

Letter To Feynman, Einstein, Wallace, Darwin, Maxwell and Mendeleev

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Abstract

The Roberts-Janet Nuclear Periodic Table has emerged recently. The inversion of the Periodic Table to accommodate spatial variation of atomic energy levels relative to the nucleus has subsequently been underwritten by Quantum Field Theory's $U(1) \times SU(2) \times SU(3)$ group symmetry and Clifford Algebra resulting in a one-to-one mapping between the Roberts-Janet Table and The Quantum Mechanical Table. This manuscript attempts to show the over-arching nature of the Roberts-Janet Table epitomised by two cycles. The first of these is the role of causality within the lower half of the table in nucleosynthesis and cosmology whilst the second attempts to outline causality's path in the upper half of the table in biochemical settings. The link between the cycles is the set of elements themselves; within theoretically an infinite group of elements as radioactivity is reignited having been extinguished temporarily in the ebb and flow of production and annihilation of white dwarfs, neutron stars and black holes. The current scientific landscape is outlined to create a platform from which to proceed. Various sizes of black hole production suggest a hierarchy of outcomes which produces a reignition of radioactivity and potentially a creation of other universes from the explosions of larger supermassive black holes as energies increase to the Planck scale resulting in periods of inflation and condensation that predate quark production. Universes could be superimposed on previous universes explaining why some supermassive black holes appear nearer than current theoretical models.

Current scientific discourse is embarking on a convergence-absorbing the individual atoms as displayed within the upper half of the Roberts-Janet Nuclear Periodic Table with molecular mechanisms, biochemical pathways and origins of life [1]. Never before has a theory, Quantum Field Theory, reached a level of description and empirical evidence where such an attempt to accommodate the scientific disciplines within a mathematical

framework of axioms been contemplated. Yet this is merely a start as unexpected observations await in science; mathematical models will be enhanced by Artificial Intelligence-as illustrated by the release of the structure of every protein known to science using the Deep Mind AI Alpha Fold 2 generating structures for the human body, yeast, fruit fly and mice [2].

Table 1: Roberts – Janet Nuclear Periodic Table

								∞	∞	
LIMITS TO QUANTUM ENERGY STATES OF ELECTRONS								\uparrow	\uparrow	
Period11		221 ^{6b} 242	243 ^{7g} 260	261 ^{8f} 274	275 ^{9d} 284	285 ^{10p} 290	291 ^{11s} 292	2(6) ²		
Period10			171 ^{6g} 188	189 ^{7f} 202	203 ^{8d} 212	213 ^{9p} 218	219 ^{10s} 220		2(5) ²	
Period 9			121 ^{5g} 138	139 ^{6f} 152	153 ^{7d} 162	163 ^{8p} 168	169 ^{9s} 170	2(5) ²		
Period 8		ELECTRON STATES OCCUPIED BY ATOMS OUTSIDE STARS		89 ^{5f} 102	1036d112	113 ^{7p} 118	119 ^{8s} 120		2(4) ²	
Period 7				57 ^{4f} 70	71 ^{5d} 80	81 ^{6p} 86	87 ^{7s} 88	2(4) ²		
Period 6					39 ^{4d} 48	49 ^{5p} 54	55 ^{6s} 56		2(3) ²	
Period 5					21 ^{3d} 30	31 ^{4p} 36	37 ^{5s} 38	2(3) ²		
Period 4							13 ^{3p} 18	19 ^{4s} 20		2(2) ²
Period 3								5 ^{2p} 10	11 ^{3s} 12	2(2) ²
Period 2							3 ^{2s} 4		2(1) ²	
	$\infty \leftarrow$	51 - 72	33 - 50	19 - 32	9 - 18	3 - 8	1 - 2	GROUP		
Period 1							1 ^s 2	2(1) ²		
ZERO POSITIVE ELECTRIC POTENTIAL									2(0) ²	
INFINITE NEGATIVE ELECTRIC POTENTIAL								2(0) ²		
RESERVOIR ENERGY STATES OCCUPIED BY PROTONS IN PLASMA PRIOR TO FUSION							2		2(-1) ²	
							2		2(-1) ²	
						6	2		2(-2) ²	
						6	2		2(-2) ²	
					10	6	2		2(-3) ²	
					10	6	2		2(-3) ²	
				14	10	6	2		2(-4) ²	
				14	10	6	2		2(-4) ²	
						18	14	10	6	2
		18	14	10	6	2		2(-5) ²		
								\downarrow ∞	\downarrow ∞	
Strong Field Cloaks Quarks Forming Larger Nuclei After Trigger of Fusion by Weak Force										

Table 2: QUANTUM MECHANICAL TABLE

2n² = n(n+1) + n(n-1) TABLE								
						n(n+1)	n(n-1)	
22	18	14	10	6	2			
22	18	14	10	6	2	42	30	n = 6
	18	14	10	6	2			
	18	14	10	6	2	30	20	n = 5
		14	10	6	2			
		14	10	6	2	20	12	n = 4
			10	6	2			
			10	6	2	12	6	n = 3
				6	2			

				6	2	6	2	n = 2
					2			
					2	2	0	n = 1
					0			
					0	0	0	n = 0
					2			
					2	0	2	n = -1
				6	2			
				6	2	2	6	n = -2
			10	6	2			
			10	6	2	6	12	n = -3
		14	10	6	2			
		14	10	6	2	12	20	n = -4
	18	14	10	6	2			
	18	14	10	6	2	20	30	n = -5
22	18	14	10	6	2			
22	18	14	10	6	2	30	42	n = -6

Much to the chagrin of chemists, the Periodic Table has lost its uniqueness, the ball and stick model of molecules dissolved in a fuzziness of quantum tunnelling, superposition, entanglement and decoherence induced by Heisenberg and Schrodinger-so much for the average energy of bonds [3].

“What would Mendeleev say?” cry the traditionalists stung by the idea of the established version of the periodic table in all its guises having to face the reality that chemistry must at some stage integrate into biological science, astronomy, particle physics and cosmology. “Evolution of the Periodic Table? Surely that is for Biology!”

Biologists have long suspected such fuzziness in Nature as evidenced by disease, sexuality across the living evolutionary landscape and more recently by the global pandemic of Covid 19 with its evolving symptoms, mutations and transmissions [4].

Yet when confronted with the regimental jacketed hypothesis of the engineers and theoretical physicists-that of the second law of thermodynamics (entropy increases), atomic chaos results for a closed system, they, the biologists retreat into the haven that by virtue of having a membrane the biological cells are closed systems so they do not violate “fundamental laws.” Quotes from What is life? by Erwin Schrodinger “an organism’s astonishing gift of controlling a stream of order on itself and thus escaping the decay into atomic chaos” and “existing order displays the power of maintaining itself and producing orderly events” indicate the apparently counter-intuitive property of living objects underwritten by structures of complex molecules. Six principles of life are

outlined by Paul Nurse in his talk at the Royal Institution [5].

It might seem childlike but the observation that cells are interconnected, assimilate nutrients from the bloodstream through diffusion, osmotic pressure and concentration gradients using semi-permeable membranes must surely imply a non-classical set of pathways reminiscent of Maxwell’s demons of the 1860’s and the beginning of information entropy and quantum properties of superposition and entanglement. What does a closed system mean? Can entropy reverse locally? Here cells absorb materials evolve, replicate, divide and mutate into more complex forms. Surely this is entropy decreasing as self-assembly operates to create order and functionality in the cell.

This raises the philosophical question: Is the second law of thermodynamics universally applicable? or do the phase changes outlined in the Roberts-Janet Table suggest that as we move from low entropy high order initially into high entropy low order in condensed matter and back to low entropy high order once more in the form of white dwarfs, neutron stars and black holes is this merely an oscillation between low and high entropy where given suitable boundary conditions such oscillations occur?

The Second Law of Thermodynamics would apply to where entropy increases but what of such science where the opposite is true macroscopically-white dwarfs shrinking as they gain mass-phase changes within states-and microscopically at the nano and scales even lower now beginning to be explored and in the future? [6].

One example of this self-assembly is the fourth phase of water discovered by Gerald H Pollack. When touching hydrophilic surfaces, water transforms into EZ (exclusion zone) water in a hexagonal cell structure where at the nano scale dissolved substances migrate by electric charge repulsion leaving pure water in this region with the formula $H_3O_2^-$ negatively charged while the rest of the water adjacent to this region is positively charged. (A reconfiguration of the OH^- and H^+ ions). This explains why when sea ice extends beyond the current ice structure by freezing, it is only the pure water (ice) that solidifies leaving the dissolved substances (sodium chloride and other compounds) within the remaining water or ocean. Cells being mainly water will possess these migratory properties of positively and negatively charged ions which can act as a battery within cells. As Pollack quotes in his book *Cells, Gels and the engines of Life*, Albert Szent-Gyorgyi, regarded as the father of modern biochemistry, felt that “Life is water dancing to the tune of solids” [7, 8].

“Messrs Wallace and Darwin you may be interested to know of other developments as well as the fourth phase of water. Plants are also familiar with the use of quantum properties in the conversion of water and carbon dioxide into glucose molecules within the cell structures using photons of light from the Sun-photosynthesis. The process is virtually 100% efficient due to a quantum field effect of superposition of electrons within the cell structure. They all absorb some energy at the same time rather than passing it from one to another like billiard balls using fields and wave functions.”

“These days, Mr Feynman, we are aware that plants and various varieties of stars use quantum field theory every day. The trouble is they are really smart-they’re not going to tell us how they do it-we have to figure it ourselves.”

Pollack believes the central role of water has been overlooked and forgotten with current reductionist approaches that emphasize slice and dice rather than more holistic approaches. Water creates the necessary boundary conditions for these essentially quantum field phenomena.

In a recent Cell Science Webinar, Sinerik Ayrapetyan wrote

“The activation of Quantum-Sensitive Camp-Dependent Na/Ca Exchange in Reverse Mode as a Primary Mechanism for Generation of Pain. He proposes the existence in the cell membrane of a distinct quantum sensitive mechanism(s) controlling semi-permeable properties of a membrane some of which may be activated by the presence of water by inflammations which result in the experience of pain.”

Do avenues of thought, imagination, consciousness and neuroscience extend from quantum processes within cells?

Both Pollack and Ayrapetyan question Hodgkin and Huxley’s

hypothesis for the ionic mechanisms involved in excitation and inhibition in the peripheral and central portion of the nerve cell membrane. It appears that the resolution available to Hodgkin and Huxley at the time of their experiments concealed an underlying fuzziness familiar to biologists but of a quantum field nature. Hodgkin himself in his 1963 Nobel lecture concedes;

“To begin with we hoped that the analysis might lead to a definite molecular model of the membrane. It gradually became clear that different mechanisms could lead to similar equations and that no real progress at the molecular level could be made until much more was known about the chemistry and fine structure of the membrane.”

Is history repeating itself now in ways not dissimilar to the 1935 classic put-down of Chandrashekhar’s theory of collapsed stars from white dwarfs to neutron stars and black holes by Arthur Stanley Eddington’s “reductio ad absurdum?”-group thinking of the Cambridge Cabal of that era. Here instead of being dismissed out of hand by Eddington, Chandrashekhar’s theory proved correct and supported Quantum Field Theory indirectly during its troubled childhood. While now the accepted theory on transmission of ions in membranes of cells is being superseded by quantum concepts which attempt to explain phenomena now being discovered by improved resolution and empirical evidence-Hodgkin and Huxley being overtaken by Pollack and Ayrapetyan.

Note the 2021 Nobel prize for Physiology and medicine together with Photosynthesis breakthrough for increasing CO_2 uptake in plants University of Copenhagen and high-resolution Lab Experiments show how cells “Eat”-solves a problem in cell biology lasting over 40 years Ohio State University.

Enter the geologists. With their painstaking analysis of fossil record, rock structures and processes within the Earth since its formation, insights as to how species evolved through climate change, as habitats waxed and waned through continental drift have become apparent. Yet the mystery of the origin of life and its evolution remains with pockets of trace elements: calcium, sodium, zinc, manganese, iron, potassium, phosphorus and others being part of the story. Until only recently, the biologists, since the time of Gregor Mendel, have encountered the dismissiveness of physicists as being of inconsequential low orders of energy compared with plasma, nucleosynthesis, black holes and relativity though this has changed recently with the discoveries of DNA, genome sequencing and CRISPR gene editing.

Coupled with this, the biologists and others have observed the detached, almost unhinged inventions of mathematicians with their constructs of towers of infinities, topologies and dimensions in their quest for rigour and proof despite being clearly overwhelmed by the complexity, shape and dynamic replication of Nature itself.

A mathematical model to describe Nature in all its states and transient phases has so far eluded them whilst schisms have formed within the mathematical community [9-11].

Godel's Incompleteness Theorem and Cantor's size of infinities measured by cardinality result in the premise-not all infinities are equal but some are more equal than others. This raises the vexed question within quantum field theory as how to accommodate the dynamic interplay between states and transition phases at all orders of magnitude down to the Planck scale encompassing both halves of the Roberts-Janet Table-renormalization.

Hello Mr Feynman with his phrase, "If anyone says they understand quantum mechanics, then they don't understand quantum mechanics." To which the bright spark riposte is "Ok. I might be seventy something going on six, you figure it out." "Shut up and calculate" retorts Feynman with another put down.

"If you can't or won't calculate it, I'll ask my friends artificial intelligence about quantum field theory and see what they say. I know you like to work through processes over and over again and be led by the evidence before making predictions keeping an open mind and remaining independent-personally I know that feeling. These days we still have to discipline the imagination to conform to scientific principles and symmetries-but what happens when some of those very principles are called into question. What then Mr Feynman?"

Ben Still's video the fundamental constituents of matter and the Eightfold Way takes up the story [12]. Just after the triumph or disaster depending on your point of view of the Manhattan Project, strange particles were discovered called kaons followed by an explosion of particles in atom smashing machines in the 1950's. These strange particles formed rapidly but decayed slowly. Were there two separate processes at work? -one for production and another for decay. Murray Gell-Mann suggested another quantity strangeness was conserved when the particles were created but violated when they decayed. He looked at properties of charge, strangeness and isospin and started to place particles into a pattern-similar to the way you, Mr Mendeleev, placed elements according to their chemical properties, reactivity and mass number in creating the Periodic Table. You found gaps and made predictions as to what properties, approximate mass number these elements would have. Subsequently such elements were discovered. When Gell-Mann placed these subatomic particles according to their properties, shapes like octets and decuplets appeared called symmetry groups. He with others predicted the existence of the omega minus baryon in 1961 which was observed in 1964. This led to the proposal by Gell-Mann and Zweig of quarks. Meanwhile Higgs had proposed a mass interacting boson particle and you, Mr Feynman, along with Schwinger helped to develop quantum field theory in the forms of quantum chromodynamics and quantum electrodynamics which

led to the Standard Model including six quarks- up, down, charm, strange, and a third generation of quarks proposed in 1973 by Kobayaski and Moskawa to explain CP violations in kaon decay. The names top and bottom were introduced by Harari in 1975 to reflect the fact that the two were the "up" and "down" component of the weak isospin doublet first observed by Stern and Gerlach in 1922. "Though the bottom quark was discovered in 1977 it was not, Mr Feynman, until 1995 that the top quark was discovered with spin half, electric charge +2 and interactions with all four forces. The role of the strong force's range-asymptotic freedom-was developed by Wilczek and the Higgs boson has now been discovered, you'll be pleased to know Mr Feynman, in 2012. With detectors sufficiently sensitive, gravity waves were observed, Mr Einstein, in 2016 some one hundred years after you first made the theoretical prediction." Those cosmologists and mathematicians also have their internal debates involving the Hubble Constant and its range of empirical values as measured by different methods currently outside experimental errors [13].

The lower half of the Roberts-Janet Table and its one-to-one mapping with the Quantum Mechanical Table suggest that local regions of individual supernovae in themselves may be isotropic but different when compared with other supernovae. This occurs as ratios of isotopes vary with every supernova giving rise to extremely large numbers of periodic tables with a diverging set of mass numbers initially which over time converge as the expansion of the universe proceeds; radioactivity itself having been extinguished and reignited from time to time as phases of white dwarf, neutron star and black hole formation and annihilation come and go. The whole system is underpinned with identical atomic numbers-the elements themselves [3].

The universe at a granular level may well be anisotropic giving rise to variations in the Hubble Constant where local perturbations dominate as the expansion of the universe proceeds. Entropy and thermodynamics need to be interpreted with care in different settings as they appear increasingly localised and reversible. The first ionization energy levels within the Roberts-Janet Table appear to show this pattern at the completion of each quantum set of states as indicated by the Quantum Mechanical Table [14]. Boundary conditions play a vital role in changes of state so any mathematical model will have to merge one set of conditions into another. The Butterfly Effect may play a role in more numerous dimensions but disappears as decoherence at smaller scales thus preserving information entropy. The implications raise questions of numerous dimensions within the conventional three space and one time. Since infinities lie between the integers not forgetting complex numbers, in our reality within the parameters of three space and one time may lie subsets of infinities leading to different outcomes from almost identical initial conditions. No wonder then, Mr Feynman, it is so difficult to plot causality in all its manifestations. Chaos in our reality results in unique outcomes making predictability extremely difficult yet causality working simultaneously its

inexorable inevitable progress. Examples include murmurations of starlings, weather patterns in Earth's atmosphere and oceans where climate change is starting to skew the amplitude and range of events or predicting the lava flow from a volcanic eruption and the initial and final times of such an eruption.

Note the Nobel Prize for Physics 2021 for work on order in complex systems like climate in large scales and the spins inside atoms for small scales. Moving into the quantum world beneath this perceived large-scale reality the researchers at Los Alamos found, "We can actually see what happens with a complex quantum world if we travel back in time, add small damage, and return [15]." In the team's experiment Alice, a favourite stand-in agent used for quantum thought experiments, prepares one of her qubits in the present time and runs it backwards through the quantum computer. This action disturbs the qubit and destroys all its quantum correlations with the rest of the world. The system is then run forward to the present time. Yan and Sinitsyn, the authors of the research, found that most of the presently local information was hidden in the deep past in the form of quantum correlations that could not be damaged by minor tampering. They showed that the information returns to Alice's qubit without much damage despite Bob, another popular stand-in agent for quantum thought experiments, interfering. Counter-intuitively, for deeper travels to the past and for bigger "worlds" Alice's final information returns to her even less damaged. When all qubits return to the "present" they appear largely unaltered, as if reality is self-healing. "We found that the notion of chaos in classical physics and in quantum mechanics must be understood differently" said Sinitsyn.

Bubeck and Sellke have shown in a recent paper that smoothly fitting high-dimensional data points require not just n parameters but $n \times d$ parameters where d is the dimension of the input [16]. For a network to memorize its training data over-parameterization is not just helpful-it's mandatory.

Other processes involving adaptation to the environment maybe at work including left-handed chirality, protein folding, active sites of chromosomes and vibronic mixing [17-19].

The latter suggests that molecular systems can alter the pathways of energy according to conditions in the environment using oscillations of electronic vibrational mixing coupled with nuclear degrees of freedom. It is how a traffic light system operates switching the flow of traffic at a junction from one pathway to another depending on the surrounding conditions.

Though embedded within quantum field theory, some of these descriptions begin to impinge on relativity-spacetime granular or continuous, how to accommodate sets of infinite frames of reference and the role of time. Recently astrophysicists have observed the red shift of white dwarfs caused by gravity and studied the Mass-Radius Relation for this group of white dwarfs [20].

As white dwarfs add mass, they shrink in size until they collapse into neutron stars. Here gravity appears to be creating a quantum effect of high order. To quote Vedant Chandra, the lead author of the paper;

"The way I extolled to my grandad is, you're basically seeing quantum mechanics and Einstein's theory of general relativity coming together to produce this result. He was very excited when I put it that way." This presents an opportunity to address Mr Einstein himself. "You may have climbed on the shoulders of Maxwell and seen further but recently it appears Quantum Field Theory has done likewise and is beginning to address his (Maxwell's) demons of self-assembly, entropy and thermodynamics. Feynman may have described you as one who has his head in the clouds but his feet on the ground. Quantum Field Theory too has its head in the clouds (applications in all scientific disciplines including neuroscience, consciousness, imagination and thinking) but also has its feet on the ground (quantum computing and emerging artificial intelligence). Mr Einstein you may be interested to know how quantum error correction, which explains how to protect and recover quantum information in quantum computers and other complex interacting systems, now becomes fundamental to the understanding of quantum gravity [21]."

To quote Anatoly Dymarsky the lead author of the report who said, "Normally information stored in physical systems is localized. Say a computer file occupies a particular small area of the hard drive. By error we mean any unforeseen or undesired interaction which scrambles information over an extended area. In a rather unexpected twist, scientists realized not too long ago that quantum gravity-the theory describing quantum dynamics of space and time-operates similar mathematical protocols to exchange information between different parts of space. The locality of information within quantum gravity remains one of the few open fundamental problems in theoretical physics. That is why the appearance of well-studied mathematical structures such as quantum error correcting codes is intriguing. Yet the role of codes was only understood schematically and the explicit mechanism behind the locality of information remains elusive. Now we have a new playground to study the role of quantum error correcting codes in the context of quantum field theory. We hope this is a first step in understanding how locality of information works and what lies behind all this beautiful mathematics."

A truly wonderful extension to Alice and Bob's Quantumland has appeared for them to enjoy and explore [22]. Thought provoking as they are, will such illustrations, if ever, be testable, verifiable or falsifiable? A quantum mathematical framework with axioms at this stage maybe optimistic but that is no reason not to make the attempt as the recent verification by NASA of Hawkin's Theorem for black holes bears testament.

Though the contents outlined here are relatively recent, they are part of a long- standing motivation by indigenous tribes, past

civilizations, philosophers and writers alike; that of a curiosity to search for the truth and describe Nature as they perceive it with their understanding at the time. The tension between mathematical theory and empirical experimentally based evidence of observation and deduction can be described using many stories. The white rabbit and Alice of Alice's Adventures in Wonderland or the Emperor and the child of The Emperor's Clothes come to mind but the most apt would appear to be The Hare and The Tortoise of Aesop's Fables. This is not a physical race but a mental one towards understanding and enlightenment. The mathematicians and the theorists represent the hare while the experimentalists of all scientific disciplines represent the tortoise. The theoreticians seek solutions to precise problems and then generalise within a formula and almost taunt, ridicule and challenge the experimentalists to find proof of their great ideas. The experimentalists work methodically refining their measurements, improving resolution, developing better instruments and adding insights on the way.

At first the theoreticians delight in their success and brag only for experimental evidence or self-doubt to deflate them as the realisation dawns of the size and scale of the challenge. They shrink into a state of silence or confusion while the experimentalists continue to mull the evidence with all the debate and disagreement that entails. Starting from a difficult childhood, quantum field theory has matured through this self-doubt and has produced several equations as has relativity but they appear irreconcilable at times and the dismissiveness between the camps has produced more silence than triumphalism in recent years as the size of their achievements has shrunk on an intuitive scale. The experimentalists have discovered and observed many new quantum phenomena recently some predicted by the theoreticians but others completely unexpected bringing the need for further experimentation with additional models to explain the new observed effects using tunnelling, superposition, entanglement and decoherence.

The moral of this story is that in this mental race the finishing line becomes blurred with so many infinities, large and small, phase transitions and quasi-particles such as anyons, axions and fractons together with fractal shapes that it may not be possible to determine when the race has finished. Please note the example of the current development of quantum topological computing [23]. Suddenly the fable of the hare and the tortoise is transformed from a single hare and tortoise race with a prescribed finishing line into many hares and many tortoises appearing from multiple starting points collaborating in many different ways as some tortoises draw level with hares and team up whilst other hares back track and reconsider some of the nuances seeking further co-operation [24]. Beyond the mist of quantum fuzziness will the topological magnetic monopole appear not in real space but in momentum space as the Berry curvature within the Berry phase? [25].

Now with the help of the surreal nature of quantum physics Markus Graf at the Fraunhofer Institute for Applied Optics and Precision

Engineering in Jena Germany has discovered a way to create holograms of items without detecting any light from them [26].

"The light that illuminates the object is never detected" Graf says. "The light that is detected never interacted with the object."

This is the mist of fuzziness, the hallmark of quantum physics, where atoms and other building blocks can exist in a state of flux of "superposition" meaning they can be located in two or more places at once. One consequence of quantum physics is entanglement wherein multiple particles are linked and can influence each other instantly regardless of how far apart they are. One way to generate entangled photons is by shining a beam of light at a special "non-linear" crystal that can split each photon into two lower energy photons of longer wavelengths.

In this case the researchers used a non-linear crystal to split a violet laser into two beams, one far-red, the other near infra-red. The far-red beam was used to illuminate a sample-a glass plate engraved with symbols-while they used a camera to record the near infra-red light. Using entanglement, they could use data from the near infra-red light to reconstruct a hologram based on the details of the object the far-red beam had scanned.

By tinkering with the way in which non-linear crystals and other components manipulate light this new "quantum holography" technique could use say a mid-infra-red beam to scan an object while using the partner visible light beam (which can then be detected by conventional visible-light sensors) to generate the hologram. Potential applications would be medical imaging.

Stepping back for a moment to address some of those who have helped science progress, "Mr Darwin, you grappled with a personal dilemma for over twenty years following your journey round the world with insights gained on time scales, geological eruptions and changes of characteristics in animals, reptiles and birds-evolution/divine intervention. It was only when you received Wallace's abstract that it catapulted you into publishing what became known as Origin of Species. Yet throughout this time the idea of a "vital force" creating living things was gradually being rejected as first urea, a substance found in living things, was replicated from inorganic compounds by Friedrich Wohler in 1828 followed by acetic acid in 1845 by one of his students, Kolbe. As more organic compounds were synthesized such a vital force theory became superfluous as applications for medical use became widespread. Overuse of antibiotics in recent years has resulted in the evolution of bacteria resistant to such antibiotics presumably by the very process of evolution you proposed in 1859 though considerably more details and nuances have been introduced since that time. The question then was what pre-dated evolution-such a timescale in your era was inconceivable as was nucleosynthesis.

Do I detect an uncomfortable feeling approaching fury, Mr

Mendelev? As science comes to the inescapable conclusion that the elements whose pattern you created in the Periodic Table are not only created from plasma hydrogen then fusion but can themselves decay by radioactivity into a chain of elements some extremely unstable. Adversarial theories are being replaced gradually with hindsight, a young and developing skill in science compared to rejection and dismissiveness to create convergent theories which have to embrace so much more detail. Such is the progress science has made over time. Observation and experiment will be the human input which may become complemented for theories with artificial intelligence.

During the 1920's Oparin and Haldane working independently producing the Oparin-Haldane hypothesis suggesting that life arose gradually from inorganic molecules with building blocks like amino acids then combining to make more complex molecules-abiogenesis [27]. The Miller-Urey experiment of 1952 provided the first evidence that organic molecules needed for life could be formed from inorganic components. But what researchers had never explicitly considered was whether the nature of the container used in the experiment had any effect on the outcome. "We don't know why no-one looked at this before," said Ernesto Di Mauro at the Institute of Molecular Biology and Pathology in Rome. "Sometimes it's the simplest things people miss." Scientists repeated the experiment recently in three versions; using the same type of borosilicate glass container as in the original experiment, a Teflon container which remains inert and adding silicon chips to another Teflon container. The borosilicate glass still produced the most diverse mixture of complex organic compounds, the least the Teflon container and in between the silicates in the Teflon container. The silicates in the glass had catalysed the reactions like the minerals in the rocks on Earth and more organic compounds were found in the borosilicate glass container than in 1952 experiment due to better detection [28]. Hindsight is such a wonderful thing. Scientists in general take note as with Albert Szent-Gyorgyi's phrase "Life is water dancing to the tune of solids." Now self-assembly of molecules is appearing to create pathways in an ever-increasing variety of biochemical settings [29-32]. Who knows where and how evolution will emerge both on land with humans, plants, animals and viruses or in the deep oceans with bio-luminescence as the temperature rises? Maybe evolution can also enigmatically emerge in cosmic clouds by quantum tunnelling.

Mr Einstein, the time it takes for an electron to be dislodged from a molecule when hit by a quantum of light energy has recently been measured as a few attoseconds (10⁻¹⁸ seconds). It is ironic that with Max Planck, having initiated quantum theory, you remained sceptical most of your life and devoted much of your efforts to reconciling this to relativity despite the predictions of black holes and singularities within relativity itself. These issues are being addressed today. One such group is a research team at Kyoto University's Yukawa Institute for Theoretical Physics.

They observed that the conservation of charge resembles entropy. Conserved entropy defies this standard definition as the existence of this conserved quantity contradicts Noether's Theorem in which conservation of any quantity generally arises because of some kind of symmetry in a system. This new definition of the energy-momentum tensor intrigues another team member Shinya Aoki,

"Generally, curved spacetime, a conserved quantity can be defined even without symmetry [33]." Your paradox of 1935 Einstein Podolsky Rosen (EPR) has been scrutinised to this day. We now have empirical evidence of such phenomena within quantum field theory-entanglement, superposition and decoherence as the universe appears able to self-heal using protocols of error correcting codes within quantum information theory and Gamow's quantum tunnelling. In the 1980's the development of string theory has recently led to the theoretical proposal that ER and EPR are different manifestations of the same phenomenon. Albert Heisenberg writing in Quora digest takes up the story,

"ER stands for Einstein-Rosen bridges first postulated by you Mr Einstein in 1935 after Schwarzschild had proposed black holes from solutions to your General Relativity Field Equations. These bridges are colloquially known as wormholes, theoretical tunnels that connect two distance places in space time no matter how far apart they are. EPR is entanglement-how two particles no matter how far apart can communicate instantaneously with each other. Ads stands for anti-de Sitter spaces and cft stands conformal field theory. In theoretical physics, the anti-de Sitter/conformal theory sometimes called Maldacena duality or gauge/gravity duality is a conjectured relationship between two types of physical theories. On the one side are anti-de Sitter (Ads) spaces used in theories of quantum gravity formulated in string theory or M theory. On the other side of the correspondence are conformal theories (cft) which are quantum field theories, including theories similar to the Yang-Mills theories that describe elementary particles. The duality represents a major advance in understanding of string theory and quantum gravity. This is because it provides a non-perturbative formulation of string theory with certain boundary conditions and is the most successful realization of the holographic principle originally proposed by Gerard't Hooft. For reference read the article Wormhole Entanglement and the Firewall Paradox-of Maldacena and Susskind."

Mr Einstein there is a proposal to launch a set of satellites to extend LIGO and VIRGO detectors to test the boundaries of general relativity in 2037. The theoreticians with the help of artificial intelligence (the hares) will have some twenty years to develop models before facing the continuing barrage of empirical results from these instruments and experimentalists (tortoises). Self-scrutiny, hindsight, collaboration and insight may then combine to develop the scientific method beyond 2042."

"Mr Wallace, you embody the dilemma faced by today's young and

independent researchers of all ages when faced with the difficulty of publishing new and forward-thinking scientific ideas in a journal with no previous publications to their name. Having had the time and space to think, reflect and articulate your ideas observations and conclusions of your many voyages on your sick-bed in 1858, you sent an abstract in good faith by post to the one access point to academia you knew- Charles Darwin. These days with the internet there are numerous journals some of which may be regarded as predatory but how else can such a researcher achieve the success of publication or recognition within academia itself today with the advent of the internet-such a powerful tool for the dissemination of information in today's scientific world challenging the previous order of publication?"

Moving from philosopher to painter, in an attempt to describe current science in its complexity, we introduce the two cycles within the Roberts-Janet Periodic Table. The first is depicted by the lower half of the table and the second the upper half of the table connected by the elements themselves known and implied in all their predicted guises by the first cycle.

Before embarking on the task of painting a picture of each cycle with brush marks as fine as dots similar to Van Gogh's self-portrait, the painter must first prepare a canvass on which to overlay his painting. Unfortunately, science is yet to establish the nature of such a canvass. From an apparent initial high order, low entropy universe via inflation and condensation, stars and galaxies formed subject to the four fundamental forces. Following recycling through supernova explosions, heavy elements resulted with the subsequent formation of white dwarfs, neutron stars and black holes. These latter recreate an environment of high order, low entropy once more. Gravity, being universal, can have a geometric property-enter relativity-but the role of time becomes increasing ill-defined [34]. Black holes themselves have pressure and radiate so gradually decay over time [35].

Erker, Marcus Huber and others realised that quantum information theory and quantum thermodynamics which underpin quantum computers and engines also provided the right language for describing clocks.

"One major aspect of the mystery of time is the fact that it doesn't play the same role in quantum mechanics as other quantities like position and momentum; physicists say there are no "time observables"-no exact intrinsic time stamps on quantum particles that can be read off by measurements. Instead, time is a smoothly varying parameter in the equations of quantum mechanics, a reference against which to gauge the evolution of other observables. Physicists have struggled to understand how the time of quantum mechanics can be reconciled with the notion of time as the fourth dimension in Einstein's theory of general relativity, the current description of gravity," said Huber.

Likewise, chemists have to grapple with catalysts, reversible reactions and organo-catalysis.

"Modern attempts to reconcile quantum mechanics and general relativity often treat the four-dimensional space time fabric of Einstein's theory as emergent, a kind of hologram cooked up by more abstract quantum information. If so, both time and space ought to be approximate concepts. The clock studies are suggestive in showing that time can only be measured imperfectly. The "big question"" said Huber, "is whether the fundamental limit on the accuracy of clocks reflects a fundamental limit on the smooth flow of time itself-in other words whether stochastic events like collisions of coffee and air molecules are what time ultimately is.

What we've done is to show that even if time is a perfect, classical and smooth parameter governing time evolution of quantum systems we would only be able to track its passage imperfectly through stochastic, irreversible processes. This invites the question. Could it be that time is an illusion and smooth time is an emergent consequence of us trying to put events into a smooth order? It is certainly an intriguing possibility that is not easily dismissed."

Heisenberg's Uncertainty Principle?

Add to this the appearance of supermassive black holes in the early universe; the quantised oscillations of fields describing three of the four forces as yet with varying orders of scale and energy, neutrino mixing implying non-zero mass for the neutrinos, possible further particles outside the Standard Model, information entropy, the Roberts-Janet Nuclear Periodic Table extending from atomic to Planck scale; atomic black holes and antimatter; the accelerating universe and the value of the cosmological constant, multiverses and or cyclic universes and it becomes clear why any canvass on which to paint the two cycles within the Roberts-Janet Table is incomplete [36].

As John Baez so aptly puts it in his article The end of the Universe, the time scales are so huge and the science so vague that maybe out of these fluctuations may appear other universes with or without the same laws of science [37]. An interesting model to combine quantum mechanics and general relativity is that of E Stanfanescu.

"In this framework, we believe, that our universe is a huge black hole, with the explosion of its central matter as the Big Bang Inflation process and an increasing radius on account of an absorption of matter from the Total Universe where our universe has formed [38]." The video, The Black Hole Information Paradox, provides a valuable summary of the current conjectures and ideas in this area of cosmology [39].

In 2010 Roberts, acting like the child in the story of the Emperor's Clothes, realised that by inverting the Periodic Table one could explain spatial variation relative to the nucleus for energy levels of increasing atomic number as well as a pathway to nucleosynthesis

and cosmology. Janet had attempted such a concept a few years prior to Dirac's concept of antimatter but at that time insufficient detail of the mechanisms for nucleosynthesis was known-1930. Spatial dimensions could be displayed at 10-6m for atomic size down to 10-15- 10-18m for the strong and weak forces without prescribing exact values for energy and scale-Heisenberg's Uncertainty Principle. Energy changes could be of the order of electron volts at high orders of spatial magnitude but millions of electron volts or more for lower orders of spatial magnitude. However, there was a problem. Why was it there were repeating patterns within the Periodic Table for energy states for example 8, 8, 18, 18? Clearly there was a pattern in the number of energy states 2, 8, 18, 32 which gave $2n^2$ for integer values of n but this would give only one set of values. Either there were two columns of $2n^2$ for no particular reason or there was some other explanation.

Then a chance meeting in Nov 2017 with Claud Daviau indicated that the $2n^2$ states from quantum field theory could be expressed as $n(n+1) + n(n-1)$ gave Roberts the insight of not only periodicity and compressibility but by mixing the two sets of states within condensed matter repeating patterns emerged within the Periodic Table [40]. The Quantum Mechanical Table and the Roberts-Janet Table now had a one-to-one correspondence based on an original suggestion by De Broglie [41]. In the condensed matter section, the upper half of the table, the energy states appeared to spread out but in the nucleosynthesis section, the lower half of the table, the energy states started to merge closer together-a mirror image based on the zeros of the table. There were two such zeros, one a cut-off points of no further quantum states outside the nucleus and the second representing an infinite separation of either protons or heavy nuclei prior to gravity compressing nuclei to produce nucleosynthesis-the first with the electric field attractive, the second with the electric field repulsive. As a result of this correspondence between the two tables, a scientific commentary emerged in the form of two cycles within the Roberts-Janet table.

CYCLE ONE LOWER HALF ROBERTS-JANET TABLE

High order Low entropy Universe

Inflation and Condensation

Hydrogen and Helium form at atomic spatial dimensions

Local gravitation creates stars via fusion and plasma. Heavy elements formed through recycling p , r , s processes and electron capture within nucleosynthesis.

Counter-intuitively energy states increase as spatial dimensions reduce towards the range of the strong and weak fundamental forces.

Vacuum energy fluctuations result in the appearance of second, third generation and multi-quarks together with other fundamental particles. Symmetry breaking, CP Violation, Asymptotic Freedom, Quark and neutrino mixing, Antimatter.

Formation of White Dwarfs. Gravity and Quantum Field Theory merging. Further electron capture. Formation of neutron stars.

Radioactivity extinguished. Quantum Information, quantum thermodynamics. Gravity and the role of time.

Black holes form. Entropy minimum recreating low entropy environment. Hierarchy of outcomes as mergers of large or supermassive black holes result in creation of new universes superimposed on previous ones as inflation and condensation predate quark production. Planck length is approached. Absorption of material from previous universes may explain the close proximity of other supermassive black holes not in current theoretical models.

Collisions of neutron stars/ white dwarfs/black holes. Evaporation of black holes. Reignition of radioactivity in presence of small atomic number extremely large mass number nuclei.

Rapid radioactive decay. Production of large atomic nuclei.

Further decay producing current elements within the Periodic Table approaching from high atomic number.

CYCLE TWO UPPER HALF ROBERTS-JANET TABLE

Hydrogen and Helium form from initial inflation and condensation of universe

Heavy elements condense within cycle of supernova explosions. Stars, Comets, Asteroids and Planets form with large numbers of Periodic Tables.

Earth forms; water condenses, organo-catalysis, abiogenesis and climate change initiated. Polar and Non-Polar carbon compounds formed. Membranes created by two layers of hydrophilic hydrophobic molecules. Lipids form encapsulation and self-replication. Combinations of carbon monoxide and hydrogen heated with minerals present in early earth create lipids coupled with prebiotic amino acids present in membranes allowing amino acids to form proteins despite presence of metallic ions in water.

Plausible pathway to create living cells appears overtime by incremental steps. Mechanisms of superposition, entanglement, local reversal of entropy, quantum tunnelling and decoherence. RNA and DNA emerge over time.

Bacteria, microbes and viruses organo-catalysis accelerates. Step to live cells via trace elements still elusive. Photosynthesis plants evolve.

Evolution of Animals, infections, genetic diseases, biochemical pathways, enzymes, amino acids, proteins, gene silencing and editing, vibronic mixing and protein folding.

New materials and phase transitions discovered. Development of Forensic Science, drug discovery and delivery. Human manipulation of quantum states in specific compounds-higher temperature superconductors, quantum holography.

Collapse and Renewal of ecosystems as Keystone Predators disappear and re-emerge. Plastic and other forms of pollution develop. Change in sea levels, Global warming rise of CO_2 and CH_4 . Redistribution of ocean heat currents.

Expansion of Sun absorbs inner planets. Cycle two mergers into cycle one.

Ode to Science

With Eternal Thanks to Rudyard Kipling
If you can keep your head when all about you
Are losing theirs and blaming it on you.
If you can trust yourself when all men doubt you
But make allowance for their doubting too.
If you can wait but not be tired by waiting
And yet don't look too good nor talk too wise.

If you can embrace the subtle ways
That Nature constantly displays.
If you can explore distant galaxies in every detail
And analyse their content as blind men read braille.
If you can dream and invert the Periodic Table,
If you can think and extend it as far as you are able,
If you can put two and two together
And place Hydrogen and Helium by each other.

If you can force fields and energy to serve you
And locally reverse time and entropy aplenty,
Wilczek's asymptotic freedoms to enjoy.
If you can picture how patterns within the table
Allow neutrons and protons to intertwine and coalesce
All manner of fusion, nucleosynthesis and elements possess
To produce Wigner's magic numbers in excess.

If you can explain how radioactive decays
Occur by such varied pathways
In so many mysterious times and byways.
If you can entangle every quantum state
Then in an instant allow them to consolidate
And all matter known to man create.

If you can meet with gravity and quantum theory
And treat those two imposters just the same.
If you can apply mathematics stochastically yet with serendipity
To show how Nature develops empirical yet orderly tranquillity.

If you can bear to hear the truth you've spoken
Twisted by knaves to trap men's minds and create indifference.
If you can talk to chemists and keep your virtue
Or walk with astrophysicists nor lose the common touch.
If all scientists count with you but none too much.
If you can follow quantum pathways
Familiar to bacteria, plants; all manner of beings
That photosynthesise and thrive.

If you can fill the unforgiving minute
With sixty seconds worth of distance run
Ladies and Gentlemen-yours is the universe and all that's in it
And-which is more-you'll be enlightened, empowered and inspired.

And yet and yet

Nature's mysteries still conspire like Heisenberg's Uncertainty
To tunnel, superpose, entangle and decohere
Within its very own quantum world so near
To cloak its dynamic evolution
Allowing only to reveal at any one instant
What humans can observe by thought, action, inquiry or experiment
Maybe masquerading as fermionic or bosonic phase transitions.

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