Entropy

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10/20/2019

Updates: 10/21, 10/22; 10/ 26

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(Note: this paper is a work in progress, and I'd be delighted to discuss it, provided that the reader has at least been exposed to the documents below to see where I'm coming from ..) Email me if interested.

There is much more to be said… (written), and if anyone has encountered my perspective elsewhere, please let me know and provide a link.

The Relativistic Unit Circle

Goldbach, Fermat, and other Thoughts

The Big Bang

Entropy (Wikipedia)

$$S = k_B \log \Omega$$

From the proof of Fermat's Theorem

Let $|x| \in |\mathbb{R}|$ be a variable over the positive real numbers $|\mathbb{R}|$ that runs over all distinct subsets in $|\mathbb{R}|$ as well as $|\mathbb{R}|$ itself; in particular, rationals $\{\mathbb{Q}\}$, integers $\{\mathbb{Z}\}$ and prime numbers $\{P\}$.

In general, it can be shown that if the elements are positive definite, then the entropy is proportional to area via Boltzmann's constant k_B

$$\Omega_x = \left(\sqrt{x}\right)^2$$
$$A \triangleq \log_{\Omega_x} \left(\Omega_x\right)^2 = 2 = \left(\sqrt{2}\right)^2$$
$$S_x = k_B \log_{\Omega_x} \left(\Omega_x\right)^2 = k_B 2 = k_B A$$
$$S \sim A$$

Two Physical Systems of interacting identical particles (x = m)

$$\Omega_x \triangleq \log_\varphi(\varphi)^x = \left(\sqrt{x}\right)^2 = x$$

$$\varphi^x \triangleq \left[\sum_i a_i\right]^x = \left[\sum_i (a_i)^x\right] + \operatorname{Re} m(a_i, x)$$

$$\sum\left(\varphi^x\right) \triangleq \left[\sum_i (a_i)^x\right]$$

$$\prod\left(\varphi^x\right) \triangleq \operatorname{Re} m(a_i, x)$$

$$\varphi^x = \sum\left(\varphi^x\right) + \prod\left(\varphi^x\right)$$

$$\Omega_x \triangleq \sum\left(\varphi^x\right) \triangleq \left[\sum_i (a_i)^x\right] = \left(\sqrt[n]{\Omega_x}\right)^n = \left(\sqrt{\left(\sqrt[n]{\Omega_x}\right)^n}\right)^2$$

$$\log_{\Omega_x}(\Omega_x)^2 = 2 = \left(\sqrt{2}\right)^2 = A$$

$$S \triangleq k_B \Omega_x = k_B\left(2\right) = k_B\left(A\right)$$

$$\therefore S \sim A_2 = 2$$

$$\Omega_x \triangleq \prod\left(\varphi^x\right) = \left(\sqrt{\prod\left(\varphi^x\right)}\right)^2 = \left(\sqrt[n]{\Omega_x}\right)^n = \left(\sqrt{\left(\sqrt[n]{\Omega_x}\right)^n}\right)^2$$

$$\log_{\Omega_x}(\Omega_x)^2 = 2 = \left(\sqrt{2}\right)^2 = A$$

$$S \triangleq k_B \log_{\Omega_x}(\Omega_x)^2 = k_B\left(2\right) = k_B A$$

$$\therefore S \sim A = 2$$

$$\Omega_x = A + A = \left(\sqrt{A + A}\right)^2$$

$$A \triangleq \log_{\Omega_x}(\Omega_x) = 2 = \left(\sqrt{2}\right)^2 = 2$$

$$S \triangleq k_B \Omega_x = k_B\left(2\right) = k_B A$$

Note that:

$$\varphi^x = \left[\sum_i (a_i)^{\Omega_x}\right] \Leftrightarrow \operatorname{Re} m(a_i, \Omega_x) = 0$$

That is, there are no multiplicative interactions, which is a result of Fermat's theorem.

For $n = 2$, where n is the number of particles,

Prime Numbers

(Proof of Golbach's conjecture)

For prime numbers, two non-interacting particles (nomials, prime numbers) $p_1 = (c\tau)$ and $p_2 = (v\tau')$,

$$L = p_1 + p_2 = 2N = 2p_1p_2$$

$$\varphi = (p_1) + (p_2)$$
$$\varphi^2 = (p_1 + p_2)^2 = (p_1)^2 + (p_2)^2 + 2p_1p_2$$
$$\Omega_A \triangleq \left(\sqrt{p_1 + p_2}\right)^2 = p_1 + p_2$$
$$A \triangleq \log_{\Omega_A}(\Omega_A) = 2 = \left(\sqrt{2}\right)^2$$
$$S \triangleq k_B \log_{\Omega_A}(\Omega_A) = k_B 2 = k_B A$$
$$\therefore S \sim A$$

$$\Omega_A \triangleq \left(\sqrt{p_1p_2}\right)^2 = p_1p_2$$
$$A \triangleq \log_{\Omega_A}(\Omega_A) = 2 = \left(\sqrt{2}\right)^2$$
$$S \triangleq k_B \log_{\Omega_A}(\Omega_A) = k_B 2 = k_B A$$
$$\therefore S \sim A$$

Note that for

From the proof of Goldbach's conjecture,

$A = 2A$ and $S = S \Leftrightarrow k_B = k_B$

Interaction ("Spin")

In terms of the Relativistic Unit Circle and "Spin" interaction (particle-field interaction):

"Cartesian coordinates"

$$\varphi = \left(c\tau'\right) = (c\tau) + (v\tau')$$

$$\varphi^2 = \left(c\tau'\right)^2 = \left[(c\tau) + (v\tau')\right]^2 = (c\tau)^2 + (v\tau')^2 + \operatorname{Re} m(c\tau, v\tau', 2)$$
$$= (c\tau)^2 + (v\tau')^2 + 2\left(c\tau\right)\left(v\tau'\right)$$
$$h^2 \triangleq 2\left(c\tau\right)\left(v\tau'\right)$$
$$s^2 \triangleq \left(c\tau\right)\left(v\tau'\right)$$
$$h^2 = 2s^2$$
$$s = \frac{h}{\sqrt{2}}$$

"Radial Coordinates"

Multiply the terms in the 2nd order expression by π:

$$\pi\varphi^2 = \pi\left(c\tau'\right)^2 = \pi\left[(c\tau) + (v\tau')\right]^2 = \pi(c\tau)^2 + \pi(v\tau')^2 + \pi \operatorname{Re} m(c\tau, v\tau', 2)$$
$$= \pi(c\tau)^2 + \pi(v\tau')^2 + 2\pi\left(c\tau\right)\left(v\tau'\right)$$

Note that the "spin" can be characterized as an interaction between two circles, one with $r = c\tau$ and $r' = \left(v\tau'\right)$ with the interaction point at the junction of the circumference and radius.

So from $r'' = r + r'$, we have:

$$\pi\left(r''\right)^2 = \pi\left(r + r'\right)^2 = \pi r^2 + \pi\left(r'\right)^2 + r\left(2\pi r'\right)$$

Where r is the radius of one and $C = 2\pi r'$ is the circumference of the other, so the "spin" is characterized by the interaction of the two circles where

$h^2 = r(2\pi r') = 2\pi\left(s^2\right)$ for $s = \left(\sqrt{rr'}\right)^2 = \left|rr'\right|$ so that $s = \dfrac{h}{\sqrt{2\pi}}$

and for $r = r'$ $s^2 = r^2$ for $h^2 = 2\pi r^2 = 2\pi s^2$

$$\sum_{c,\tau,v,\tau'} \{(c\tau),(v\tau')\} \triangleq (c\tau)^2 + (v\tau')^2$$

$$\prod_{c,\tau,v,\tau'} \{(c\tau),(v\tau')\} \triangleq (c\tau)(v\tau')$$

$$\varphi^2 = \sum_{c,\tau,v,\tau'} \{(c\tau),(v\tau')\} + 2\prod_{c,\tau,v,\tau'} \{(c\tau),(v\tau')\} = (c\tau)(v\tau')$$

$$\Omega \triangleq \left(\sqrt{(c\tau)^2 + (v\tau')^2}\right)^2$$

$$\log_{\Omega}(\Omega) = 2 = \left(\sqrt{2}\right)^2$$

$$A = \left(\sqrt{2}\right)^2$$

$$S = k_B \log_{\Omega}(\Omega) = k_B(2) = k_B(A)$$

$$\therefore S \sim A$$

$$\Omega \triangleq \left(\sqrt{(c\tau)(v\tau')}\right)^2 = (c\tau)(v\tau')$$

$$\log_{\Omega}(\Omega) = 2 = \left(\sqrt{2}\right)^2$$

$$A = \left(\sqrt{2}\right)^2 = 2$$

$$S = k_B \log_{\Omega}(\Omega) = k_B(2) = k_B(A)$$

$$\therefore S \sim A$$

$$\Omega_{\varphi} \triangleq \varphi^2 = \left(\sqrt{(\Omega + \Omega)}\right)^2 = \Omega + \Omega$$

$$\log_{\varphi}(\varphi^2) = \log_{\varphi}(\Omega_{\varphi}) = 2 = \left(\sqrt{2}\right)^2$$

$$A_{\varphi} \triangleq \log_{\varphi}(\Omega_{\varphi}) = 2$$

$$S_{\varphi} \triangleq k_B \log \Omega_{\varphi} = k_B(2)$$

$$\therefore S_{\varphi} \sim A_{\varphi}$$

Boltzmann's Constant (Wikipedia)

"The Boltzmann constant, k_B, is a scaling factor between macroscopic (thermodynamic temperature) and microscopic (thermal energy) physics." Macroscopically, the ideal gas law states that, for an ideal gas. The product of pressure P and volume V is proportional to the product of amount of substance n (in moles) and absolute temperature T:

$$pV = nRT$$

where R is the gas constant. (8.31446261815324 J*K-1*mol-1. Introducing the Boltzman constant transforms the ideal gas law into an alternative form:

$pV = Nk_BT$ where N is the number of molecules of gas. For n=1 mol, N is equal to the number of particle in one mole (Avogadro's number)."

Let n be the number of molecules, where each molecule is an identical physical system.

$$PV = nkT$$
$$P = \frac{F}{A} = \frac{F}{x^2}$$
$$PV = Px^3$$
$$x \triangleq F$$
$$E_{PV} = PV = F^2 = n\frac{F^2}{n} = nk_BT = kT\log_{k_BT}(k_BT)^n$$
$$n = 2$$
$$E_{PV} = 2k_BT = k_BT\log_{k_BT}(k_BT)^2$$
$$n = 1$$
$$S_{PV} = E_{PV} = k_BT = k_BT\log_{k_BT}(k_BT) = k_BT\log_{\Omega}(\Omega)$$
$$\frac{L}{2} = \frac{S_{PV}}{T} = k_B\log_{\Omega}(\Omega)$$
$$L = 2k_B\log_{\Omega}(\Omega)$$

Definition of Entropy

(Note: I think this is right, but I am still thinking about it, so this is a start and will be updated..)

$$L = 2N = 2p_1p_2 = S = k_B(2) = k_B \log_\Omega \Omega$$
$$\log_E(E)^2 = \log_\Omega \Omega = \log_\Omega \left(\sqrt{\Omega}\right)^2 = 2$$
$$k_B = N$$
$$S = L = 2N = 2p_1p_2$$

(Note that L can be partitioned into sums of products, but the product $N = p_1p_2$ is unique by the Fundamental Theorem of Arithmetic applied to Goldbach's conjecture). Relativistically, "coordinates" are identified with mass, so that $V \triangleq m^3$, $m = c\tau$ and other parameters interpreted accordingly.

$$N = p_1p_2 = \left(\frac{pV}{NT}\right) = \left(\frac{V}{N}\right)\left(\frac{p}{T}\right) = k_B$$
$$p_1 = \left(\frac{V}{N}\right) = \left(\sqrt{\left(\frac{V}{N}\right)}\right)^2$$
$$p_2 = \left(\frac{p}{T}\right) = \left(\sqrt{\left(\frac{p}{T}\right)}\right)^2$$
$$N = T = 1$$
$$p_1 = V, \text{ volume per unit N}$$
$$p_2 = p, \text{ pressure per unit T}$$
$$E = |E| = \left(\sqrt{\mathrm{E}}\right)^2 = \left(\sqrt{p_1p_2}\right)^2$$
$$S = L = 2N = (p_1p_2)(2) = (V)(p)(2) = k_B \log_E\left(\sqrt{E}\right)^2 = k_B \log_E(E)$$

Entropy is a model of (elastic) interactions (interpreted from the Ideal Gas Law), where:

$$S = L = 2N = (p_1p_2)(2) = 2(c\tau)(v\tau') = 2\left(\sqrt{c\tau}\right)^2\left(\sqrt{v\tau'}\right)^2 = 2\left(\sqrt{(c\tau)(v\tau')}\right)^2 = 2\left(\sqrt{N}\right)^2$$

Then entropy is the count of all the interacting particles, represented by prime numbers, and thus is equivalent to the model of Planck's "constant" h= $h^2 = S = L = 2N = (p_1 p_2)(2) = 2(c\tau)(v\tau')$ where $h^2 = 2s^2$ for the "spin" $s = \frac{h}{\sqrt{2}}$ from the "interaction" equation":

$$
\begin{aligned}
&c\tau' = v\tau' + c\tau \\
&(c\tau')^2 = (v\tau')^2 + (c\tau)^2 + 2(v\tau')(c\tau) \\
&s = \sqrt{(v\tau')(c\tau)} \\
&(c\tau')^2 = (v\tau')^2 + (c\tau)^2 + h^2 = (v\tau')^2 + (c\tau)^2 + 2s^2 \\
&h^2 = 2s^2 = 2\left(\sqrt{(v\tau')(c\tau)}\right)^2 = 2(v\tau')(c\tau)
\end{aligned}
$$

Here h is an interaction energy "area" (again affirming that with this identification so is the entropy S, a la Beckenstein/Hawking, without any help from Einstein's GTR) from the RUC (four quadrants) of the interaction "triangles", so that:

$$
\begin{aligned}
&h = 2\left(\frac{\beta}{\gamma}\right) = 4\left(\frac{1}{2}\frac{\beta}{\gamma}\right) \quad \text{(radiation)} \\
&h = 2\beta\gamma = 4\left(\frac{1}{2}\beta\gamma\right) \quad \text{(absorption)}
\end{aligned}
$$

(not sure about this)

Let all elements be positive definite, so that $x = |x| = \left(\sqrt{x}\right)^2$

$$c = a + b$$

$$c^n = \left(a+b\right)^n = a^n + b^n + rem(a,b,n) = a^n + b^n + \left(\sqrt[n]{rem(a,b,n)}\right)^n$$

$$d = \left(\sqrt[n]{rem(a,b,n)}\right)$$

$$c^n = a^n + b^n + d^n$$

$$n = \log c^n = \log a^n + \log b^n + \log d^n$$

Then for any integer d d, $d^n = \prod_k p_k$, where p is a prime number (by the fundamental theorem of arithmetic.

$c^n = \prod_i p_i = a^n + b^n + d^n = \left(a^n + b^n\right) + \prod_k p_k = \prod_j p_j + \prod_k p_k$, where the p's are prime numbers.

Let

$$|c| = \left(\sqrt{c}\right)^2 = \sum_i |a_i| = \sum_i \left(\sqrt{a_i}\right)^2$$

Expanding via the Multinomial Expansion and equating to a single valued result, where red indicates the non-interacting elements and blue indicates the interacting elements:

$$c^n = \left(\sum_i a_i\right)^n = \sum_i \left(a_i\right)^n + rem(a_i, a_j, n) = \sum_i \left(a_i\right)^n + \left(\sqrt[n]{rem(a,b,n)}\right)^n$$

Where

$$n = \log_c\left(c^n\right) = \log_{\left(\sum_i a_i\right)}\left(\sum_i a_i\right) = \log_{a_i}\left(a_i\right)^n + \log_{\left(\sqrt[n]{rem(a,b,n)}\right)}\left(\sqrt[n]{rem(a,b,n)}\right)^n$$

By the Fundamental Theorem of Arithmetic,

$rem(a_i, a_j, n) = \prod_m p_m$, where if p_m is even,

$$rem(a_i, a_j, n) = \prod_s 2\left(p'\right)_s = 2\prod_s \left(p'\right)_s$$

Setting $c^n = 0$ so that $0 = \left(\sum_i a_i \right)^n + rem(a_i, a_j, n)$ and examining the difference

$$0 = \left(\sum_i a_i \right)^n - rem(a_i, a_j, n)$$

$$\left(\sum_i a_i \right)^n = rem(a_i, a_j, n)$$

$$\sum_i (a_i)^n = rem(a_i, a_j, n)$$

$$(c_i\tau_j) = (c_i\tau_i) + (v_j\tau_j)$$

$$(c_i\tau_j)^n = (c_i\tau_i)^n + (v_j\tau_j)^n + \mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right]$$

$$\mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right] = \left(\sqrt[n]{\mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right]}\right)^n$$

$$n = \log\left(\sqrt[n]{\mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right]}\right)^n$$

$$Let\ (c_i\tau_j)^n = \{0^n\} = (c_i\tau_i)^n + (v_j\tau_j)^n - \mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right]$$

$$(c_i\tau_i)^n + (v_j\tau_j)^n = \mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right] = \left(\sqrt[n]{\mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right]}\right)^n$$

$$n = \log_{(c_i\tau_i)}(c_i\tau_i)^n = \log_{(v_j\tau_j)}(v_j\tau_j)^n = \log_{\left(\sqrt[n]{\mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right]}\right)}\left(\sqrt[n]{\mathrm{Re}\,m\left[(c_i\tau_i),(v_j\tau_j),n\right]}\right)^n$$