ENTROPIC SPACETIME THEORY

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ENTROPIC SPACETIME THEORY —A COMMENT

by Louis H. Kauffman

The purpose of this short comment on Jack Arnel's Entropic Spacetime Theory (EST) is to bring out, in skeletal form, the major assumptions of the theory and how these assumptions work together.

First, it is assumed as given the de Broglie formula $E = h\omega$ where $\omega = c/\lambda$, h is Planck's constant, c is the speed of light, λ denotes wavelength and E is energy. It is assumed that the de Broglie formula applies to the energy of space itself.

Second, it is postulated that there is a quantum of space with minimal length l_0 , and that to each (quantum of) energy there is an associated distance l . This distance l is an integral multiple of l_0 .

Third, energy is stored in space according to Hooke's law: $E = kl$. (The constant k is determined by constraints of the theory).

In this context of space quanta, de Broglie and Hooke, it is natural to associate a wavelength λ with a length l : $l = \lambda x$. What is x ? We have $E = h\omega = hc/\lambda = hc x/l$, and we have $E = kl$. Thus $kl = hc x/l$. Hence $x = kl^2/hc$ and we conclude that for λ the wavelength of a space-quantum of length l , $\lambda l = hc/k$. Wavelength is inversely proportional to physical length with a constant of proportionality hc/k .

Now we assume that the minimal length l_0 corresponds to the minimal energy $E_0 = h$. Thus $h = E_0$ implies $\omega_0 = 1$. This implies $\lambda_0 = c$. Hence $l_0 \lambda_0 = hc/k$ becomes $l_0 c = hc/k$. Thus $l_0 = h/k$. The minimal length is the ratio of Planck's constant and the spring constant.

Now consider the energy density $\rho_0 = E_0/l_0^3$ associated with the space quantum l_0 . We have $\rho_0 = E_0/(h/k)^3 = h/(h/k)^3 = k^3/h^2$. Planck's constant being very small, the energy density of the EST vacuum is very high! See the text to see just how high this density turns out to be. This high vacuum energy density is one of the key points of EST. Space itself becomes the final reference for all energetics.

So far we have made no assumptions about the geometrical nature of the space-quantum, other than its associated length l and elastic ability to store energy. EST further assumes a geometric model for these quanta as small chunks of spacetime. Model building for more complex quanta such as photons, electrons and quarks proceeds geometrically and topologically under the constraints imposed by known facts and parameters about these entities. Many remarkable fittings occur at the submicroscopic and cosmological levels.

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PREFACE

Even if there is no end in the search of knowledge, I awakened this morning with a sense of completion. The last page was in place, the giant crossword puzzle was filled in...the entropic spacetime theory was as complete as I was capable to make it. Please don't laugh when I tell you that the morning after completing this work I started on two new aspects of this theory which I felt were not yet properly looked after. What kind of a theory is it?

It is a theory of space. It suggests how and when all matter and radiation was created. It proposes a cosmology. It delineates what "dark matter" is. It describes a discrete universe and offers specific dimensional limits.

It preserves the conservation of energy in all its aspects; there is no need to abandon it in cosmology. It has order—it cycles from expansion (where we are today) to an equilibrium, then to a compressive epoch. The universe never reached the state of "singularity" as many of our brothers have envisioned. The cosmos just "breathes" like we do.

The destiny of humanity is not forever, but we are likely to exist long enough to attain great ends. The projected length of our existence in this universe is about twice the age of the present epoch. That is, we should exist through the equilibrium and again as long as the universe is old now. The equivalent of some forty billion years of the projected future seems quite ample.

Yes, there was a big bang, the theory proclaims and there will be another and another in due course. The bang will be caused by matter—antimatter release of energy. Like the seasons, each new cycle will carry some of the previous seasons surviving galaxies into the new cycle. In other words each new epoch will start expanding fully equipped with the elements of the galaxies. An expanding epoch cannot create new galaxies from space. That is why our astronomers cannot place the creation of galaxies into our present epoch.

But then this theory does not deal with cosmology exclusively. It actually deals with the nature of space. I only told you about the future of our universe so that you will say—"It sounds all right but how did you figure this out?"

You will be surprised, as I was, when you find that space is very dense—more dense than any matter can be. You will be less surprised when I tell you that this theory says that time is variable and is not much good for measuring the passing of events for really long periods.

“How is it then that you gave predictions in billions of years?” You might say.

Well it happens that most of the expansion has already taken place (85%) in only half of the expected duration of the universe, before compression starts. Moreover the compression epoch starts very slowly and speeds up later. So if you believe that our present age is already some 20 billion years old (our time) then we will have another twenty billion before compression starts and a comparable twenty billion more in the next epoch—the one where antimatter is being created. In other words time crawls in tiny increments in the early stages after the big-bang. From now until the corresponding point in the compression epoch which resembles ours, time is not quite so ridiculous and can be approximated to units which we understand.

I have another surprise for you, before you ask how is matter or antimatter being created. In this theory, space, (called entropic spacetime) is the creator of all elementary things: radiation and matter. It can only do that in the compressive epoch.

There are other surprises in this theory. The universe is discrete and finite. Everything—not only energy comes in little bundles. Length, charge and time are all quantized.

Another surprise is that space is not a void or a vacuum but consists of tiny electric charges (a ten billionth the size of the electron). These charges are both positive and negative and are called dipoles. The distance between the charges is time and length. (Spacetime in effect). The energy content of space spreads the charges apart and hence we have expansion of space.

This makes it possible to explain gravity.

This is a highly deterministic theory—just the opposite of everything you’ve been accustomed to hearing about physics. There are numbers and values for all these items. There is no infinity, except in mathematics—and that is one of humankind’s exclusive inventions which is not taken directly from observed nature. No, it does not attack or destroy the present physics of relativity or quantum theory. It sits in between the two, because it deals exclusively with space as a thing. It deals mostly with “rest energy” not kinetic energy. The latter is left to the present physics.

This covers the “WHAT”. If you want to find out “HOW” then you’ll have to read on.

Would you believe that it took more than thirty years to figure this out? The

last ten rather intensively! I must be grateful to Helen for putting up with me for such a stretch. Also my son David, who calls me regularly to ask how the “great work” is coming along. Most of all I am grateful to Lou Kauffman, the professor and knot theorist from the University of Illinois, who could easily pass as my son. He has challenged and inspired me all at once and for a long time.

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CONTENTS

PREFACE	v
CHAPTER I An Overview of the Theory	1
An approach to space	3
A cure for infinity	4
Conservation of energy	5
Quantization of space	6
Dilation	7
CHAPTER II The Fabric of Entropic Spacetime	9
A quantitative description of space	10
Constant of elasticity	13
Description of space	13
CHAPTER III Gravity	17
Gravitational attraction—why not repulsion?	18
The interface between EST and the kinetic system	20
The acceleration of gravity from entropic data	20
The Mach Principle	21
Causality	23
Gravitons	24
Density of EST space	24
Energy content	24
Time	24
Conversion of conventional density to EST density	26
How does gravity work?	27
Buoyancy analogy	27
Antigravity	28
CHAPTER IV Cosmology	29
A vast mass of entropic spacetime	29
One Friedmann universe	30
Singularity	31
Temperatures	32
Equilibrium data on space quanta	33
The age problem	34
After the entropic equilibrium	34

At equilibrium	36
Touching on quantum field theory	36
About matter collapsing into high densities	37
The end of the contraction epoch	38
Peering at the edge of time	38
More on when the galaxies were created	39
A rationale for dark matter	39
A review on the entropic spacetime theory	41
Internal gravitational force of space quanta	42
On Great Attractors, the Wall, the Great Void	42
The upper limit	43
The dimensions of the universe	44
Frequency ω	44
Reconciling methods	46
CHAPTER V The Inflationary Universe Theory—Is It Necessary?	47
The horizon problem	47
Where are we today?	50
Gravitational lens bending	51
Time	51
What happens to time at the big bang part of cycle?	52
Black holes?	53
CHAPTER VI Model Making of Radiation and Matter in a Shrinking Universe	55
Model 1. The smallest vector boson	56
Model 2. A beam of photons	57
Model 3. Vector boson capable of pair production	57
Model 4. An electron	58
Model 5. Phase change 1	59
Phase 2. A writhe	60
Phase 3. A writhe of writhes	61
A conceptual quark	61
Specification—quark	62
Neutrons and protons	62
Bosons and fermions	64
The neutrino	66
Model making and quantum mechanics	67
Double slit experiment—Wave Particle duality	68
Why a photon knows no time	70
Time and velocity in a discrete universe	71
CHAPTER VII Surfaces	73
The Coulomb law breakdown	75
More on surfaces	76

The classical radius of the electron	77
Upon the anomaly of the electron magnetic moment	78
The anomaly, as seen through EST Theory	78
CHAPTER VIII EST and the Quantum Field Theory	81
Outside the standard model	82
A little more on quantum theory	83
The analogy with Moiré sheets	84
CHAPTER IX Unitless Identities of Nature	85
Conversion of entropic value to unitless identity.	86
Empiricals	87
The Planck equations	87
Tests	89
Planck mass	91
CHAPTER X Forces	93
The strong force	93
The weak force	94
The gravitational force	95
The electrical force	95
Other derivations	96
Summary	98
CHAPTER XI Laws of EST and a Few Proofs	101
Second Law	101
Is there an interaction between matter and EST?	102
A note about E	104
More "Proofs" ^{now}	104
APPENDIX 1	
Wavelength Ranges for Scalar Bosons, Vector Bosons and Fermions	107
TABLES OF EST VALUES	108
INDEX	113