-ordinate position which becomes the new origin **O'**, the above process repeats ad infinitum (*t* = 7, 8, …).

fig4.



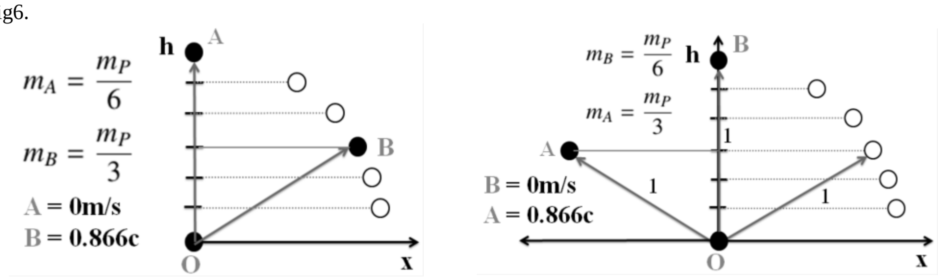
The process also repeats for **A**.

fig5.

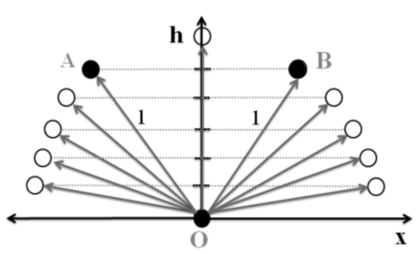


In the space-time examples I depicted a graph where for **A**; $v = 0$, mass = $m_P/6$ and for **B**; $v = 0.866c$, mass = $m_P/3$. However in the (h, x) graphs we find that the lengths **OA** = **OB**, this is because the hyper-sphere is expanding radially, not vertically and the radius = wavelength of **A** = **B**. As a consequence **B** can rightly claim that it is **A** whose velocity is at $v = 0.866c$ and for **B** velocity $v = 0$ (radius $r = 1$ refers to 1 wavelength).

fig6.



Both **A** and **B** are travelling at the speed of expansion (which translates to ***c***) from the origin **O**. In the virtual coordinate system everything travels at, and only at, the speed of expansion as this is the origin of all motion, particles and planets do not have any inherent motion of their own, they are simply pulled by this expansion. After 1 second both **A** and **B** will therefore have traveled the equivalent of 299792458m in virtual co-ordinates from origin **O**. Each of the 11 depicted solutions are equally valid, there is no distinction between them as the radius (**A** and **B** particle wavelength) is the same.



Besides mass, wavelength and frequency, particles have an N-S spin axis. As the universe expands, it stretches particle **A** (position and motion of **A** are undefined). When $t = 6$, the wave state collapses to the defined point state, as represented by the N. This means that of all the possible solutions, it is the particle N-S axis which determines where the point state will actually occur. Thus if we can change the N-S axis angle of **B**, then as the universe expands the **B** wave state will be stretched as with **A**. But the point of collapse will now reflect the new N-S axis angle. **B** does not need to have an independent motion; **B** is simply being dragged by the universe in a different direction as the universe expands. We can simulate the addition of a physical momentum to **B** by simply changing the N-S axis. The radial universe expansion does the rest.

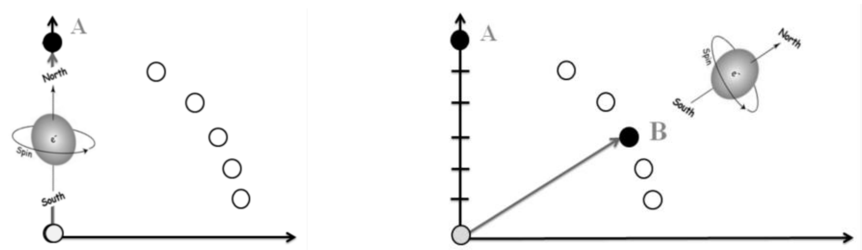


fig7.

Here I depict 3 particles **ABC**, each with the same wavelength, being pulled by the radial expansion in different (N-S axis) directions.

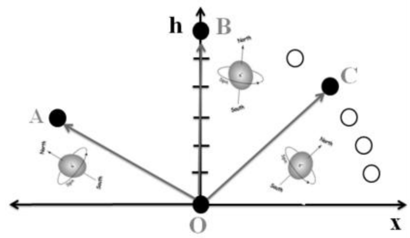
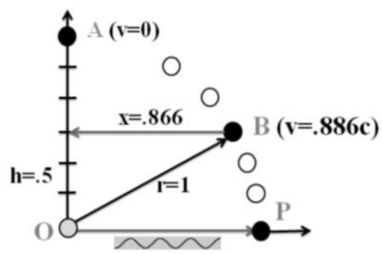


fig8.

fig9.



Information between particles is exchanged by photons. Adding momentum to a particle changes its N-S axis and thus its angle of motion. Adding momentum to a photon changes its frequency. Thus light cannot travel through time but retains the time-stamp of the particle that emitted it. At **O**, particle **A** emits photon **P**. It travels horizontally at the speed of light.

If we emit light from a stationary object then the frequency of the light = $\boldsymbol{f}_{\mathbf{v=0}}$. If we emit that light from a fast moving rocket $\boldsymbol{f}_{\mathbf{rocket}}$ then an observer will notice a (relativistic) Doppler shift. As on our x-axis length $\mathbf{x = v/c}$, on the h-axis length $\mathbf{h = sqr(1^2 - x^2)}$.

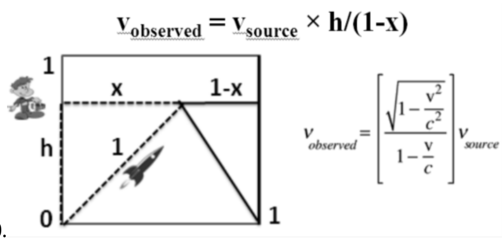
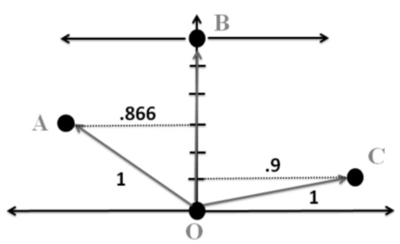


fig10.

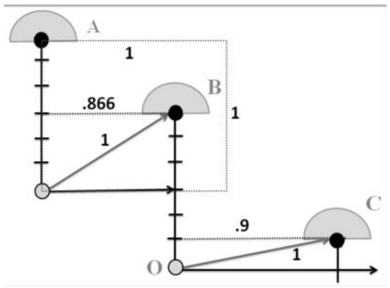
fig11.



Returning to our **ABC** particles, as information can only be exchanged along the horizontal axis which are the (*x*, *y*, *z*) axis, **ABC** will only 'see' this horizontal information. Instead of **OA**, **OB** and **OC**, the (*x*, *y*, *z*) axis will be able to measure only the horizontal **AB**, **BC** and **AC**. Thus although in Virtual Universe co-ordinates mass, velocity and wavelength are constants, when projecting only the (*x*, *y*, *z*) axis, particles **ABC** will see only the horizontal (**AB**, **BC**, **AC**) co-ordinates (representing 3-D space). Furthermore time for **ABC** translates as motion, without motion in the (*x*, *y*, *z*) axis there will be no means to measure time, thus the dimension time for the **ABC** world derives from simulation time and may equate to simulation time (as measured in units of Planck time) but it is a measure of particle motion and not the simulation time itself.

We can also place **A** in the center by combining an **AB** diagram with a **BC** diagram

fig12



In summary, by using that expanding virtual hyper-sphere artifice, particle mass, velocity and wavelengths are constants, and motion and momentum are functions of the hyper-sphere expansion via the particle N-S axis and so we avoid the requirement to compute relative position and motion. Instead we need only project the (*x*, *y*, *z*) axis onto our computer screens to achieve the desired effect, the simulation of relativistic motion. Relativity reduces to the mathematics of perspective, the (*x*, *y*, *z*) relativistic universe embedded within the absolute (virtual) universe.

We may construct a black hole inside our simulation using the same artifice. As only 3 axis can be seen externally (from astronomers outside the black hole), the black hole will be interpreted in terms of surface, the more planets and hapless astronauts (information) that fall into the black hole, the greater the surface area (information) of the black hole, however describing the inside of the black hole is meaningless as this cannot be measured. The analogy being a soap bubble, adding more soap increases the surface area of the bubble, but not its (soap) volume.

4. Gravity

If we set 1 point-state = 1 unit of Planck mass then we can solve gravity as a point-state to point-state interaction, the gravitational coupling constant $(m_e/m_P)^2$ simply reflecting the probability of any 2 particles being simultaneously in the point-state for any particular unit of time. Gravity could then be assigned the same magnitude as the strong force (it would appear weak but that is simply because in this context it seldom occurs, electron frequency = $m_e/m_P = 0.418489 \times 10^{-22}$).

For example, at any unit of Planck time, the earth mass; $m_{earth} = 5.972 \times 10^{24}$ kg = 2.7454 10^{32} m_P (points), a 1kg satellite; $m_{satellite} = 45940892$ m_P (points). We then assign an orbit between every m_P point-state on the earth with every m_P point-state on the satellite, the number of orbits = 2.7454 $10^{32} \times 45940892 = 0.126 \times 10^{41}$. This is equivalent to the gravitational coupling constant albeit using the earth and a satellite.

We reduce our planet and satellite to 2 equivalent sized black holes, therefore we measure the distance between the earth center and the satellite center. For a satellite on earth, radius r = 6370km and so orbit = $2\pi r$ = 7.485 Hz. If we send the satellite from earth into a geosynchronous orbit, r = 42164km, orbit = $2\pi r$ = 1.132 Hz, and the change of energy = 7.485Hz - 1.132Hz = 6.354Hz = $.421\times10^{-32}$ J.

As we have 0.126×10^{41}orbitals, the total energy required to lift our satellite = $.421\times10^{-32} \times 0.126 \times 10^{41} = 0.53\times10^{8}$ J/kg.

If these orbitals are aligned, the satellite will follow a circular path around the earth, if they are unaligned the satellite will drop towards to earth, if they are semi-aligned the satellite will follow an elliptical path. Gravitational kinetic energy and potential energy reduce to measures of this alignment.

The merit with this approach [4] is that we already have mapped out the information we need regarding the particle point-states.

References

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