Epistemology in Cyclic Time

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Abstract
Consider the scenario, in which human civilization undergoes periodic eras of progression and regression, and consequently, changes in cosmological knowledge are cyclic. There exist solutions of general theory of relativity, such as the Gödel universe, in which the cosmos is rotating. If the real universe is indeed rotating, than this would be a reversion to rotating universe models, used in ancient cosmological models. We argue that such reversions in physical models would be inevitable in a space-time in which time is having S^1 (circular) topology.

KEY WORDS: Gödel universe, Ancient Cosmologies, Epistemology

1 Introduction

Evolution of events in identical cycles, has been a hall mark of ancient philosophical systems - right from American Indians, and Greeks, on one hand, to Asian Indians, and Chinese on the other [1]. In more recent times, Poincare and Nietzsche attempted a mathematical formulation of the idea, which is now enshrined in mathematical physics as Poincare recurrence concept [2]. In the last quarter of twentieth century, isolated attempts to resolve certain problems of theoretical physics, using a cyclic concept of time have been made [3, 4] - notable among them is Segal's cosmological model [5, 6], which successfully re-interprets all observational evidence, hitherto attributed to big-bang cosmology. In this model, universe is closed - having topology of 3-sphere, and time cyclic. In this space-time, light rays return to their origin, after circling the closed universe in a single time cycle. Popper [7] cedes, that changes in knowledge occur gradually, but being an evolutionist, he feels that the changes began billions of years ago, many of which are in built in the structure of our sense organs and brains - and that this series of changes in knowledge will continue indefinitely. However, provided one combines, Popper's concept of gradual change in human knowledge, with Poincare's concept of result of a series of changes being a cycle, one is lead to epistemology in cyclic time.

If one considers the possibility that human civilization has always been extant in this cyclic time, with number of generations of humans being a very large integer, then one is lead to the inescapable conclusion, that human knowledge, science and technology, also change in identical cycles. One is lead to ask the question, as to what is the driving force in this cyclic changes in human knowledge. As human knowledge arises by observation and interpretation, a function of mind and intellect, therefore, the driving force behind cyclic change in human knowledge, must be cyclic changes in perspicuity and purity of human mind and intellect.

As a striking example of evolution of knowledge in cycles (within a physical cyclic time), consider the conceptual status awarded to nature of earth, and earth's relationship with cosmos. Prior to Aristotle, as indicated in ancient Indian texts, earth was considered flat, and the universe rotating daily above this flat earth. Around about Aristotle's time the world view emerged, that various differences in Sun's latitude observed at different northern points could be attributed to a spherical earth. However, the universe continued to rotate daily around the spherical earth, in Aristotelian cosmology [8]. During

the generations of Kepler, Copernicus, and Galileo, the accumulated data on movements of astronomical bodies, lead them to conclude, that earth was not the center of universe, but was a planet, and rotated once around the sun once every year, and this was the cause of seasons.

Both changes, the first one around Aristotle's time, and second one around Galileo's time, were based on the generally accepted validity of Euclidean geometry - fundamental assumption being that light travels in straight lines. However, geometry itself, underwent fundamental changes during 19th century, when it was realized, that alternatives to Euclidean geometry were possible, by modifying its axioms [9]. Notable among them was the work of Riemann, which laid foundation for Einstein's general theory of relativity [10]. One immediate result of general relativity was that light stopped travelling in straight lines, in minds of men, after confirmation of Eddignton's solar eclipse experiment [11] on bending of star light near sun. Since then a number of solutions to Einstein's field equation for gravitation have been found. Einstein's original cosmological model had a 3-sphere universe, and an infinite time, and was called "Einstein's cylinder". Hopes of general relativists, that Einstein's field equations determine the universe's large scale structure uniquely were dashed to the ground by Gödel's discovery of a rotating universe model [12], which though had a same local distribution of matter as Einstein's cylinder, nevertheless, differed remarkably from it in over all properties - most notable among them being that, Gödel universe had closed time like curves, and it was possible for an observer to access its past in principle. Gödel got around this problem of causality violation, by denying freewill to observers. Since then, a number of generalizations of Gödel universe have been created, including those, in which universe is charged, and a constant electromagnetic field is present everywhere within universe [13].

Many modern physicists are of the view, that mankind is near climax of conceptual knowledge [14]. Such being the case, a believer of cyclic time, in which human observers exist eternally, is lead to ask the question, as to how, given the present state of human knowledge, will the humans revert back to the belief of universe rotating daily, above a flat stationary earth. This is an example of issues facing Epistemology in cyclic time. One possibility is that, through a series of artificial or natural calamities, mankind is reduced to a state deprived of its intellectual inheritance, and therefore, out of ignorance, such primitive world view prevails. There exists, however, an altogether, different, striking, possibility, which I find very exciting, and would like to

share with you.

2 Rotating Universe models in General Relativity

As mentioned earlier, rotating Gödel universe is a solution to Einstein's field equations. Behavior of light rays, in Gödel universe, has the remarkable property, that light rays curve back, after travelling a finite distance perpendicular to the direction of rotation [15]. Thus imagine, a flat earth in Gödel cosmology, with rotation axis perpendicular to the flat earth. A picture taken from a space-craft, above this flat earth in Gödel cosmology, will show light arriving at the camera, only from a circular patch - light from remaining parts of flat earth curving away from camera and never reaching it. This will generate illusion of sphericity, for one who assumes that space-time geometry near earth is basically Euclidean. Similarly, light from stars such as sun, will be accessible, only from a circular patch, on this flat earth, remaining parts of earth, being deprived, as the light curves away, as it approaches earth. At circumference, of this circular patch, light rays will be tangential to flat earth, thus explaining the apparent sunrise, sunset etc..

Further if such a rotating universe is charged, it will generate a magnetic field which reverses, periodically, as a result of quantum cosmological tunnelling between two counter-rotating solutions of quantum gravity Wheeler-DeWitt equation [16], which describes such a universe. I have done some calculations [17] which show magnitude of this geomagnetic polarity reversal to be 157 degree, which is close to actual value measured from paleo-magnetic rock samples. My prediction of paleomagnetic intensity during transition periods also matches that observed in samples. Presentations of these detailed calculations would however, be beyond scope of this conference and paper. I invite reader to contact me for these details. However, time is not cyclic in Gödel universe, and universe also is not closed. These two objections can be overcome by what is called as "conformal compactification", [18] in jargon of general relativists, which make the time cyclic and universe closed, with other properties of Gödel universe, such as rotation, and presence of closed time like curves, remaining intact.

Needless, to say a number of unresolved issues remain, before widespread adoption of a "quantum gravity rotating Gödel universe", takes place - which

will have to be tackled one at a time, as was the situation faced by Galileo [19]. Interestingly, it can be shown that notion of causality in Gödel universe is actually consistent with implications of Einstein-Podolsky-Rosen (EPR) paradox [20], which is claimed to have been experimentally verified in recent times [21]. I am of the opinion, that if time is cyclic with eternal existence of civilized humans, then provided a catastrophe, which breaks the continuity of evolution of human knowledge, does not occur, then the quantum gravity Gödel universe must be the best description of our universe. So I find epistemology in cyclic time indeed exciting, and welcome the reader to share in the churning on true nature of time (cyclic or linear) and its implications.

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