On the nature of Time

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Let us postulate an expanding (black hole) universe with a contracting (white hole) twin, this dual expansion and contraction occurring via an exchange of angular momentum.

Let us further suggest that the Planck units are geometrical shapes or forms constructed from this angular momentum. We may use the analogy of a tall building under constant construction, where each completed floor represents a unit of Planck mass, Planck volume and Planck time and "2.c" representing the speed of construction (addition of new floors). We cannot see the actual construction of each floor; however we can observe the completed (Planck) floors.

Such that at the big bang (the 1st "floor"), the universe comprised a single unit of Planck mass, Planck volume and Planck time… after the completion of the 2nd "floor", the universe comprised 2 units each of Planck mass, Planck volume and Planck time. In other words, this universe is expanding by 1 unit of Planck mass and 1 unit of Planck volume per unit of Planck time. First we must justify this premise by comparing a theoretical (Planck) mass density with the observed (NASA) density of dark matter.

Universe mass density:
Assume the universe is 13.7billion years old. If age is measured in seconds then Planck mass * age / Planck time **(kg*s / s = kg**) gives us the mass of the universe in kg (using m[d], t[d] and l[d] to represent this Planck mass, Planck time and Planck length). Note: this is a geometrical solution.

$$mass = 2\,\pi\,r$$

$$r = \frac{m_d\,age_{\mathrm{sec}}}{t_d}$$

From velocity * age **(m/s * s = m**) we can calculate the volume of the universe – presuming that **2.c** is the (constant) speed of the expansion of the universe.

$$volume = \frac{4\,\pi\,r^3}{3}$$

$$r = 2\,c\,age_{\mathrm{sec}}$$

Mass density = mass / volume.

$$mass\_density = \frac{3}{16}\,\frac{m_d}{{age_{\mathrm{sec}}}^2\,t_d\,c^3}$$

Replacing Planck time with Planck length

$$mass\_density = \frac{3}{32}\,\frac{m_d}{\pi\,{age_{\mathrm{sec}}}^2\,c^2\,l_d}$$

The age of the universe is estimated to be 13.7 billion years, converted to seconds…

"age = 13.7e9 * 365.25 * 24 * 60 * 60 = .432e18 seconds"

$$mass\_density = 0.24\ 10^{-26},\ units = \frac{kg}{m^3}$$

When the universe had just began (1st unit of Planck time / space / mass):

$$mass\_density = 0.38986318647748\ \ 10^{94}$$

From the Friedman equation, converting G to Planck units and using p = mass density (above);

$$G = \frac{l_d\, c^2}{m_d}$$

$$\lambda = \frac{3\, c^2}{8\, \pi\, G\, p}$$

$$\lambda = 4\, c^2\, age_{\text{sec}}^{\ \ 2}$$

$$\sqrt{\lambda} = 2\, c\, age_{\text{sec}}$$

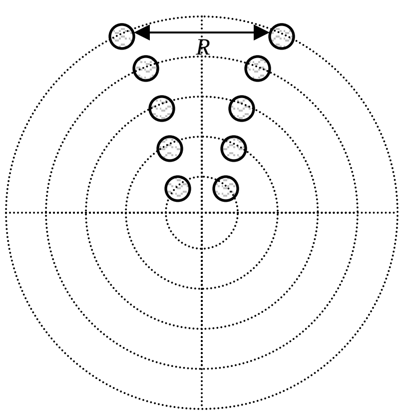
This lambda (Hubble parameter) is simply the radius of the universe.

WMAP determined that the universe is flat (map.gsfc.nasa.gov) and it has an equivalent mass density of **.99e-26** kg/ m^3. Of this total;
4% atoms
23% cold dark matter (**.23e-26** kg/ m^3)
73% dark energy.

The result, **"0.24e-26** kg/m^3**"** for age = 13.7 billion years coincides with NASA's (**.23e-26** kg/ m^3) dark matter suggesting that dark matter may be simply the mass density of the universe.

It has been observed that galaxies are moving apart at an accelerating rate, re: dark energy. If the universe is physically growing (and not merely expanding), then "dark energy" is not required.

The following diagram shows 2 galaxies, initially the galaxies are close and the gravitational force is strong



…however as the universe grows, it tends to pull them apart… until finally the distance between them – and so the gravitational force – is so weak that they follow the expansion of the universe independently of each other… they may appear to be accelerating away from each other - but it is simply that gravity can no longer hold them together.

Our time:
Motion is imparted to particles by this constant addition to our universe of angular momentum. Without this growth, all motion (the motion of all particles) would cease. This is time as we see it, the movement of the leaves in the wind, the hands of a clock, movement of traffic…

We look at a metal bar and say – this is 1 kg or this is 1 meter. We cannot point at a clock and say – this is 1 second. Our perception of time arises from the observation of the frequency of 1 event in reference to the frequency of another event…I measure my heartbeat at 65 beats a minute where 1 minute is 1 revolution of the second hand on my watch.

If the universe ceased expanding, there would be no movement… and there would be no means to mark the passage of time… for there would be no passage of time to mark. Our dimensions are time and velocity (rather than space-time), for these are the dimensions of motion, reflecting this momentum.

What the universe defines as time, and from which derives our unit “the second”, is the frequency of the “primary” event of the universe and not the time (i.e. motion) that we perceive. Literally 1 second is 10^{43} occurrences of an event we call Planck time.

Particles therefore are in constant motion, driven by this expansion of the universe with each unit of Planck time referring to a discrete entity (as the individual frames of a film).

The forward “arrow of time” therefore derives from the expansion of the universe… for the event we call Planck time follows this expansion…

The events of the universe lie along this time axis… this axis being that which links these events to form the story, the story of the universe. Time becomes time-line.

The internal “duration” of a unit of Planck time (what happens between frames) may involve many complex steps, but these we cannot see.

Time dilation:
If we replace space-time with velocity-time, then distance (space) is dependent on motion. 1 second is presently defined as the duration of 9,192,631,770 “ticks” of a cesium atom. The number of units of Planck time required to generate a single tick of that cesium atom will depend on the velocity of that cesium atom. A cesium atom traveling at a near light speeds will require more units of Planck time to generate 9,192,631,770 “ticks” than would a cesium atom at rest.

In other words, if we compare a moving cesium clock to a cesium clock at rest, the moving clock will show less time has elapsed. Planck time has not changed; the universe continues to expand at a constant rate… the only difference is that now it takes more units of Planck time for the cesium clock to do whatever cesium clocks do to generate those ticks.

Planck time is constant, our second is not.

Note: Space limitations prevented a mathematical description of time dilation. I would also have liked to include a discussion on time as it relates to wave-particle duality and the principal quantum number n. The above text was taken from an analysis of the geometry of angular momentum… an outline of which can be found at www.platoscode.com (www.platoscode.com/theory).

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