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On the axiomatic description of the origin of any given space-time

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We formulate the origin of a spacetime from a naked singularity using elementary set theory and modal logic. This leads to the proof of the existence of statements/results which govern the initial state of any universe originating from a 'big bang-like' event. We provide a qualitative description of the dynamics and mechanism of spacetime formation.

We use certain assumptions and axioms which may be related to the statements in Gödel's Ontological Proof [1.] and can be further used in the FaTe Model of Hyperspace [2.] Please refer to the notational index provided below.

NOTATIONAL INDEX:

$\subset$	is a subset of
$\prec$	precedes
$\in$	is an element of
$\equiv$	identical to
[]	locality
()	event
:	such that

Basic Formulation:

If a spacetime S containing n independent subsets 'X' is represented as

$$S = \{X_1, X_2, X_3, \dots, X_n\} \; then \; \exists X_i \subseteq S$$

Where X_i is called the general spacetime subset of S

Also, the element $x_i : x_i \in X_i \,, X_i \subseteq S$ is called the general spacetime element of S

Axiom 1: If X_i exists, S exists

Axiom 2: If S=Φ, S doesn't exist

Axiom 3: Space and time elements cannot exist individually in S

i.e. $\{X_i\} \neq \{[X_s] + [X_t]\}$

It should be noted that any two subsets of S may or may not be disjoint.

e.g. - X= {elementary particles} is a set of all elementary particles and

Y= {box,toy,quark}

If $X, Y \subset S$ then, $X \cap Y = \{quark\}$

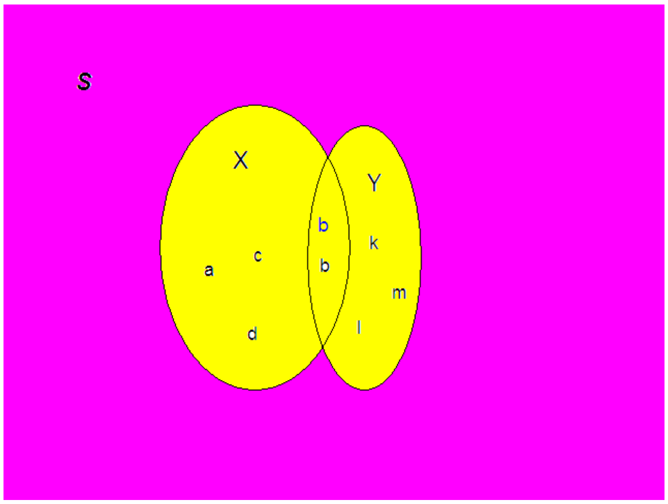
It is also true that union of two or more subsets of S will create overlapping states if they are not disjoint.

That is, if X= {a,b,c,d}

And Y= {k,b,l,m}

Then $X \cup Y = \{a, b, b, c, d, k, l, m\} \quad b \in X, Y$

And 'b' is the ***overlapping state***. This does not happen in standard set theory. Here this overlapping exists because elements of the Spacetime S are physical objects. For example a set in the real universe contains particles a, b, c and d. Another set contains particles k, l, m and b. Thus on combining these two sets physically, the union will contain a total of 8 particles, two out of which will be 'b's. ***Thus any subset of the spacetime S is a physically existent set and can contain multiple elements of same type***.



Assumption: A single universe is treated as a single spacetime and the words "spacetime" and "universe" can be used interchangeably

Now, for two universes S_1 and S_2

If $S_1 \cap S_2 = \emptyset$, then the universes are completely different from each other in every respect.

And if $S_1=S_2$, then the universes are indistinguishable from each other!!

Dynamics of Spacetime origination

We now introduce two quantities $\tilde{\lambda}_\infty$ & $\bar{\lambda}_\infty$ such that

$\bar{\lambda}_\infty \longrightarrow A = S$ where $\bar{\lambda}_\infty$ represents a naked singularity

That is, the action of a naked singularity (behaving as a white hole) on an arbitrary set A gives the spacetime S

$\bar{\lambda}_\infty$ maybe used as an operator when using Group Theory.

Axiom 4: $\bar{\lambda}_\infty$ always lies outside S

Axiom 5: $\tilde{\lambda}_\infty$ always lies inside S

$\tilde{\lambda}_\infty$ actually represents a black hole singularity

In general, if $X_i = \tilde{\lambda}_\infty \quad : X_i \subseteq S$

Then the Spacetime S is said to contain black holes.

We know that any universe has some rules which it's working. For the spacetime S, let R(x) be a general rule.

Axiom 6; If R(x) is true for a subset of S, it is true for all subsets of S if and only if R(x) is a proved generalization.

For example: let R(x): "speed of light in vacuum=$3X10^8$ m/s"

R(x) is true for all x ∈ X_i : there exists $X_i \subset S$

Existence Theorem

Let \$ be a subset of A where A is an arbitrary set.

If $n(X_i \cup \$) > n(X_i)$, then $[A] \prec [\bar{\lambda}_\infty]$ and [A] exists in S

PROOF:

Let A be an arbitrary set outside S : $\$ \subset A$

$$n(X_i \cup \$) = n(X_i) + k$$

where k is a natural number.

Therefore, $n(X_i \cup \$) > n(X_i)$ i.e. $[\boldsymbol{A}] \prec [\bar{\boldsymbol{\lambda}}_\infty]$

Since $X_i \subseteq S$ & $X_i \cup \$ \neq X_i$

$\therefore \$ \in S$ that is, $ 'exists' in S

If $n(X_i \cup \$) = n(X_i)$

$\therefore [A] \prec [\tilde{\lambda}_\infty]$ but $\$ \notin S$, that is $ does not exist in S

The result of the existence theorem can be explained as: "***a quantity which always existed before a 'big bang-like' event in a spacetime S can still exist in S if the no. of elements in union of*** X_i ***and $ is greater than the no. of elements in*** X_i***".***

<u>Explanation of a 'big bang-like' event</u>

A big gang-like event is most probably a huge explosion from a naked singularity. This may be a white hole according to some theorists. This assumption will not affect our approach.

We represent such an event by $(\bar{\lambda}_\infty)$ at an instant. Using the axiomatic approach discussed so far, we can establish some rules and conditions for an event (E) to be 'big bang-like'.

<u>Rules:</u>

1. Let a spacetime event be represented by (E) such that (E) ∈ [X_i] where [X_i] is the locality of the general spacetime subset

If at a point, $(E) \equiv (\bar{\lambda}_\infty)$, the E is said to be 'big bang-like'

Let (E) ∉ [X_i]

⇒ (E)→A=S and ($\bar{\lambda}_\infty$)→A=S

Hence, (E) ≡ ($\bar{\lambda}_\infty$)

Also, E lies outside spacetime S.

Therefore, $\{\boldsymbol{if}\ (\boldsymbol{E}) \equiv (\bar{\boldsymbol{\lambda}}_\infty), \boldsymbol{then}\ (\boldsymbol{E}) \notin [\boldsymbol{X_i}]\}$ **(i)**

2. If an event E lying outside S can be 'big bang-like' if (E) ∈ [A] i.e. E lies in the locality of an arbitrary set A such that

$$\bar{\lambda}_\infty \longrightarrow A = S$$

Therefore, $\{\ \boldsymbol{If}\ (\boldsymbol{E}) \notin [\boldsymbol{X_i}]\ \&\ (\boldsymbol{E}) \in \boldsymbol{A} :\ \bar{\boldsymbol{\lambda}}_\infty \longrightarrow \boldsymbol{A} = \boldsymbol{S}\ , \boldsymbol{then}\ (\boldsymbol{E}) \equiv (\bar{\boldsymbol{\lambda}}_\infty)\}$ **(ii)**

We are now at a stage to conjecture the 'cause' of a 'big bang-like' event. From (i),

For all \$ ∈ A and \$ ∉ S such that

$\bar{\boldsymbol{\lambda}}_\infty \longrightarrow \boldsymbol{A} = \boldsymbol{S}$**, the element \$ is said t be the 'cause' of** $(\bar{\boldsymbol{\lambda}}_\infty)$

Now at least mathematically we have defined the cause of big bang in our universe, the cause of our very origin.

<u>CONCLUSION:</u>

We have tried to answer some of the deepest questions in science in this paper using very basic mathematical ideas. These ideas need further improvements and can be further extended using functions, mapping, group theory and other tools and used in many areas of science.

REFERENCES:

[1.] “Reflections on Gödel’s Ontological proof”, Christopher .G. Small, University of Waterloo

[2.]”FaTe Model of Hyperspace”, Shreyak Chakraborty
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