Laws for World Cycle

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The concept of events repeating in identical cycles is strong enough to call for reformulation of known or accepted physical laws. The accepted corpus of physical laws is based on small space-time intervals, and implicitly assumes linear time. This approach even yields results which agrees quite well with experimental results. This is because for small time intervals, curvature of time may have only a small effect, and so may get hidden in error band of experimental result. It could therefore be neglected, as a first approximation. However, we are interested in behaviour of matter over a long time intervals, or rather over a time interval equaling the complete time cycle. Hence, we cannot apply linear time laws and expect to get repetition of events in identical cycles. So 'what must be laws for world cycle', is the question that this paper addresses. Formulation of such laws is a first step towards a new physical theory, whose experimental confirmation would give scientific grounding to the world cycle concept. This would propel other branches of knowledge - biology, geology, genetics, history, linguistics, astrophysics and astronomy, towards new paradigm of 'world cycle', and usher in a scientific revolution, along the lines visualised by Thomas Kuhn in his book "Structure of scientific revolution".

While, people in past have come to conclusion of possibility of universe repeating in identical cycles, nowhere, a scientific or rational attempt to estimate the size of time cycle has been made. Among the modern physicists, Poincare, championed the cause of an eternal cosmos repeating itself in identical cycles, however, he could only establish what is now called asymptotic recurrence. What this means is that given a system of finite number of particles, in a finite volume, the positions and velocities of all particles will be observed to repeat, if one waits for a sufficiently long time. This long time, could be even infinite - hence the name asymptotic (tending towards infinity) recurrence. Time period for recurrence is called Poincare period. An attempt to apply this idea to the whole universe, given the present state of knowledge of dynamical laws governing particle motions and interactions, yields astronomical high figures, of the order of billions of years at least. However, this cyclic time picture is not in complete accordance with Godly Knowledge propounded by Brahma Kumaris - because the recurrence period in Godly Knowledge is only a few thousand years.

Correspondence Principle.

What must be the relation between laws in cyclic time and linear time? Clearly, linear time can be regarded as a special case of cyclic time, with time of repetition being infinite. This can be geometrically visualized as follows. Cyclic time is represented as a circle and linear time as a straight line. Now imagine the straight line touching this circle. As the size of circle increases, it gets closer and closer to the line. In the limit when the radius of circle becomes infinite, it coincides with straight line. This is well known geometrical result, that a line can be regarded as a circle of infinite radius. This suggests following correspondence principle between cyclic time and linear time -

Laws of cyclic time should tend towards those of linear time, as the size of time cycle tends to infinity. This limit may be termed the linear time limit. This gives a clear clue to cross-check formulation of cyclic time laws, i.e., they should match the presently known linear time laws, when the size of time cycle is made infinite.

It should be clear to reader, that above correspondence principle is a most natural guiding light on this research. Other laws which follow naturally are discussed below.

Laws for Cyclic Change.

Recurrence of all events in a finite time, means that the original configuration of universe is restored. This recurrence in finite time, is different from Poincare's asymptotic recurrence, which is based upon conventional dynamics. The right approach to solving the finite recurrence problem is, to re-work the behavior of particles, adopting the finite recurrence idea as a hypothesis or postulate. This yields the following dynamical laws for finite recurrence, in time period T , on which one would have to base one's equations of motions, and particle interactions -

1. All particles return to their original position, with original velocity, acceleration etc., at the end of time cycle. This law is fairly straight forward. It also implies,
(a) All particle paths are closed,
(b) Time taken by all particle to complete their closed paths is equal to recurrence time.

2. Total change of any particle over a single time cycle is zero. That's how, the particle would have the initial momentum, energy etc., at the end of time cycle.

3. Change in movement from Point A to Point B on time cycle is inverse of change in movement from Point B to Point A. This time movement is unidirectional. Thus total change over cycle is zero.

4. Consider the case when Point A is very close to Point B, so that they are infinitesimally close to each other. Thus the distance between A and B is infinitesimal, while the distance from B to A is equal to complete time cycle. The change between A and B can be regarded as instantaneous change. It follows from law 3 above, that this instantenous change is reverse of change during rest of time cyle. This change could be in anything - energy, momentum etc., of a particle, during a collision or interaction and is negative of the change undergone, throughout the rest of the time cycle. That's how the total change in the complete time cycle would be zero. This is an important constraint in cyclic time, but is missing in linear time.

These laws appear to yield a basis on which a new physics compatible with new Spiritual Knowledge can be developed.

Links between space and time.

Next I consider issue of size of time cycle. I consider the special case of closed universe - i.e., in which particles do not keep moving indefinitely into space, but circle around the universe and come back to their starting point. The idea here is that -

If size of time cycle in N years, circumference of universe should be N light years.

Since, light is conventionally regarded as the fastest material particle, it is required that circle of light in a single time cycle should have the size of few thousand light years. This therefore should be the circumference of the universe, in which matter exists. In turn, this figure gives a universe radius of about one thousand light years. This means all the astronomical distance calculations would have to be revised, keeping in mind curved nature of space and time, rather than assuming them to be flat.

Size of Time cycle - Dirac's Large Number Hypothesis.

Dirac, one of the founding fathers of quantum mechanics, had formulated an interesting hypothesis -

Ratio of universe radius and electron radius, equals ratio of electromagnetic attraction between electron and proton, and gravitational attraction between electron and proton.

One obtains very large numbers when one takes these rations. For example, universe (the biggest physical object) is much, much bigger than electron (smallest physical object), and hence the ratio is very high. Similarly, electromagnetic attraction between electron and proton is much, much stronger, than gravitational attraction between these two particles. These large numbers turn out to be of the order 1040 (i.e., 1 followed by 40 zeros). While these numbers are not exactly equal, and cannot even be worked out precisely, only order of magnitude estimates are currently known. Dirac, used electron's classical radius (about 10-13 cm) in his equation, as a measure of size of electron, and obtained a figure of few billion light years for universe size. However, electron radius has recently been determined by so called Penning trap experiments, and yields a figure of 10-20 (decimal followed by 20 zeros) centimeters. When, one puts this figure in the equation for Dirac's large number hypothesis, one gets universe radius of few hundred light years, and universe circumference of a few thousand light years. If one wants a universe circumference of say 5000 light years, the required value of electron radius is 1.9 x 10-19 cm, which is of comparable with the value determined using Penning trap experiments.

These considerations suggest that the figure few thousand years for size of time cycle may have strong scientific grounding, which needs to be properly investigated. Main considerations to be established are the Dirac's large number hypothesis (DLNH) - which as such does not have a rigorous foundation, but is only an empirical observation, and the relation between size of time cycle and size of universe. I am optimistic, that such a formulation is shortly forthcoming,

Unforced Motions.

High school students are taught Newton's first law of motion, which states that every body continues in a state of rest or uniform rectilinear motion, unless acted upon by an external force. This law was actually initially formulated by Galileo - Newton's original contribution lay in formulation of the second and third laws of motion. Second law states that acceleration of a body in inversely proportional to its mass and directly proportional to the applied force. While the third law states that action and reaction are equal and opposite and act on different bodies. These three laws form the basis of classical physics, based upon which other developments, of classsical mechanics, celestial mechanics, statistical mechanics, have occurred. However, as shown below, this law leads to problems and conflicts when applied in conjunction with spiritual philosophy system of Brahma Kumaris World Spiritual University, which proclaims that events repeat in identical cycle every few thousand years. Cyclicity of events requires that all particles return to their original position at the end of time cycle, where as Galileo-Newton first law of motion would suggest that particles would continue to move in a straight line, and therefore at the end of time cycle, would be at a large distance from their initial starting point. How do we resolve this conflict? Clearly discussion is only for particles which donot collide or interacat with other particles, throught out the time cycle, and thus are in preview of first law, which considers motion without forces.

Lets consider how the first law of motion should be modified, when the universe is repeating itself in identical cycles. Clearly, if time is cyclic, all particles should resume their original position, after completion of the time cycle. In the formulation of first law of motion, given above, this is not possible in a straight forward manner, and additional constraints are required. For example, if the universe is a higher dimensional sphere (hypershphere), with circumference such that, in a single time cycle, light particles (photons) are able to travel around the universe and return to their starting point, then at least light particles, have resumed their original position at the end of time cycle. However, particles travelling slower then light will require a longer time period to complete their circle of universe, and therefore will not be at their original position when the time cycle is completed. In a cosmological model with cyclic

time, additional constaraint has to be imposed on free motion of particles.

Since, incorporation of non-Euclidean geometry in physics, with advent of general theory of relativity, propounded by Einstein, concept of free motion of particles has been gradually redefined. If the space itself is curved, then straight lines do not exist. For example, on a plain, a stream of water can flow in a straight line. However, if the stream is on a mountain, it takes a curved path - the path of least resistance or obstruction. This is the concept of geodesic. The curved path taken by a stream of water on a mountain is an example of geodesic motion. Thus what we require in cyclic time, is closure of all geodesics, i.e., closure of all particle paths in a single time cycle. What this means is, no matter what path a particle takes, it should return to its starting point in a single time cycle. Thus a re-formulation of first law of motion, when no forces are acting on the particle, is as follows

Natural particle paths are circles whose radii are directly propotional to particle's velocity.

Interestingly, ancient greeks believed, that natural particle paths were circles, rather than the Galileo-Newtonian straight lines. Their conclusion was based upon the apparent daily rotation of heavenly bodies around the stationary earth based on belief in Aristotelian cosmology. However, the Greek first law of motion, was based upon the 24 hour cycle of day and night. In contrast, our new first law of motion is based upon identical repetition of events in cycles also called as Brahma's day and Brahma's night, in spiritual philosophy system of Brahma Kumaris.

Forced Motions.

As indicated above, first law of motion in cyclic time states that inertial motion of particles is on a velocity dependent circle. However, what happens when the particles are interacting, colliding with each other? How is reccurence being ensured in presence of collisions, and forces, which modify natural geodesic motion defined in first law, which would otherwise ensure reccurence? This is the purview of second law - motion in presence of forces.

It is clear, that where as some particles may interact, only a few times (such as weakly interacting neutrinos), other may interact many times (such as strongly interacting hadrons). There may be exceptional particles, which may not interact at all, due to sheer chance. Therefore, what is required is a simple rule, which will ensure reccurence, of initial position, velocity and acceleration of the particle, irrespective of how much it has interacted. This is possible by defining a second law of motion as follows -

Disturbance of original pure motion of particle, induces a metric force on the particle, which is proportional to inverse powers of remanant time in the time cycle, and leads to restoration of the original configuration in a violent manner.

What the law means is that motion of a particle after a collision is not the simple circular inertial motion defined in first law, rather, it is an accelerated motion which will resotre its original position, velocity, acceleration etc., at the end of time cycle. The source of this accelerateion, is attributed to the space-time metric which will re-define or modify natural geodesic motion of the particle and ensure recurrence. Reccurence geodesic means, a geodesic, along which the particle's motion will lead to resotration of original configuration. Thus, the metric (defining reccurence geodesic) as experienced by a particle, will depend upon its complete past history, and criticically on its initial configuration, at the start of time cycle.

This disturbance of original pure motion due to interactions can be regarded as the natural mechanical entropy, - a dis-order of trajectories, which increases through out the time cycle.

This mechanical entropy is reduced to original level, during the final violent movement of the particles, when the restoring metric psuedo-force becomes un-opposable by all other interactions. This final motion will be experienced as destruction, by sentient creatures. Thus in this second law, destruction, entropy increase, as well as entropy restoration, all are inbuilt.

Entropy need not be introduced as an emperical idea in thermodynamics, which keeps increasing, but follows naturally from second law. Second law of thermodynamics (increasing entropy) thus is inbuilt within second law of motion.

This new second law of motion in cyclic time leads to conventional linear time behaviour, in linear time limit. As size of time cycle tends to infinity, restoring, metric pseudo-force will always be zero, hence subsequent motion of a particle after an interaction, will be the conventional inertial (straight line). Entropy will also keep on increasing, - there never will be a moment of entropy reduction.

Eternal Particles.

One may object that in this paper, we have not examined creation or destruction of particles, and have assumed particles to be ever-lasting. However, if there exist any fundamental particles, they are likely to be eternal. In any case, even Newton and others assumed eternal particles, while developong their dynamical theories, and so we can be excused in this enquiry. It may however be possible to take into account creation and annihilation of particles, at a future date.

SpARC logo

The logo represents Reality in terms of three facets, viz., material, temporal, and spiritual, that are indicated by three orthogonal circles. The horizontal circle with atom indicates cyclic movement of atoms and other physical particles in physical plane. The vertical circle with soul symbolised as star, indicates movement of soul from metaphysical to physical and back to metaphysical again. The flat circle, in plane of paper indicates universe repeating in identical cycles.