

Evidence for a Guiding Coherence Principle in Quantum Physics

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Abstract

In 1905 Einstein proposed the idea that electromagnetic radiation is quantized and appears only in defined energy packets. The energy of a photon for a given type of radiation can be computed using the frequency relation published in 1900 by Planck. It is proposed in the present paper that the energy distribution of these packets is according to a Pythagorean distribution of frequencies. Evidence for this hypothesis has been found by a meta-analysis of 500 biomedical papers related to electromagnetic frequencies of living cells and bio-molecules, in addition to an analysis of 60 papers in physics that deal with the influence of electromagnetic frequencies on the promotion of entangled states in Einstein, Podolsky and Rosen-experiments, as well as a study on measurements of the masses of 37 different elementary particles. It turns out that Einstein was right, and that electromagnetic radiation is quantized according to a precise distribution of defined energy packets.

Key Words: Life algorithm, novel biophysical principle, coherent EM-scale, solitons and polarons, bio-solitons, coherent electromagnetic frequencies, beneficial and detrimental frequencies, meta-analysis of bio-medical literature, phyllosilicates, clay nano-materials, morphogenic resonance, non-thermal EM fields, anti-cancer therapy, first life in biological evolution, quantum entanglement, Fröhlich, Einstein-Podolsky-Rosen, Bohm

Quantum Biosystems 2018; 9(1): 1-7

Introduction

In 1905 Einstein proposed the idea that electromagnetic radiation is quantized and appears only in defined energy packets called photons. The energy of a photon for a given type of radiation can be computed using the relation published in 1900 by Planck, involving a new constant that is now called Planck's constant: $E=h\nu$.

Planck was the first to introduce quantization, but he did not go so far as to say that light is quantized: he proposed emission in packets, but not that light could exist only in such packets (Veltman, 2003).

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Einstein explained the photoelectric effect by postulating that light, or more generally all electromagnetic radiation, can be divided into a finite number of "energy quanta" that are localized points in space.

From the introduction section of his March 1905 quantum paper "*On a heuristic viewpoint concerning the emission and transformation of light*", Einstein stated:

"According to the assumption to be contemplated here, when a light ray is spreading from a point, the energy is not distributed continuously over ever-increasing spaces, but consists of a finite number of 'energy quanta' that are localized in points in space, move without dividing, and can be absorbed or generated only as a whole" (Folsing, 1993, Stone 2006).

In 1923, the French physicist Louis de Broglie put forward his theory of matter waves by stating that particles can exhibit wave characteristics and vice versa.

Later, Erwin Schrödinger invented wave mechanics and launched the non-relativistic Schrödinger equation as an approximation to the generalized case of de Broglie's theory.

The Bohmian interpretation of quantum mechanics was definitely introduced in 1952, and later called the ontological interpretation, and is an interpretation of quantum mechanics that is causal, non-local, and does not treat systems and measuring apparatus differently.

1 - Mathematics of a Guiding Coherence Principle in Quantum Physics

From Einstein we have learned that mass and energy are essentially equivalent ($E = m c^2$), and we can hence use the unit of energy also as a unity of mass, from Planck we learned that energy is quantized ($E = h \nu$), and we can hence use the unit of energy also as a unity of frequency:

$$E = m c^2 = h \nu$$

(E : Energy; m: mass; c light velocity;
 h: Planck's constant; ν : frequency)

Bohm proposed that quantum mechanics is causal, local as well as non-local.

Geesink and Meijer (2017) discovered that the energy of living materials/cells/biomolecules consist of a typical distribution of energy quanta, to be described by a so called GM-scale (generalized musical scale).

It is now proposed that energy: E_n is distributed according to Planck's constant, multiplied by a sequence of unique series of 0, 0.5 and integer powers of 2, 3, multiplied by consecutive integer powers of 2, from the lowest till the highest possible energy:

$$E_n = \hbar \omega_{\text{ref}} 2^n 3^m (2^p)$$

(E_n : Energy distribution, ω_{ref} : Reference frequency 1 Hz, \hbar : Reduced Planck's constant, n : Series of integers: 0, 0.5, 2, 4, 5, 7, 8, -1, -3, -4, -6, -7, m : series of integers: 0, 1, 2, 3, 4, 5, -1, -2, -3, -4, -5, p : Series of integers: <-4, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, > +52)

A similar distribution pattern has been found for EPR experiments and for masses for elementary particles and zero-point energy of elements (see later).

In relation to this, it is proposed to denominate the energy packets as called by Einstein, as energy packets, that are precisely distributed according to the principles of coherence and decoherence (Geesink and Meijer, 2018a).

These coherent energy quanta, that can be found both in living cells/organisms and in typical inanimate materials, obey both to entanglement in local, and in typical non local situations.

A mathematical basis for spectrum of discrete electromagnetic field (EMF) frequencies, that were shown to affect health and disease (Geesink and Meijer, 2017), was elaborated and generalized (Geesink and Meijer, 2018 a), see Figure 1 and Table 1, 2.

The particular EMF pattern was earlier revealed by us through a meta-analysis of more than 500 biomedical publications that reported life-sustaining as well as life-decaying EMF frequencies.

The detected eigenfrequencies could be arithmetically scaled according to an adapted Pythagorean tuning.

The particular semi-harmonic scale exhibits a core pattern of twelve eigenfrequency functions with adjacent self-similar patterns, according to octave hierarchy (Geesink and Meijer, 2018a).

It is important to note that just in between the coherent semi-harmonic frequency bands, non-coherent, non semi-harmonic values, were found that evoke life-deteriorating/detrimental effects. The mathematical analysis shows that the derived arithmetical scale exhibits a sequence of unique products of integer powers of 2, 3 and a factor $\sqrt{2}$.

Five discrete values of the twelve values of the GM-scale are precisely harmonic, seven values are approaching harmonic values. The GM-scale is a descending Pythagorean scale, with an adaptation of the seventh value, that is the square root of 2, see table 1.

All semi-harmonic frequencies can be calculated, see for some examples related to sound, colours and extreme low frequencies: see table 2.

These discrete eigenfrequency values can be related to supposed bio-resonance of solitons or polaron quasi-particles in life systems.

Bio-solitons are conceived as self-reinforcing solitary waves, that are constituting local fields, being involved in intracellular geometric ordering and patterning, as well as in intra- and intercellular signaling.

Additional literature search, revealed very similar frequency patterns in the color spectrum, for wave resonances of nucleotides in aqueous solution, for a candidate RNA-catalyst, as well as for sound-induced vibrations evoked in thin vibrating membranes as reported by Chladny and analytically calculated by Ritz for the eigenfrequencies of a thin square membrane (Ritz, 1909).

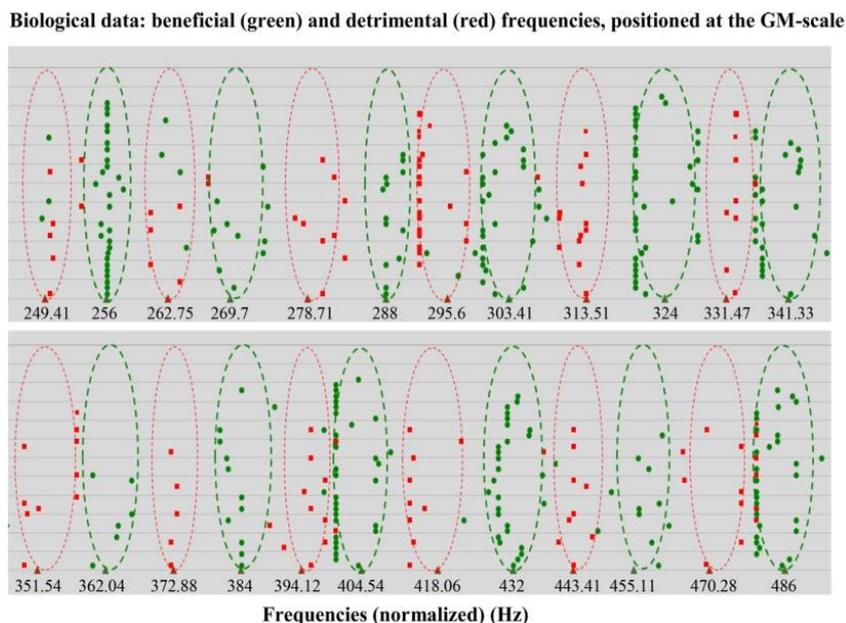


Figure 1: Measured frequency data of living cells systems that are life-sustaining (green points) and detrimental for life (in red squares) versus calculated normalized frequencies. Biological effects measured following exposures or endogenous effects of living cells in vitro and in vivo at frequencies in the bands of Hz, kHz, MHz, GHz, THz, PHz. Green triangles plotted on a logarithmic x-axis represent calculated life-sustaining frequencies; red triangles represent calculated life-destabilizing frequencies. Each point indicated in the graph is taken from published biological data and are a typical frequency for a biological experiment(s). For clarity, points are distributed along the Y-axis.

GM-scale	1.01.0535	1.1250	1.1852	1.2656	1.3333	1.4142	1.5000	1.5803	1.6875	1.7778	1.8984	
Desc. Pyth.	1.0	1.0535	1.1250	1.1852	1.2656	1.3333	1.4047	1.5000	1.5803	1.6875	1.7778	1.8984
Equal temp.	1.0	1.0595	1.1225	1.1892	1.2599	1.3348	1.4142	1.4983	1.5874	1.6817	1.7818	1.8877
Harmonic	1.0	1.0667	1.1250	1.2000	1.2500	1.3333	1.4000	1.5000	1.6000	1.6667	1.7778	1.8750
Harm. ratios	1.0	16/15	9/8	6/5	5/4	4/3	7/5	3/2	8/5	5/3	16/9	15/8

Table 1. Proposed coherent GM-scale of 12 numbers. Descending Pythagorean scale, equally tempered scale and harmonic scale are indicated for comparison.

256.0	269.70	288.00	303.41	324.00	341.33	362.04	384.00	404.54	432.00	455.12	486.00 Hz
1.0	1.0535	1.1250	1.1852	1.2656	1.3333	1.4142	1.5000	1.5803	1.6875	1.7778	1.8984 Hz
											
532.5	505.6	473.4	449.3	420.8	399.5	376.6	710.1	674.0	631.3	599.1	561.0 nm

Table 2. Examples of calculated equivalent coherent 12-number frequency scales

This collective evidence points at a generalized biophysical algorithm underlying complexity in nature, evidently manifest in both animate and non-animate modalities, and was coined by us the generalized musical (GM) principle (table 3).

The particular semi-harmonic frequency spectrum, may reflect a discrete pilot-wave structure that can be interpreted as a, so called, hidden variable in Bohm's causal interpretation of quantum field theory.

$$\begin{aligned}
 F_m(\text{coh.1}) &= 2^0 3^0 2^m & F_m(\text{coh.7}) &= 2^{0.5} 2^m \\
 F_m(\text{coh.2}) &= 2^8 3^{-5} 2^m & F_m(\text{coh.8}) &= 2^{-1} 3^1 2^m \\
 F_m(\text{coh.3}) &= 2^{-3} 3^2 2^m & F_m(\text{coh.9}) &= 2^7 3^{-4} 2^m \\
 F_m(\text{coh.4}) &= 2^5 3^{-3} 2^m & F_m(\text{coh.10}) &= 2^{-4} 3^3 2^m \\
 F_m(\text{coh.5}) &= 2^{-6} 3^4 2^m & F_m(\text{coh.11}) &= 2^4 3^{-2} 2^m \\
 F_m(\text{coh.6}) &= 2^2 3^{-1} 2^m & F_m(\text{coh.12}) &= 2^{-7} 3^5 2^m
 \end{aligned}$$

Table 3. Coherent GM-scale of 12 numbers, that can be extended to more than 56 octaves ($m = < -4$ till > 52)

2. EMF wave frequencies in EPR/entanglement studies

In view of the current interest in coherent states and entanglement in quantum biology, we subsequently performed a meta-analysis of 60 papers in physics that deal with the influence of electromagnetic frequencies on the promotion of entangled states in, so called, EPR experiments (Geesink and Meijer, 2018b), see Figure 2.

Einstein, Podolsky and Rosen originated the EPR-correlation thought experiment for quantum-entangled particles, in which particles are supposed to react as one entangled body.

The meta-analyses of the EPR-experiments learned that entanglement, achieved in the experiments is real, and that the applied frequencies are located at discrete coherent configurations.

Strikingly, all analyzed EPR-data of the independent studies fit precisely in the derived scale of coherent frequency data and turned out to be virtually congruent with the above mentioned semi-harmonic EM-scale for living organisms.

This implies that the same discrete coherent frequency pattern of EM quantum waves, that determine local and non-local states, is also applicable to biological order and that quantum entanglement is a prerequisite for life.

The study may indicate that the implicate order of pilot-wave steering system, earlier postulated by David Bohm is composed of discrete entangled EM wave modalities, related to a pervading zero-point energy information field.

The GM-biophysical principle was also applied to the areas of cancer therapy (Meijer and Geesink, 2018) and consciousness (Meijer and Geesink, 2016, 2017).

The latter highlighted the role of phonon/photon/electron in guiding cell-biological processes and in the scale invariant fractal creation of conscious states in brain function as well micro- and macro systems in the universe.

Einstein Podolsky Rosen-experiments can be positioned at frequency GM-scale

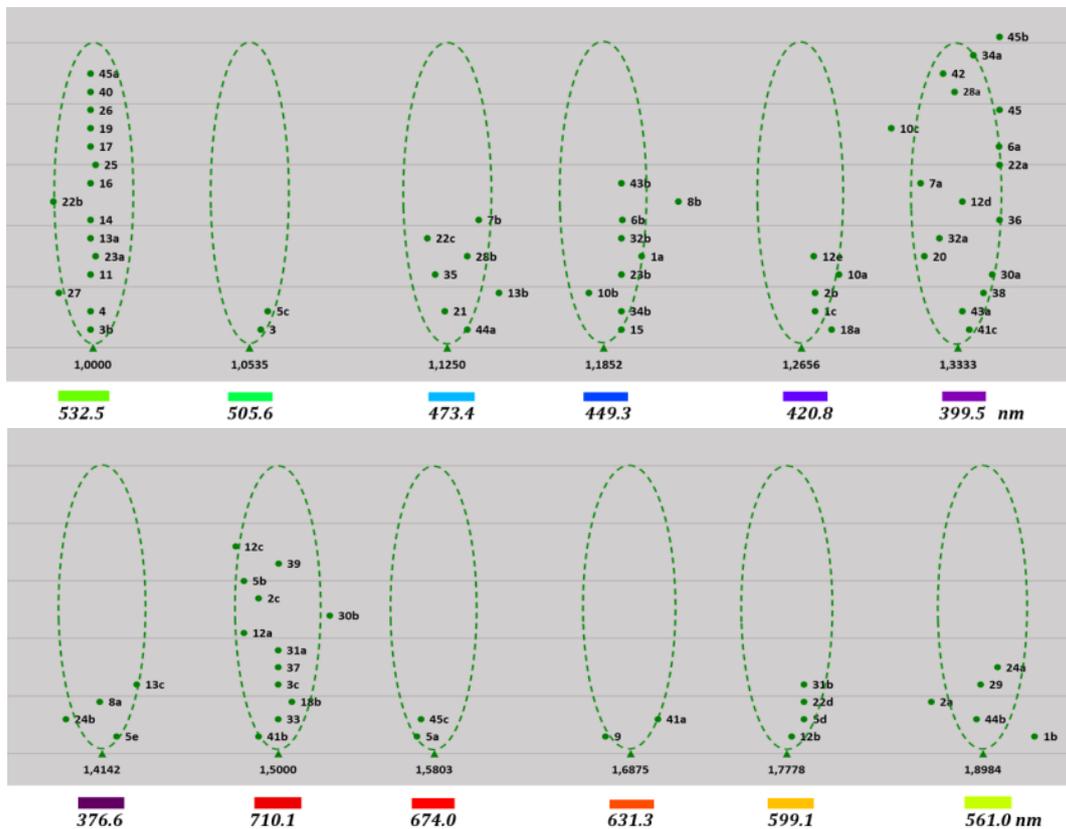


Figure 2. Frequency data of Einstein-Podolsky-Rosen experiments (1972-2017) positioned in a coherent GM-scale of frequencies. EPR-exposures at frequencies are in the bands of MHz, GHz, PHz. Green triangles plotted on a logarithmic x-axis represent normalized EPR-frequencies; green points represent calculated normalized EPR-frequencies. For clarity, points are distributed along the Y-axis. Labels of depicted points in Fig. 4, as to literature references EPR-experiments 1972-2017.

3 - Wave frequencies related to mass/energy of elementary particles

In a follow-up study, the model was further applied to the data of a meta-analysis of earlier measured discrete mass/energies and related frequencies of the presently known 37 different elementary particles, as well as zero-point energies of elements (Geesink and Meijer, 2018c), see Figure 3.

An excellent fit with the GM-frequency pattern was found indicating that it underlies the quantum field theory of subatomic particles, implying that an ontological basis of the Standard Model was found.

It was also shown that the GM-scale is frequency-locked with zero-point oscillations, and thereby evidently implies involvement of entangled states.

The present theory combines quantum mechanics and classical periodic systems, obeys both to locality and non-locality, and solves the “hidden variable theory” of Bohm, 1952.

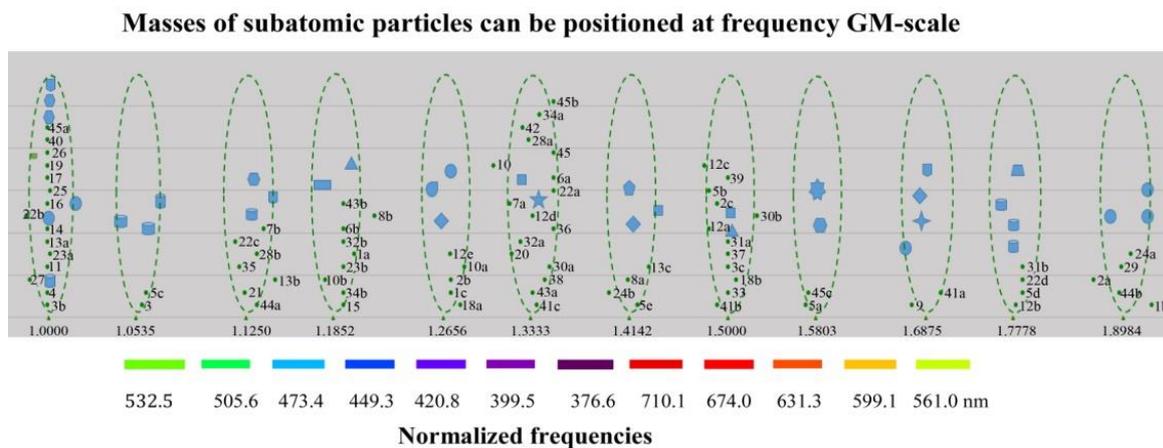


Figure 3. Normalized frequencies of masses of Elementary Particles positioned at the GM-scale and added normalized colour spectrum. Green triangles plotted on a logarithmic x-axis represent normalized coherent-frequencies. Blue points represent calculated normalized frequencies of masses:

Proton ▲ Electron ✦ Muon ★ Quark ● T./P. Quark ■ Baryon ▣ Lepton ◆ Neutrino ● Boson ▤ Graviton ● Meson ▣ Higgs ★ Digamma ● Gluon ■ Green points: data of Einstein-Podolsky-Rosen experiments (1972-2017). For clarity, points are distributed along the Y-axis.

The pattern of electromagnetic field eigenvalues, within a broad range of discrete frequencies, as revealed in the present studies, points at a de Broglie/Bohm type of causal interpretation of quantum mechanics, implying an integral resonant pilot-wave/particle modality and is according to the proposal of Einstein in 1905 that electromagnetic radiation is quantized and appears only in precisely defined energy packets (Veltman 2003, Folsing, 1997).

4. Conclusion

It is of interest that, apart from the earlier work of David Bohm, 1952, more recent papers appeared that also contain attempts to demonstrate the potential for a deterministic framework of quantum physics (Dolce, 2017, t’Hooft, 2016). Yet, it should be noted that the guiding principle on the basis of a pilot wave mechanism or to an underlying information field of cellular automation or elementary cycles, can never be fully deterministic. This can be envisioned by realizing that nature probably operates against a dynamic informational background in which information transfer is bidirectional (the so called quantum wave back-reaction (Geesink

and Meijer, 2018b, Holland 1996, Sarfatti, 2015, Sutherland, 2006), so that the all-pervading memory domain is permanently updated and therefore cannot present a fixed deterministic framework.

Highlighting the present discrete GM-biophysical frequency pattern both in biomedical EMF experiments as well as in EPR and elementary particle studies, we imply that a non-empirical basis is found for the quantum mechanical standard model, and that the earlier suggestion of quantized photon energy in quantum physics of Albert Einstein is met. It remains to be studied how the discrete frequencies could be operating in nature, in the sense of combinations to cords, melodies and even symphonies.

Can we still envision that the universe is built on harmonics and that the Pythagoreans had it right when they married mathematics, music, and the cosmos? In this respect it is intriguing that science revealed an information domain probably beyond the Planck scale, called a string-net liquid (Merali, 2017), that bears geometric and mathematical relations and may be viewed upon as the cosmic orchestra in action.

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Note

The reader can find a complete set of data on the literature studied in the three meta-analyses treated here, as well as the derived equations for the GM-scale algorithm used, in reference 5, in principle enabling (re)-calculation and relevant pattern recognition by the reader.