Short Perspective Note: Scale Free Phenomena is due to Extremum Shannon Entropy and Ante correlation (Duality): Conjectures based on Critical Flow Condition in Open Channel Hydraulics. A Request of Preliminary Consistency Assessment by the Scientific Community

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Abstract

Based on analysis of entropy in a toy model analog of critical flow in open channels , this paper offers conjectures to explain the recurrence of scale free observations in science. It reaches a set of mathematical connections with the Ramanujan summation/Euler-MacLaurin series and geometrical mean (embedded in Bloch theorem)that seems to lock all the rationale in a self-consistent framework. Moreover, discuss evidences from different branches of science that in favor of the conjectures proposed.

Fundamental mathematical background of conjectures

If there is a duality (ante correlation)   relation between two parameters A, B possible there is a   relation between both of the type 1-A=B.

In order to find the extremum Entropy (Shannon) is to perform (Prado,PF,2016a):

Find extremum of H $(A,B)=A\log_2 A+B\log_2 B$

Performing dH/dA=0 and dH/dB=0 one reach A=B=0.5

Indeed there is a Geometrical analog: considering $X=A^A$ and $Y=B^B$ entropy relies on $H(A,B) = \log_2(X.Y)$

In other hand, Geometrical Mean between X and Y (GM)

$GM=(XY)^{-1/2}$ which implies $H(A,B)=2\log_2 GM$, an explicit geometric (2D) and information linkage.

The geometrical translation (interpretation)

The mathematical connection between entropy and geometry seems to stress: geometry "rules" in the natural phenomena.

The open channel hydraulics analog is explicit on a duality between volume and superficies. The way that the R^2/R^3 vanishes when R tends to zero or R tend to infinity is ante -correlated and seems to be source of the scale-free relations observed.

The problem of find critical flow relies on the duality of free surface of the channel with de depth (volume) summarized in the Froude number. Supercritical flow stands to superficies and Subcritical stands to volume. A paper very appropriate to touch this hydraulics analogy on on cosmological scale presents the Lanikea super cluster of galaxies approach (Tully et al,2014).

This is embedded also on capacitor and inductor design .Remarkably, possible humans are just doing mimetics when we adjust our power factor of electrical networks by equilibrating capacitive reactance and inductive reactance. This adjust offers higher amount of useful energy to produce work and set the system to a maximum resilience condition about current and voltage transients on electrical engineer praxis.

It seems that the same aspect ratio considerations has promoting more accuracy to predictions of holographic gravitation ruling out dark matter (Brower et al, 2016) .This one indeed was already related to lattice and bose-einstein statistics elsewhere (Morongowe,2013) (arXiv:0705.4158 [astro-ph]).

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On the second derivatives of H(A,B)

The second derivative signal test indicate that Nature tends to <u>minimize</u> entropy to fit to analogy to hydraulics minoring specific energy allowing the maximum flow.

Consequences of a setup around the extremum of entropy

An every scale every time tendency to setup energy around the extremum of entropy possible means to create clusters of minimum energy to maximize the frequency of operation relying

on a linear segment of the informational Entropy curve. Also it maybe stands to superposition validity. This last remark is a possible source of the probable scale free validity of quantum mechanics modelling approach and allow its use to model gravity notoriously on the holographic proposal. Inevitably, the consequences of set the system around maximum entropy will be determined by how accurate this approximation is done.

It should be noted that there is model to treat chaos as an as an Intermittently Forced Linear System [https://arxiv.org/abs/1608.05306].

A Possible mathematical outcrop of the critical flow of the hydraulics analogy and geometrical mean: the Bloch theorem and waves

A recent technical report on neuroscience [http://vixra.org/abs/1609.0026] suggest an Bloch wave simulation using this graph Fig (1) and possible correlates it to brain science to Bloch wave.ie product of periodic wave with plane waves that seems to stand to geometrical mean and extremum entropy:
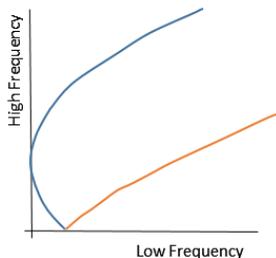

Fig 1 – Shape features resultant of simulation of Bloch wave equation modified from [http://vixra.org/abs/1609.0026]

Considering:

(1) That low frequency (periodic oscillation) waves are relate to a lattice that stands to order i.e. a extremum in contrast to randomness and

 (2) The existence of pair (value,0) =(low frequency, high frequency) in solid states physics would stand to the semiconductor waffle (material qualities) implying that high frequency correlates to the disturbance or anticorrelation to the lattice that rules the undelaying periodic oscillation.

(3) a non zero limit values that would correlate to extremum condition of the boundary layer related to order and this seems to stand to ordered Bose-Einstein on the inferior limit of temperature (near zero K) also

(4) The reported emergence of particles in quantum vacuum induced by lasers [arXiv:1302.4653v2 [hep-ph]]. This seems to possible stand to the product on the formulation related to the Bloch theorem. Vaccum would have a lattice, and lase would be the plane wave generating a multiplicative product. It is remarkably in electronics the connection of high frequency with conducting electrons at high aspect ratio Surface/volume condition this can be verified on the called skin effect.

Derived Conjecture

Then probably this Bloch wave simulation is reveling indeed a vast range of phenomena and perhaps all the space can be related to lattice (grid of different steps). Probably the E=0.5hf model for zero kelvin reveals the existence of only the lattice at the lower limit of temperature without a multiplicative plane wave

This would explain the 0.5 value in formulation (meaning just periodic waves) and generation of particles when reached by a laser energy governed by multiplicative essence : Lattice x high frequency signal due to the Bloch theorem.

This connection is reinforced to the link of Bloch waves formulation with Schrödinger equation revealing connection to quantum modeling.

Numerical support (approximated) to the conjecture about zero energy point

The lowest value simulated to low frequency is approximated 0.78 Hz by visual inspection.

This implies Lambda=384615384.6153846 m

Using Wien Law formulation, one reach the temperature of approximately Temperature = 0.007534 K

Possible out crop of the Bloch theorem in diverse branch of the scientific field

The framework described suggests that one can attribute to the every present natural frequency of oscillation to existence of a characteristic lattice.

The radiative input in high frequency seems to modulate the natural low frequency signal emitted by the earth system, for example. All the spectral response and its gaps perhaps relies on the qualities on the variety of lattices. Considering that, the possible cluster to reach an extremum (probably minimum) entropy naturally would order and create lattices in every scale.

Connection to the number theory framework o why math works..

The number theory seems also to fit t a Geometrical Mean /Bloch wave framework: a lattice defined by the number 1 and the plane waves stands to primes. Indeed the visual accordance between representation light as plane waves and Riemann surfaces is astonishing. Beside the analog to high frequencies, Necessity of new prime numbers seem also to be connected with the batiment phenomena on the amplitude modulation branch of research. All this analogy also suggest that: the pair carrier wave (linked to lattice) and the wave that modules the carrier (stands to plane wave) would be linked by duality and this pair stands to KAM tori (Prado,PF 2017c) and an isolated plane wave stands to Cantor sets. The Riemman Zeta function seems to be a map for this analogy: Reals= -1/12 signaling the lattice in close connection to C term of the Ramanujam summation indicating qualities about its analytic continuity. Trivial solutions related to Cantor Sets. Lattice (carrier) x Cantor products sets relying on the interval]0,1[. The Reals=0.5 would signal the more resilient considering duality i.e. equality between carrier and modulating signal and because this prime should really relies on it. The connection of a lattice with an typical term of the Ramanujan summation/Euler-MacLaurin series seem to lock all the rationale in a self-consistent manner suggesting that its following a promising track.

Assuming a 3D extension of lattice, this feature seems to point to a volume measure indeed and for a very simple toy realistic toy model:

The resonance box: a fixed volume with a high frequency feature plugged in. The connection to Bloch theorem and Bloch wave's formulation seems to be immediate driven by the rationale by induction the lattice symmetry is extend to volume. Another evidence is how gas, liquid occupies all the volume available. Perhaps for large scale (galaxy cluster) propose does not make sense the solid definition.

Back to number theory of natural numbers, the volume (lattice) seems to be defined by the number 1 (linearity), while the sum of 1/p p- primes over all primes seems to non-linearly approximate the volume defined by 1 .Increasing the numbers of consequent primes would provide a smoother approximation (asymptotical) to the horizontal line. This asymptotical approximation seem to be encoded on Euler number irrationality.

Checking this formulation:

$$e = \lim_{h \to 0} (1 + h)^{\frac{1}{h}}$$

h would stand to the ratio :$h= 1/$(sum of reciprocals of primes)

h approximating zero would stand to tending to infinite primes considered in the sum.

An analogy to electricity could be done. A as a font V of linearity in parallel to resistor with the value of prime numbers. Electrical current would be proportional to the non-linearity canceled with the flow and then maximum current would flow by the resistance R=2, the R= 3, R=5 and so on. This also seem to reinforce the every postulated gate math and music besides amplitude modulation itself.

The connection of e=cosx+isenx with plane waves seems to be plausible, x related to the signal that modulates the carrier on the amplitude modulation approach (related to lattice) when both has the same frequency maximizes the geometrical mean and minimizes information content as predicted by the fundamental math above.

Remarkably, indeed the impedance approach is quite similar attributing opposite values to inductive reactance and capacitive reactance, resistance related to reals. The maximum capacity of energy for work occurs when the circuities is resistive this maps to maximum product low frequency and high frequency in Bloch waves and in geometrical mean.

Scale free picture: is Nature solving the critical flow problem of the open channel hydraulics branch?

Recording : Its conjectured that Nature would be "solving" an analog of the critical flow problem of open channel hydraulics. Specific energy seems to stand to entropy. Then a condition of minimum entropy would stand to minimum specific energy and would maximize the flow as consequence improve flow resilience and its dynamics of energy. A minimum between static and dynamic inertia.

This entropy minimization would correlate to the scale free pattern frequently observed.

Velocity of light would be the analog to the critical velocity in this problem of hydraulics. This stands one for that conditions in analogy to the velocity of solitons (Kamenov, Slavov 1998 this paper discuss photon as a soliton) in water channel .And suggest that for another setup perhaps could emerge a highest one critical velocity. This would fit quantum entanglement experimental results.

Consequences of this analogy

Mass (massive) bodies would stand to the Kolmogorov's vortex (turbulence and electric field by shear effect) while magnetism would stands to the laminar flow: Earth would be surrounded by **a not understood laminar flow**. This streamlines probably is the origin of gravity and area law, as we perceive it nowadays. As a direct consequence, Wien law peak temperature would stand to the position of the analog of the boundary layer encompassing then a lower limit near 0 K . This also holds to the existence of a superior bound: perhaps the temperature of Planck. In the transition between turbulent and laminar flow. Higher temperature seem to indicate the predominance of the laminar flow.

Ant correlation (Duality) and Resonance

The relation A = B is the link to Resonance Phenomena. This is explicit on LC electric circuit model when capacitive reactance = inductive reactance the system is set on the resonant condition. Note capacitance and inductance relies purely in materials qualities and geometrical properties. Alternatively, in building structures when the frequency of perturbation is equal to the natural one as did occur to bridges in many places.

The improvement of electrical system by a dual filtering strategy: electric potential transients minored using delta connection scheme and against current transients, using star connection scheme would set the system to a central position maximizing the energy available to produce work. The star connection relies on a more random network while delta (an equilateral triangle approach) to order.

Anticorrelation (Duality) and Chaotic systems

The results of complex network studies flags that networks linked to Chaos stands to a central position between randomness and order.

Using the same rationale,   one can conjecture indeed that resonance and chaos are the same phenomena related to be in a central position (considering a duality) maximizing resilience and an extremum in entropy (thermodynamics principle). Also possibly in brain cognitive task (arXiv:1611.09428v1) to this last principle indeed probably relies the scale free quality in math modeling in frequently in almost every branch of the scientific fields. Indeed, Chaos was obtained varying ration between frequencies on the multiplication of two senoides (http://vixra.org/abs/1603.0413) suggesting also that the roughness of the sound in amplitude modulate (AM) signals (https://www.ncbi.nlm.nih.gov/pubmed/1010885) is indeed a fingerprint of a chaotic process. The gradual raise to the coincidence of frequency between senoides relates to the transition of a q-Gaussian entropy to Boltzmann-Gibbs entropy

Anticorrelation (Duality) and Quantum Mechanics

If one assume as dual the probability of life (pl) and probability of death (pd) in the Schrodinger ´s Cat paradox , he will reach pl=pd to reach a extremum of entropy, so the same rationale suggests that quantum mechanics approach is perhaps an approximation to deal with chaos (resonance) indeed. In this case, the cellular automata interpretation connection may be stressing the existence of a lattice of chaotic nodes.

The design fingerprint of anticorrelation (duality)

Tully et al (2014) shows graphical work showing a central high-density region and two high volume, low-density regions interconnected by this constriction. This design seems to be connected with those from : denoising autoenconders (related to auto-associative neural networks) (Prado,pf,2017b) perhaps two ante correlated analogs of auto-associative neural networks and also in some stage of mitosis, . Indeed the cellular division probably is an illustration of analog of Bloch waves and the correlated analog. This search for critical flow i.e. a network related to order receives high frequency energy and the configuration of network is set up to an intermediary condition between (stand roughness AM modulation) order and randomness with minimum entropy, chaotic, resonant and able to allow the maximum flow of energy (critical flow).

Also is reported the existence of ante correlated networks in the default mode network of the brain

Final remarks

After some many years it's amazing that Newton, Navier, Prandtl, Stokes, Froud ,Newton, Chezy,Bernoulli, Bakmeteff ,Bloch perhaps are indicating us the best path: the one that of maximum resilience (linearity) and at the end of day minimum Inertia, minimizing about both the static and the dynamics one, in every scale in every time.

The possible cause of scale-free phenomena is to vary the aspect ratio superficies/volume (in physics and math), set both equal and then reach the minimum entropy configuration and minimum inertia and resilience to the flow of energy in every scale. This is analog to open channel hydraulics, every time the allowing delivering maximum useful amount of energy available to do work. Also Like a scale free correction of the power factor as seen on electrical networks. In addition, with an analog on the multiplicative nature of: geometrical mean, Bloch waves and amplitude modulation (telecommunication).

An incomplete understand of the laminar flow (as the surface effects fingerprint) surrounding Earth as the origin of gravitation as we fell it (area law) seem to be on the origin of errors.

Plane Capacitor component has been our daily activities for long time giving us the importance of the volume properties. Also, to connected dark matter with lattice seems postulated some time ago [arXiv:0705.4158 [astro-ph].

Perhaps it is time to time to back the roots. Understand photon as soliton with critical velocity linked to the critical flow just like in hydraulics. Comprehend red shift as the loss of energy due to the cross of the streamlines of the surrounding laminar flow. Perhaps is not dealing well with scale issues.

In addition, experimenting with this superficies/volume ratio seems to be big deal for an adequate use of nanotechnologies that seems to maximize the effects related to maximizing superficies dominance on the behavior of this chemical compounds.

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