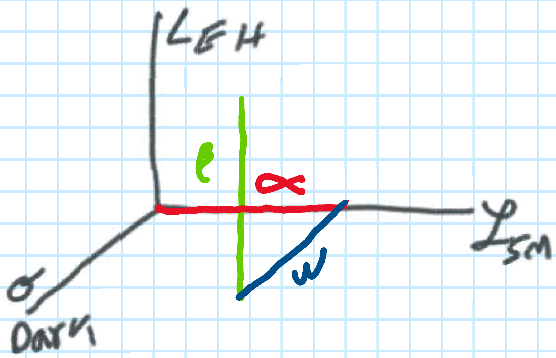
Thing theory (LEST)*

Saturday, August 26, 2017 10:57 AM

These handwritten notes are for peer review and posterity. The title "Thing theory" comes from a play on string theory. The idea being I would assume nothing about any fundamental object that may exist. The theory is built up from things we know exist and one assumption about how they are related.



Postulate:
There exist a 3D Euclidian space of Lagrangians. The Lagrangian that describes our universe $U(\alpha, \beta, w)$.

In general $U = \alpha \mathcal{L}_{SM} + \beta L_{EH} + W\sigma$

Now to find the α β and w that correspond to our universe, or any universe.

We know our any Lagrangian must satisfy the principle of least action.

$S(U(\alpha, \beta, w)) = 0$

action.

$$\delta \int U(\alpha, \beta, \omega) = 0$$

We know the physical data for our universe. If we define a gradient on this space.

$$\nabla \equiv \frac{\partial}{\partial \mathcal{L}} + \frac{\partial}{\partial L} + \frac{\partial}{\partial \sigma}$$

Then define a differential equation

$$\nabla T = \ell(\alpha, \beta, \omega) T$$

The boundary condition is that

$$\nabla T \rightarrow U \quad \text{as} \quad U \rightarrow 0 \text{ and } T \rightarrow 1$$

Meaning in the low energy limit we get the familiar physics of our universe.

The simple anzats to solve the differential equation

$$T = e^{\beta L(\alpha \mathcal{L} - \omega \sigma)}$$

$$\nabla T = \nabla e^{\beta L(\alpha \mathcal{L} - \omega \sigma)}$$

$$= \nabla(\beta L(\alpha \mathcal{L} - \omega \sigma))\, \underbrace{e^{\beta L(\alpha \mathcal{L} - \omega \sigma)}}_{T}$$

$$= ((\nabla \beta L)(\alpha \mathcal{L} - \omega \sigma) + \beta L \nabla(\alpha \mathcal{L} - \omega \sigma))T$$

$$\beta \quad (\alpha \mathcal{L} - \omega \sigma) + \beta L(\alpha - \omega)$$

$$= (\beta(\alpha \mathcal{L} - \omega \sigma) + \beta L(\alpha - \omega))T$$

$$=\left(\beta(\alpha \mathcal{L} - \omega\sigma) + \beta L(\alpha - \omega)\right)T$$

$$=(\beta\alpha\mathcal{L} - \beta\omega\sigma + \beta L\alpha - \beta L\omega)T$$

group like terms

$$=\left(\beta\alpha L + \beta\alpha\mathcal{L} - \beta\omega(\sigma + L)\right)T$$

For our universe

$\beta = \alpha = \underline{1}$ $\omega \ll 1$

$$U = \left(L + \mathcal{L} - \omega(\sigma + L)\right)e^{L(\mathcal{L} - \omega\sigma)}$$

Next deriving the generating functional. Z

$$Z = e^{i\int d^4X\, U}$$

$\int d^4X\, U$ can be evaluated analytically using the action: $L \to s$, $\mathcal{L} \to S$ and $\sigma \to \Delta$.

$$\int d^4X\left(L + \mathcal{L} - \omega(\sigma + L)\right)e^{L(\mathcal{L} - \omega\sigma)}$$

Then integrate by parts.

$$\int U\,dV = UV - \int V\,dU$$

$$V = \int d^4X\,(L + \mathcal{L} - \omega(\sigma + L))$$

$$= (s + S - w(\Delta + s))$$

$$dU = \partial^\mu L(\mathcal{L} - w\theta) e^{L(\mathcal{L} - w\theta)}$$

$$= (s + S - w(\Delta + s)) e^{L(\mathcal{L} - w\theta)}$$

$$- \int d^4x (s + S - w(\Delta + s)) \partial^\mu L(\mathcal{L} - w\theta) e^{L(\mathcal{L} - w\theta)}$$

$$0$$

canceling the generalized force.

to add interactions later.

$$\boxed{\begin{aligned} Z &= e^{i(s + S - w(\Delta + s)) e^{L(\mathcal{L} - w\theta)}} \\ &= e^{i\mathcal{S}} \end{aligned} \quad \text{The partition function of all known physics.}}$$

Consideration of grav-grav ~~interactions~~.

$$Z = Z_0 Z_1 \quad \text{where } Z_1 = e^{i\int d^4x J_R R}$$

$$\langle \Omega | R R | \Omega \rangle = Z[J]^{-1} \left(-i \frac{\delta}{\delta J}\right)\left(\frac{-i\delta}{\delta J}\right) Z[J] \Big|_{J=0}$$

$$= Z[J]^{-1} \left(-i \frac{\delta}{\delta J}\right) \left(-\cancel{i}^{\,1} i R Z\right)$$

$$= Z^{-1} (-i i R R Z) \Big|_{J=0} = Z^{-1} R^2 Z \Big|_{J=0}$$

$$= \underline{Z_0^{-1} R^2 Z_0} = e^{-iS} R^2 e^{iS} = \sum \frac{(-iS)^n}{n!} R^2 \sum \frac{iS^n}{n!}$$

$$= \bar{Z}_0 R^2 Z_0 = e^{-iS} R^2 e^{iS} = \sum \frac{(-iS)^n}{n!} R^2 \sum \frac{(iS)^n}{n!}$$

W has expanded to infinite number of term R^2

$$\langle \Omega | RR | \Omega \rangle = R^2$$

Finite energy
finite curvature. Every term has a counter term.

A crossection between gravity and E & M would be of great technical interest. If we can understand at the realized-quantum level how to manipulate gravity we can unlock a whole new vista of science and technology

$$Z = Z_0 Z_1 Z_2 \quad Z_2 = e^{i\int d^4x \, \bar{J}_\psi \psi + \bar{\psi} J_\psi + J_A A}$$

$$\langle \Omega | \bar{\psi} \psi A R | \Omega \rangle = Z^{-1} \left(\frac{-i\delta}{\delta \bar{J}_\psi}\right)\left(\frac{-i\delta}{\delta J_\psi}\right)\left(\frac{-i\delta}{\delta J_A}\right)\left(\frac{-i\delta}{\delta J_A}\right) Z \Big|_{J=0}$$

$$= Z^{-1} \left(\frac{-i\delta}{\delta \bar{J}_\psi}\right)\left(\frac{-i\delta}{\delta J_\psi}\right)\left(\frac{-i\delta}{\delta J_A}\right) R Z$$

$$= Z^{-1} \left(\frac{-i\delta}{\delta \bar{J}_\psi}\right)\left(\frac{-i\delta}{\delta J_\psi}\right) R A Z = Z^{-1} \psi \bar{\psi} A R Z$$

$$= \underline{\underline{\psi \bar{\psi} A R}}$$

Simple as that. When all the terms are summed. If mathematical beauty counts then this means a lot.

$$(1-i\$)\psi\bar{\psi}AR(1+i\$) = (\psi\bar{\psi}AR - i\$\psi\bar{\psi}AR)(1+i\$)$$
$$= \psi\bar{\psi}AR + i\psi\bar{\psi}AR\$ - i\$\psi\bar{\psi}AR + \$\psi\bar{\psi}AR\$$$

That is the lowest order correction.

While typing up the paper I coined the name Lagrangian-Euclidean space theory. The theory proposes a more fundamental space, than space.