REASONABLE EFFECTIVENESS OF MATHEMATICS

INTRODUCTORY

The validity of a mathematical statement is judged by its logical consistency. The validity of a physical statement is judged by its correspondence to reality. We collect too much data and without judging properly reject most (like at LHC). If we re-envision classical and quantum observations as macroscopic overlap of quantum effects, we may solve most problems. The physics community blindly accepts rigid, linear ideas about the nature of space, time, dimension, etc. These theories provide conceptual convenience and attractive simplicity for pattern analysis, but at the cost of ignoring equally-plausible alternative interpretations of observed phenomena that could possibly have explained the universe better. Modern theories do not give a precise definition of the technical terms used, but give an operational definition that can be manipulated according to convenience. Wigner[1] defined mathematics as the science of skillful operations with concepts and rules invented just for this purpose. This is too open-ended. What is skillful operation? What are the concepts and Rules? Who invented them? What is the purpose? Do all concepts and rules have to be mathematical? Wigner says: *The great mathematician fully, almost ruthlessly, exploits the domain of permissible reasoning and skirts the impermissible*, but leaves out what is permissible and what is not; leaving scope for manipulation.

Relations between material objects must be expressed in a language compatible with the way in which objects in the real world actually interact - through the transmission/reception of mass/energy/information. Every object is a summation of the same fundamental stuff (quarks, leptons, etc) in varying orders. Events are energy rearranging fundamental particles. The *space-time location* makes intervals in both space and time dependent on where we measure them from. This implies space-time is related to the origin of the coordinates of the observer's frame of reference. Measurement is carried out at here-now – thus, time variant (since now is the fleeting interface between past and future). Its quantitative description is mathematics – it describes the changing physical phenomena when the number or arrangement of any of the constituent parameters is changed. The changes are expressed as the result of measurement after comparison with a scaling constant (standard unit). These are always pure numbers, i.e., scalar quantities, because measurement is only the operation of scaling up or down the unit for an appropriate number of times. The results of measurement, which are time invariant, are frozen even though the object measured continues to evolve in time. Your 10 year old photo is not you.

Mathematics is the ordered accumulation and reduction in numbers of the same class (linear or vector) or partially similar class (non-linear or set) of objects. Number is one of the properties of all substances by which we differentiate between similars. If there is nothing similar at here-now, the number associated with the object is *one*. If there are similars, the number is *many*. Our sense organs and measuring instruments are capable of measuring only one at a time. Thus, *many* is a collection of successive *one*'s. Based on the sequence of perception of such *one*'s, *many* can be 2, 3, 4….n. In a fraction, the denominator represents the *one*'s, out of which some (numerator) are taken. **Zero is the absence of something at here-now that is known to exist elsewhere** (otherwise we will not perceive its absence at all).

Burrowing from M. Polanyi, Wigner says[1]: *The principal point …. is that the mathematician could formulate only a handful of interesting theorems without defining concepts beyond those contained in the axioms and that the concepts outside those contained in the axioms are defined with a view of permitting ingenious logical operations which appeal to our aesthetic sense both as operations and also in their results of great generality and simplicity*. Wigner admits not only the incompleteness of mathematics but also its manipulation according to the *aesthetic sense* of the operator. He gives the example of complex numbers and burrowing from Hilbert[2], admits: *Certainly, nothing in our experience suggests the introduction of these quantities. Indeed, if a mathematician is asked to justify his interest in complex numbers, he will point, with some indignation, to the many beautiful theorems in the theory of equations, of power series, and of analytic functions in general, which owe their origin to the introduction of complex numbers. The mathematician is not willing to give up his interest in these most beautiful accomplishments of his genius*. A reverse self-fulfilling effect!

Negative numbers are related to mutually exclusive objects or events of a coupled system. For example, position (fixed coordinates) and momentum (mobile coordinates) are mutually exclusive. In two accelerating frames of reference, one who gains has positive value corresponding to the negative value of the other. Since *one* is without similars, it does not change the value in any operation except linear addition and subtraction (becoming many or zero). Thus, squaring or square-root of 1 is 1 (these involve field). Since negative numbers belong to mutually exclusive couplets and not exclusive *one*'s, complex numbers are neither physically nor mathematically valid. **No computer algorithm is possible using complex numbers**.

Infinity is like one: without similars. But whereas the dimensions of *one* are fully perceptible, **the dimensions of infinity are not perceptible**. There cannot be negative infinity to positive infinity through zero, as it will show one beginning or end of infinity at the zero point, which is non-existent at here-now. No mathematics is possible with infinity, as all operations involving it will have undefined dimensions – thus indistinguishable from each other. History shows that whenever infinity appears in any theoretical model, it points to some fundamentally different and novel phenomena. In aerodynamics formulas, as the velocity approached the velocity of sound in the medium where the aircraft moved, the resistance of the medium returned infinite figure. It was believed that supersonic motion is impossible. But when supersonic motion became obvious, the formulas were reviewed. It was noted that they described resistance only in a continuous medium without abrupt jumps in density and pressure. However, transition from subsonic to supersonic motion involves a shock wave in front of the body, leading to abrupt jumps in density and pressure. When these factors were taken into account, the infinity vanished.

The so-called irrational numbers are also perceived as the nearest fraction of integers. Otherwise, we cannot use them in programming. We may be as precise as we want to fix the value of a number tending to zero, but it will never be zero, as that will make it non-existent at here-now making the operation impossible. Similarly, a number tending to infinity will never become infinite, as the result of all such operations become indistinguishable from each other. Like energy, infinities coexist. Only, space, time, coordinates and consciousness are infinite.

Language is the transposition of information to another system's CPU or mind by signals or sounds using energy (self communication is perception). The transposition may

relate to a fixed object/information. It can be used in different domains and different contexts or require modifications in prescribed manner depending upon the context. Since mathematics follows these rules, it is also a language. Mathematics explains only *how much* one quantity, whether scalar or vector; accumulate or reduce linearly or non-linearly in interactions involving similar or partly similar quantities and not *what*, *why*, *when*, *where*, or *with whom* about the objects. These are subject matters of physics. The interactions are chemistry. There is no equation for Observer. The enchanting smile on the lips of the beloved is not the same as geometry of mouth or curvature of lips. Thus, **mathematics is not the sole language of Nature**.

MATHEMATICAL PHYSICS

Because of logical consistency, mathematics is always deterministic. Look at the structure of any equation. The initial condition or parameters are represented by the left hand side. The equality sign describes the special conditions to be met to start any interaction: be it at macro level or micro level. Given the initial conditions, the right hand side describes the theorized outcome of the interaction. We are free to vary the parameters of the left hand side. That is our freewill (though our choices or degrees of freedom may be variously limited). Once the initial parameters are set; (math can't predict this), the right hand side (final outcome), varies correspondingly. This predetermined outcome is mathematics. The equality signs - the special conditions (like temperature threshold to start a chemical reaction), are also predetermined. But it is not defined in a logically consistent way (why that temperature?) – hence not mathematical.

Some say; mathematics, because of its inbuilt logic, writes itself - one can start writing things down without knowing exactly what they are, and the language makes suggestions to proceed. This is the ergodic monkey phenomenon, where a monkey plays with the key-board randomly and the outcome is a master piece of a novel. Though theoretically it is possible as a chance, it does not happen in reality. Others say: *Master enough of the basics; and you rapidly enter what sports players call 'the zone'. Suddenly it gets much easier. You are propelled along*. This is the 100^{th} monkey phenomenon of Sheldrake - notion that new skills are learnt with increasing ease as greater quantities of a population acquire them. There is no proof to justify this view beyond chance and functional ease due to repeated use.

Wigner says[1]: *applied mathematics is not so much the master of the function: it is merely serving as a tool*. Others say; *using mathematics, we can build abstract models without the restrictions imposed by the physical world*. This leads to the incompleteness issues, which exploit problems arising out of unnatural mathematics. We see something when the radiation emitted by it interacts with our eyes. We touch the mass that radiates light. Thus we do not touch what we see (radiation) and see what we touch (mass). **Nature prohibits reductionism**. Whole is a sum of its parts and more. Water is more than 2H and O. A triangle is more than three straight lines. This is natural number theory. 5 has independent perceptual value than 5 *one*s. If we can purchase a car in € 5k, with € 1k, we can purchase 1/5 of a car. This may *look* mathematically valid, but *1/5 of a car* is an undecidable proposition. **Hilbert's problem *whether mathematics is complete*** (every statement in the language of number theory can be either proved or disproved) and **Gödel's negative solution arise out of such unnatural mathematics**. Brute force approach is similarly unnatural, though sometimes it may succeed by chance.

Wigner is right when he talks about[1] *the succession of layers of laws of nature, each layer containing more general and more encompassing laws than the previous one and its discovery constituting a deeper penetration into the structure of the universe than the layers recognized before*. This is the principle that both macrocosm and microcosm replicate each other. As the Minutes of the American Mathematical Society for October, 2005 reported, the theory of dynamical systems used to plan trajectories of spacecrafts and those of transition states of chemical reactions share the same set of mathematics. Wigner is also right that *all these laws of nature contain … only a small part of our knowledge of the inanimate world*. But he misses the point when he says: *All the laws of nature are conditional statements which permit a prediction of some future events on the basis of the knowledge of the present, except that some aspects of the present state of the world…are irrelevant from the point of view of the prediction*. In fact, it is most relevant as the probabilistic laws of Nature. The conditional statements show interdependence of all systems in the cosmos. Our sense organs and measuring devices have limited capacity, so that it measures limited aspects in limited intervals. Since time evolution is not uniform, but conditional on interactions, we do not see each step from the flapping of the wings of the butterfly till it turns into tempest elsewhere. **The creation is highly ordered and there is no randomness or chaos**. **We fault Nature to hide our inability to know**.

Wigner says: *The physicist is interested in discovering the laws of inanimate nature…. It is, as Schrodinger has remarked, a miracle that in spite of the baffling complexity of the world, certain regularities in the events could be discovered.* In an earlier paper[3], we have shown that: **uncertainty is not a law of Nature**. **It is the result of natural laws** relating to measurement related to causality that reveal a kind of granularity at certain levels of existence. The uncertainty relation of Heisenberg was reformulated in terms of standard deviations, where the focus was exclusively on the indeterminacy of predictions, whereas the unavoidable disturbance in measurement process was ignored. A formulation of the error – disturbance uncertainty relation, taking the perturbation into account, was essential for a deeper understanding of the uncertainty principle. By directly measuring errors and disturbances in the observation of spin components, Ozawa developed a formulation: $\varepsilon\ (q)\ \eta(p) + \sigma(q)\eta(p) + \sigma(p)\varepsilon(q) \geq h/4\pi$. **Ozawa's inequality suggests that suppression of fluctuations is not the only way to reduce error, but it can be achieved by allowing a system to have larger fluctuations**. Nature Physics (doi:10.1038/nphys2194) describes a neutron-optical experiment that records the error of a spin-component measurement as well as the disturbance caused on another spin-component. The results confirm that both error and disturbance obey the new relation but violate the old one in a wide range of experimental parameters. Even when either the source of error or disturbance is held to nearly zero; the other remains finite: thus, mutually exclusive.

Light Cone is a *mathematical model* that is said to encode the causal structure of Spacetime. Each event in Spacetime has a double-cone attached to it, where the vertex corresponds to the event itself. Time runs vertically - the upward cone opens to future of this event. The downward cone shows past. But if the light pulse radiates in all directions, **it should show concentric spheres and not a double-cone**. The trick is done by first taking two dimensions and time as the third dimension. But even then it will be concentric circles and not a conic section. **Event horizon is the limit of our vision**.

Not only time is cyclic, but also is unidirectional because **'now' is linked to future in a different way; than it is linked to the pas**t. Space, Time and coordinates arise from our concept of sequence and interval. When it is related to objects, we call the interval space. When it is related to events, we call the interval time. When we describe inter-relationship of objects, we describe the interval by coordinates. *Present* and *future* are segments of these sequences of intervals that are strictly ordered - future always follows present. The same is not true for past, because any past event can be linked to the present bypassing the specific sequence. This proves unidirectional time. Since the intervals are infinite, space and time are an infinite continuum. We use segments of this analog reality. Thus, our description relates to here-now over a medium scale, which we tend to universalize. This gives a distorted picture.

MISSING THE WOODS FOR THE TREES

Does the structure and availability of existing mathematics shape the formulation of physical theories? Yes! Examples:

Dimension is the perception of differentiation between internal structural space and external relational space of an object. Since we observe through electromagnetic radiation, where the electric field and the magnetic field move perpendicular to each other and both move perpendicular to the direction of motion, we have three mutually perpendicular dimensions representing length, breadth, height that are invariant under mutual transformation. **There are no extra large or compact or n'th dimension**. The surface of a cube is not 2D, as it has no independent existence. There is no independent straight line in 1D. It is a mark on a three dimensional paper or space. The surface of a sphere is not 1D, but 3D.

Directions (axes) and sequential arrangement (coordinates) of an object are used with reference to an origin in relation to other objects. With only one object, direction is meaningless. Direction is used to:

1) Measure distance between two objects from origin by assigning + or – signs from origin along various axes.

2) Indicate shortest distance between two objects on a curved surface like a geodesic.

3) Reflect the behavior of fundamental forces of Nature; i.e., strong interactions move towards center, part of weak interactions limits movement away from center, e.m. interaction move out from center to lower concentration, beta-decay separates a part from the center, gravitational interaction relates interaction between bodies. But **often, dimension is exchanged for direction in phase space portrait and its quantum Avatar, Hilbert space**. This leads to the undecidable propositions.

If we divide 20 by 5, then we take out bunches of 5 from the lot of 20. When the lot becomes empty or the remainder is zero or below 5 (divisor) so that it cannot be considered a bunch and taken away further, the number of bunches of 5 are counted. That gives the result of division as 4. In case of division by zero, we are supposed to take out bunches of zero, which is impossible as it is not at here-now of the operator. At no stage the lot becomes zero or less than zero. Thus, the operation is not complete and result of division cannot be known, just like while dividing 20 by 5, we cannot start counting the result after taking away two bunches. Conclusion: division by zero is mathematically void; hence it leaves the number unchanged. Since zero does

not exist at here-now, it does not affect addition or subtraction. During multiplication by zero, one non-linear component of the quantity is extended to zero, i.e., moves away from here-now to a superposition of states. Thus, the result becomes zero for the total component, as we cannot have a Schrödinger's undead cat in real life. In division by zero, the non-existent part is sought to be reduced from the quantity (which is an operation akin to collapse reversal in quantum mechanics), leaving the quantity unchanged. **Division by zero leaves the number unchanged**.

Two possibilities of **measurement of a moving rod suggested by Einstein** in his 1905 paper[4] were:

(*a*) *The observer moves together with the given measuring-rod and the rod to be measured, and measures the length of the rod directly by superposing the measuring-rod, in just the same way as if all three were at rest, or*

(b) By means of stationary clocks set up in the stationary system and synchronizing with a clock in the moving frame, the observer ascertains at what points of the stationary system the two ends of the rod to be measured are located at a definite time. The distance between these two points, measured by the measuring-rod already employed, which in this case is at rest, is the length of the rod.

The method described at (*b*) is misleading. We can do this only by setting up a measuring device to record the emissions from both ends of the rod at the designated time, (which is the same as taking a photograph of the moving rod) and then measure the distance between the two points on the recording device in any unit. But **the picture will not give a correct reading** because:

- If the length of the rod is small or velocity is small, then length contraction will not be perceptible according to the formula given by Einstein.
- If the length of the rod is big or velocity is comparable to that of light, then light from different points of the rod will take different times to reach the recording device and the picture we get will be distorted due to different Doppler shift. Thus, there is only one way of measuring the length of the rod as in (*a*).

The fallacy in the above description is that if one treats *as if all three were at rest*, one cannot measure velocity or momentum, as the object will have zero relative velocity. Einstein missed this point when in the same paper[4], he said: *Now to the origin of one of the two systems (k) let a constant velocity v be imparted in the direction of the increasing x of the other stationary system (K), and let this velocity be communicated to the axes of the co-ordinates, the relevant measuring-rod, and the clocks*. But is this the velocity of k as measured from k, or is it the velocity as measured from K? K and k each have their own clocks and measuring rods, which are not treated as equivalent by Einstein. Therefore, according to his theory, they will measure the velocity of k differently. Einstein does not assign the velocity specifically to either system. Everyone missed it and got misled. His spinning disk example in GR also falls for the same reason.

On the definition of synchronization Einstein says: *Let a ray of light start at the "A time" t_A from A towards B, let it at the "B time" t_B be reflected at B in the direction of A, and arrive again at A at the "A time" t'_A. In accordance with definition the two clocks synchronize if:*
$t_B - t_A = t'_A - t_B$.

We assume that this definition of synchronism is free from contradictions, and possible for any number of points; and that the following relations are universally valid:

1. *If the clock at B synchronizes with the clock at A, the clock at A synchronizes with the clock at B.*
2. *If the clock at A synchronizes with the clock at B and also with the clock at C, the clocks at B and C also synchronize with each other*.

The concept of relativity is valid only between two objects. Introduction of a third object brings in the concept of privileged frame of reference and all equations of relativity fall. In the above description, **the clock at A is treated as a privileged frame of reference for proving synchronization of the clocks at B and C**. Yet, he claims it is relative!

Russell's paradox raises an interesting question: If S is the set of all sets which do not have themselves as a member, is S a member of itself? The general principle is that: there cannot be a set without individual elements. Collection of different objects unrelated to each other would be individual members as it does not satisfy the condition of a set. Thus a collection of objects is either a set with its elements, or individual objects that are not the elements of a set.

Example: p(x): $x \notin x$, is the defining property p(x) of any element x such that it does not belong to x. Many sets have this property. A library p(x) is a collection of books. But a book is not a library $x \notin x$. Suppose this property defines the set $R = \{x : x \notin x\}$. It must be possible to determine if $R \in R$ or $R \notin R$. However if $R \in R$; then the defining properties of R implies $R \notin R$, which contradicts the supposition that: $R \in R$. Similarly, the supposition $R \notin R$ confers on R the right to be an element of R, again leading to a contradiction. The only possible conclusion is that, the property $x \notin x$ cannot define a set. It is convenient to choose a *largest* set in any given context called the universal set and confine the study to the elements of such universal set only. This set may vary in different contexts, but in a given set up, the universal set should be so specified that no occasion arises ever to digress from it. Otherwise, there is every danger of colliding with paradoxes such as the Russell's paradox. In the case of EP, we do blunder!

All objects fall in similar ways under the influence of gravity. Hence locally, it is said, the difference between an accelerated frame and an un-accelerated frame cannot be known. But these must be *related to be compared as equivalent or not*? In the example of a person in an elevator falling down a shaft, it is assumed that during any sufficiently small amount of time or over a sufficiently small space, the person can make no distinction between being in the falling elevator and being stationary in completely empty space, where there is no gravity. This is a wrong description – distinction of what? Unless we relate the elevator to the outside space, we cannot relate *motion of the elevator* to it. The moment we relate to the structures beyond the elevator, we can know the relative motion of the elevator. Inside a spaceship in deep space, objects behave like Brownian motion (unaccelerated) or like the asteroids in the asteroid belt (accelerated). Usually, they are relatively stationary within the medium unless some other force acts upon them. If the person can see the outside objects, then he can know the relative motions by comparing objects at different distances. If he cannot see the outside objects, then he will consider only his position with reference to the spaceship – stationary or floating within a frame. **There is no equivalence because there is no other frame for comparison**. Relativity theory needs revision.

A same logic applies to the ray of light that appears curved to the occupants of the spaceship. The light can be related to the spaceship only if we consider the bigger frame of reference containing the source of light and the spaceship. If we consider outside space as a separate frame of reference unrelated to the spaceship, the ray emitted by it cannot be considered inside it. If the passenger could observe the scene outside, he will notice this difference and know that the spaceship is moving. Otherwise, the consideration will be restricted to the rays emanating from within, which will move straight. In either case, the description is faulty. Thus, the foundation of GR - the EP - is **wrong description of reality**. Hence all mathematical derivatives built upon such wrong description are wrong. **There is no inertial mass increase**.

Einstein has used equations $x^2+y^2+z^2-(ct)^2 = 0$ and $\xi^2 + \eta^2 + \zeta^2 - (c\tau)^2 = 0$ to describe the evolution of the same light pulse that the observers see. But $x^2+y^2-(ct)^2 = 0$ describes a circle with ct as the radius! Hence z and ζ have to be zero. It can't be a sphere! **Since (x. y. z) is a point on the circumference, moving in z direction will be tangential. It describes a cylinder and not a sphere! The geometer's descriptions of π-sphere and the topologist's descriptions of n-dimensional sphere are mathematically and physically void**.

Einstein can describe two concentric spheres with the points (x,y,z) and (ξ, η, ζ) on their respective circumferences. Since the second person is moving away from the origin, the second equation relates to sighting from his here-now (new origin). Assuming he sees the same sphere, he should know its origin (because he has already seen it, otherwise he will not know that it is the same light pulse). In case he takes a new measurement from his origin, according to Einstein, the reading from two frames will be different. In other words, he will either measure it independently as different or measure the same radius as the other, implying: either:
$x^2+y^2+z^2-c^2t^2 \neq x'^2+y'^2+z'^2-c^2\tau^2$, $t \neq \tau$.
Or $c^2t^2 = c^2\tau^2$ or $t = \tau$. **This creates contradictions, which invalidates his mathematics**.

LOOKING AHEAD

Recent discovery of galactic blue-shift (Lowell Observatory Bulletin No. 58 Vol. II No. 8) and arXiv: 1402.6319 v1 [astro-ph.GA], galactic merger (Astronomy Newsletter - 18th July, 2014) and the absence of red-shift in galactic or lesser scales should prove dark energy a myth. Energy is perceived through its interactions. If it is not interacting, it cannot be energy. Fluids are also smooth and persistent. Interpretation of M & M experiment is faulty, as light is a transverse wave, which is background invariant. Like the solar system, the universe id spinning around a galactic center. Dark energy is the universal background structure.

Abundance of 'Hot Jupiters' among alien planets and protons in cosmic rays shows macro-micro relation. Separately we have shown that the internal structures of Jupiter and proton are similar.

Bare mass or bare charge is fiction. The equation $e = mc^2$ is mathematically invalid as LHS is time invariant and RHS time variant (per second). It should be written as (m) $e \rightarrow (mc)^2$ which balances it to show the rate at which energy acts on mass. Energy cannot be confined in packets, but only by mass. Confined mass-energy is fermion (hence half integer spin) and unconfined mass-energy is boson (zero spin). Fluid (intermediate) behavior is integer spin.

Result of Time dilation experiment with atomic clocks was faked. This can be verified from the original data kept at US Naval Archives. The delayed signal of GPS is due to refraction when the signal reenters the denser atmosphere of Earth. Time dilation is relative time evolution of elements in entropy, where thermodynamic process sustains life and total disorder is annihilation of form.

There is a need to ponder over these issues, introspect and rewrite physics.

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