Are Pollack batteries possible?

February 27, 2026

M. Pitkänen[1], M. Manninen[2], T. Sorakivi[3], V-E. Saari[4]

[1] Independent researcher. Email: matpitka6@gmail.com.
http://tgdtheory.fi/.
Postal address: Valtatie 8 as 2, 03600, Karkkila, Finland.

[2] Email: elomedia@gmail.com.

[3] Email: gigabrain@tuta.io.

[4] Email: ville@saari.nu.

Abstract

DoNut Lab has made rather bold claims about a solid state battery that they have developed. It is however difficult to understand how these claims could be consistent with the standard views of solid state physics and chemistry. In the TGD inspired quantum biology, the Pollack effect, involving new quantum physics, plays a central role. It is already known that the addition of water to natrium-vanadium batter could increase its charging capacity by almost a factor 2. Therefore it is interesting to see whether the Pollack effect as an additional element could allow what might be called a Pollack battery, perhaps consistent with the claims of DoNut Lab.

1 Introduction

This article was motivated by the claim of Donut Lab about a breakthrough in battery technology. February 2026, Donut Lab published one of a planned series of independent VTT test reports covering fast-charge performance only. All other claimed specifications – energy density (400 Wh/kg), cycle life (100,000 cycles), extreme-temperature tolerance, safety, and cost – remain entirely unverified by any independent party.

Using LLM, Marko Manninen has prepared a report [L24] (see this) and a Youtube video (see this) about the claims related to the Donut battery. The report compares the measured performance of the Donut Lab Solid-State Battery V1 against current lithium-ion technologies and competing solid-state efforts. All Donut Lab figures are derived from VTT test data where available; all competitor figures come from published specifications and third-party reports. Where Donut Lab data is unavailable, scenario analyses and flag assumptions are represented clearly.

What was announced was "Ultra high energy density, the fastest charging time, practically unlimited cycles, extreme safety, and lower price than lithium-ion". The reactions from professional circles have been skeptical. It is indeed difficult to see how the claims about Donut batteries could be consistent with standard condensed matter physics.

1. The claim about very rapid charging time of about 5 minutes is verified in the VTT test. This corresponds to charging rate 11 C, where 1 C corresponds to a charging time of 1 hour.

2. It was found that there is a high heat production during charging. During VTT Test #6, the cell reached $\sim$ 90 °C under 11C charging with passive cooling only, triggering an automatic safety cutoff by the test equipment — the cell itself showed no damage or signs of thermal runaway.

3. The number of life cycles is claimed to be extremely large, about 10^5 cycle times and testing of so many cycles has been claimed to be implausible since it would require years. VTT made only 7 tests meaning 7 cycle times. The strong heating during the loading by ohmic currents is expected to cause damage to the electrode receiving the charge and this reduces the number of cycle times.

4. The claimed energy density of about 400 Wh/kg is very high. Suppose that the system consists of basic units with mass Am_p (m_p is proton mass) having atomic volume a_0^3, where $a_0 = 10^{-10}$ m. This would give an energy density of $dE/dm = 1.4 \times 10^{-10}$, where the unit $c = 1$ is used. This would mean .1 eV per proton mass $m_p \simeq 10^9$ eV.

   The energy density relates closely to the reported energy efficiency related to the counterpart of capacitor charge about 10^5 Coulombs, which is very high but consistent with that for mobile phone batteries. Note that the energy density is proportional to the dielectric constant ϵ of a dielectric possibly used between the positively and negatively charged electrons. It measures how large fraction of energy is stored as chemical energy. For a simple capacitor the energy is mere electrostatic energy.

5. Donut battery is claimed to be a solid state battery cell. VTT did not verify the chemistry of the cell. Donut patent application gives the following information about the battery.

   - Cathode with cathode material in particulate form + polymeric binder (polymeric binders are used to bind together battery materials)
   - Solid electrolyte with solid electrolyte material + polymeric binder
   - Anode with anode material in particulate form + polymeric binder

   Module is manufactured *without* use of: Prussian blue ($Fe_4[Fe(CN)_6]_3$), lead, cadmium, cobalt, nickel, mercury, manganese, sulfuric acid, organic solvents, fluorinated compounds, antimony, arsenic, beryllium, thallium, selenium, perfluorinated compounds, polyvinyl chloride, silicon, lithium, neodymium, dysprosium, lanthanum.

The basic problem is what is called trilemma. In the framework of standard condensed matter physics, the conditions for high charging speed, large number of life cycles, and high energy density are mutually conflicting. The high charging rate, which has been verified, requires high energies so that the charging involves ohmic dissipation and large energy and momentum transfer to the electrode causing its deterioration. It is claimed that the momentum transfer during the charging is small.

The following is a kind of private brain storming session about whether TGD based physics could allow the the realization of batteries based on Pollack effect [I2, L1, I4, I3] consider from the TGD view point in [L1, L2, L13, L7, L14, L12]. I am not specialized to battery technologies and these considerations are just speculations and need not have much to do with the Donut Lab battery, except as a thought ignition and framing the energy charging, storage, and dissipation systems. The basic inspiration comes from biological analogies and the charging of the battery is regarded as an analog of photosynthesis.

The notions of field/magnetic body, the hierarchy of effective Planck constants and Pollack effect are the key elements of the model and the following gives a brief summary of h_{eff} hierarchy and Pollack effect.

1.1 Large h_{eff} phases of ordinary matter behaving like dark matter

Large h_{eff} phases of ordinary matter behaving like dark matter are in key role in the TGD inspired quantum biology.

1. In the TGD view of quantum biology, the dark matter at field/magnetic bodies with a large value of h_{eff} is in a central role. The original for the hierarchy of phases of ordinary matter labelled by the values of effective Planck constant $h_{eff} = nh_0$, with estimated to satisfy $h = (7!)^2 h_0$, came from the findings of Blackman [**?**]nd others about quantal looking physical and behavioral effects of ELF radiation on verterbrate brain occurring at cyclotron frequencies of

endogenous magnetic field $B_{end} \simeq .2$ Gauss. h_{eff} measures the scale of quantum coherence identified as the size scale of the space-time surface.

The number theoretic interpretation of h_{eff} as the dimension of algebraic extension of rationals and degree of corresponding Galois group emerged later and means that h_{eff} measures algebraic complexity. In TGD inspired theory of consciousness [L21, L22] h_{eff} serves as a universal "IQ" and the matter at field body behavin like dark matter would naturally control the ordinary biomatter and receives information from it (say by EEG).

2. TGD inspired quantum biology leads to a model of genetic code [K1] [L8, L4, L5, L11] in which A simple model for linear dark proton triplets predicts their states to be in a 1-1 correspondence with DNA, RNA, tRNA, and amino-acids and the numbers of codons coding for given amino-acid are predicted to be the same as for the vertebrate genetic code [K1] [L8, L4, L5, L11].

3. Especially interesting example of very large h_{eff} are phases labelled by gravitational Planck constant [L10, L9], originally introduced by Nottale [E1]. h_{gr} is proportional to the product of the masses of the systems involved. Also the electric Planck constant h_{em} [L12], proportional to the product of the charges of two systems involved, is important. Genes, cell nucleus, cell, central nervous system and its parts, and even the Earth's biosphere form evolutionary hierarchies with increasing h_{eff}. The negatively charge exclusion zones (EZs) created in the Pollack effect creating $h_{eff} = h_{gr}$ phase at the gravitational body, has a large value of h_{em} [L21, L22].

1.2 Pollack effect briefly

In the Pollack effect (PE) [I2, L1, I4, I3] negatively charged exclusion zones (EZs) are induced at the boundary between the gel phase and water by an energy feed such as IR radiation.

1. The Pollack effect would play a key role in the transfer of ordinary particles to dark phases at the field bodies [L1, L13]. p-Adic length scale hypothesis [L17, L23], for which the number theoretic vision provides a justification, makes possible quantitative predictions.

2. The negative charge of EZ is explained as a formation of flux tubes carrying dark protons, which are interpreted as dark nuclei. Every 4^{th} proton should transform to a dark proton transferred to the flux tubes to explain the observations.

   EZs are able to remove impurities from their interior in conflict with the second law of thermodynamics (SL). The TGD based explanation is that the time reversal by BSFR at the level of MB [L6] also induces an effective time reversal in long time scales at the level of ordinary bio-matter.

3. PE explains the occurrence of a charge separation in living matter. DNA has one negative charge per nucleotide, microtubules are negatively charged, the cell is negatively charged, and ATP carries 3 units of negative charge. Therefore ZEO suggests that PE plays a key role in bio-control and macroscopic SFRs play a key role in living matter.

4. Pollack effect is expected to occur at quantum critical temperature $T_P \sim 300$ K for the Pollack effect involved with the transformation of nucleons to their dark counterparts at magnetic flux tubes. Dark nuclei would transformed to ordinary nuclei liberating almost all nuclear binding energy.

   T_P could be near the Hagedorn temperature for gravitational monopole flux tubes (for the TGD view of the notion of gravitational Planck constant. [L10, L9]). At the level of chemistry, the Pollack effect would naturally correspond to the flip of a topological qubit having as its bit values OH and O^- + dark proton [L15] and this means that it has many generalizations.

It has become clear that of Pollack effect can be generalized considerably [L12]. A mechanism providing the energy needed to kick ordinary protons to dark protons at the monopole flux tubes.

Photons are one such mechanism but one can imagine large number of mechanisms of this kind. This suggests that Pollack effect is plays a key role in quantum biology [L20, L2, L7, L14, L12, L19].

Also "cold fusion" identified in TGD as dark fusion at the monopole flux tubes of the magnetic body could involve Pollack effect [L16]. One can also speculate with the role of generalized Pollack effect in making possible conscious computers as hybrids of classical and quantum computers [L15, L18].

2 Could the notion of Pollack battery make sense?

I have considered the possibility that the Pollack effect plays a central role in electrolysis, which is the key effect in the chemistry of batteries. The following is an attempt to build a model for a battery based on the Pollack effect.

2.1 What Pollack battery could mean?

The claimed properties of the Donut battery can be used as guidelines in speculations. Something new making possible the rapid charging and the resolution of the trilemma and Pollack effect could be the missing element. I have discussed its generalization and possible applications to biology [L10, L12] and also to develop some speculative ideas about living computers [L15, L18].

1. The fast charging could be understood if the ions are generated by the Pollack effect or its generalization at the second electrode. Protons or perhaps even alkali ions could be generated by the generalized Pollack effect. In the presence of an electric field the positively charged ions would travel to the second electrode in the electric field (note that for static electric fields the voltage is the same along the space-time sheet for ordinary matter and for the magnetic flux tube).

   Since the value of h_{eff} is large, dissipation would be small and could be even absent if the analog superconducting is in question. Therefore the travel time would be very short and could make rapid charging possible. In the simplest classical model the particle would experience the analog of free fall in the approximately constant gravitational field of Earth.

2. It is enough to get the positive ions to the opposite electrode. The positive electrode generates an opposing electric field E_{opp} causing a gradually increasing electric force. It is enough to have a gradually increasing electric field E, which exceeds this opposing electric field. The dark positive ions would experience the force $\Delta E = E - E_{opp}$. This would save energy in charging and minimize the effects caused at the positive electrode. The positive ions could be transferred with minimal energy and momentum transfer to the positive electrode. ΔE could be much weaker than the electric field E_{opp} between the electrodes defining the voltage of the battery. This would minimize the damage to the electrode.

3. Where the positive dark ions would be generated by the Pollack effect. Could the Pollack effect occur at the electrode becoming negatively charged or in the counterpart of electrolyte between the electrodes? The recent finding reported in ScienceDaily (see this) that addition of water to a Sodium-Vanadium battery increases its charge capacity almost by a factor 2, suggests that the Pollack effect for water is in an essential role.

   What is nice is that Sodium and Vanadium are not rare metals unlike Li. Researchers found that keeping water inside a key sodium-ion battery material nearly doubled its charge storage. It also charges faster and stays stable for hundreds of cycles. This discovery could make lithium obsolete. The same material can also desalinate seawater into drinking water.

   This suggests that the Pollack effect generates negatively charged EZs in water. The first guess is that the negative charge is transferred to the negatively charged electrode by conduction in the electric field used for charging. If this occurs by ohmic conduction, a small value of ΔE would make the transfer slow. There is however evidence for the change of the arrow of time at the electric field body and this suggests large h_{em} [L21, L22]. If the negative ions are in large $h_{eff} = h_{em}$ phase (proportional to the charge of the electrode), the transfer could occur without dissipation and be fast.

Also the huge dielectric constant ϵ (as large as 10^6) strongly suggests that chemical energy storage dominates over electrostatic energy storage. This storage would naturally occur to the dielectric between the electrodes. The energy storage would be chemical as in biosystems and the electret would take the role of proteins and lipids. This suggests that the solid state dielectret should be organic material able to store metabolic energy. Carbon polymers carrying energy in carbon-carbon and carbon-hydrogen bonds is what suggests itself. In this case the use of the energy cannot lead to the catabolism producing CO_2 and water. The molecules must however experience a chemical change liberating energy. Double bonds (C=O)-(CH_3) groups are essential in the energy storage using proteins and lipids.

4. Very large charge for the capacitor-like system is required. A capacitor with parallel plates cannot realize this demand. The idea is that the standard capacitor is replaced with a very thin, highly folded bilayer, analogous to the pair of the lipid layers of a cell. These layers are insulated from each other by using a polymer so that dielectric breakdowns do not occur between the layers. There would also be electrolytes between the layers as electrodes.

   If the bilayer is folded several times, the surface area increases so that the charge (and capacitance) can become very large. Interestingly, a also the cortex is also highly folded, which supports the idea that the surface area and the associated charge are maximized for both cells and cortex to increase the value of the total charge. This ensures maximum value of electric Planck constant h_{em} proportional to the total charge of the bilayer and serving as a universal IQ in TGD inspired theory of conscious experience [L21, L22].

5. The simplest Pollack battery would not involve the electrolyte and would store energy as electrostatic energy. The naive idea is that the addition of current wire between two electrodes makes it possible to use the energy of the capacitor. The addition of electrolyte is also possible.

   Ohmic conductivity makes possible the transfer of currents in the electrolyte and the storage of energy as electric energy. Taking into account the contribution of the electric energy means the replacement of the electric energy $CU^2/2$ with electric plus chemical energy $\epsilon_r CU^2/2$. For water the value is in the range 78-80. Doped semiconductors/polymers can have dielectric constant exceeding values 10^6. This suggests that the dielectric storage of energy dominates overy the electrostatic storage. This would mean that the charging by Pollack effect should transfer energy to the electret requiring "dropping" of positive ions to the electret where they react chemically.

   Does the presence of ohmic current create negative effects spoiling the nice features of Pollack battery? Should one require the dropping of the positively charged ions to the positive electrode or is the dropping to a possible electrolyte containing region between the electrodes desirable?

Just for fun, one can make brave amateurish guesses about the actualization of the Pollack battery. Pollack effect is the new element.

1. The first guess would be the use of water for which Pollack effect certainly occurs. As alredy noticed, the addition of water to Sodium-Vanadium battery increases the charge storage capacity by a factor of almost 2 and also the charging becomes faster (see this).

2. One can also consider more exotic options. Could Carbon nanotubes (see this) serve an additional element of the Pollack battery besides electrodes and electrolyte? Carbon nanotube has an aromatic ring with six C atoms as a basic building block. Each C atom has a double bond with one of the neighboring 3 carbons associated with an aromatic ring.

   It is known that -OH groups can be added to the defects (C=C is replaced with C-C) associated with the aromatic rings and the surface of Carbon nanotubes and they could could serve as seats of Pollack effect [L3]. The Pollack effect as transformation -OH$\rightarrow$ O^- + dark proton, followed by the transfer of electron as dark electron to the negative electrode or to electrolyte, would replace C-OH with C-O. O has an unpaired electron. The loading of hydrogen would transform C-O back to C-OH.

A feed of hydrogen and irradiation by IR light to induce the Pollack effect as the analog of photosynthesis would create dark electrons and protons accelerating them in the electric field. Could this store energy to chemical ordinary energy to electrolyte as they transform to ordinary protons and electrons and bind chemically?

When hydrogen gas consisting of H_2 molecules is used to generate energy, it qwould combine with oxygen molecules O_2 and generate water. Now this process should occur for H_2 and C-O of carbon nanotubes to create C-OH. Is this process possible energetically? The reaction H_2 +2C-O *rightarrow* 2C-OH should occur. Is the binding energy for 2 C-OH bonds larger than the sum of binding energies of 2C-O and H_2?

2.2 A simple model for the charging by Pollack effect

The following model for the charging of the Pollack battery is very simple but might give some idea about orders of magnitude. For simplicity one can consider a piece of the Pollack battery looking like an ordinary capacitor. The batteries with large values of charges of order 10^5 C involve a multiple folded pair of electrodes.

The transversal dimensions of the batteries used in mobile phones are of order $l \sim 10$ cm and the thickness is $d = 2$ millimeters. The total length of the folded bilayer is of order $L = 1$ m. The thickness of the bilayer varies in the range $h = 20 - 25$ μm. This would allow the bilayer to fold in the vertical dimension $N < d/h \sim 10^2$ times $N \sim 10$ would give a length of 1 meter.

One must solve Newton's equations for the motion of charge in the constant net electric field $\Delta E = E - E_{opp}$ associated with the pair of electrets. One can require that $\Delta E = e\Delta U/h$ is time independent and has the correct sign (for clarity voltage is denoted as U). For proton (mas m_p), the solution can be written as

$$h = \frac{e\Delta U\tau^2}{2hm_p} \quad .$$

Here τ is the time taken to travel the distance h between the electrodes. This gives

$$\frac{\Delta U}{V} \times \frac{eV}{2m_p} = (\frac{h}{c\tau})^2 \quad .$$

Note that ΔU is invariant under the scaling $h \to h$ and $\tau \to x\tau$.Using $eV/m_pc^2 \simeq 10^{-9}$ this gives

$$\frac{\Delta U}{V} = 2 \times 10^9 \times (\frac{h}{c\tau})^2 \quad .$$

From this one obtains τ if h and ΔU are given.

$$\tau = \frac{h}{c}\sqrt{\frac{1}{\Delta U/V}} \times \sqrt{2} \times 10^{4+1/2} \quad .$$

$\Delta U = 1$ V and $h = 20$ μ m gives

$$\tau = \frac{h}{c}\sqrt{2} \times 10^{4+1/2} = (2\sqrt{2}/3) \times 10^{-1/2}\ ms \simeq .2\ ms \quad .$$

The scaling of $\Delta U/V$ by a factor 10^{-6} would give $\tau \simeq .2$ s. The scaling of $e\Delta U$ to the voltage .04 eV assignable to cell membrane which corresponds roughly to the thermal energy at room temperature gives $\tau \simeq 4\ ms$ which is the time scale assignable to nerve pulses.

It seems that the time scale is much faster than the charging time scale so one can ask whether the Donut battery could be modelled as a Pollack capacitor. In fact, the TGD view of dielecrets quite generally involves dark ions travelling at monopole flux tubes and also the generalized Pollack effect.

2.3 Charge capacity and energy density

The value $Q = 26$ Ah$= 10^5$ C of the charge capacity claimed by Donut [L24] measures the total charge of the battery. This value is reached also in mobile phone batteries. One can make a rough estimate about the charge density associated with the layers of the bilayer from, $Q = N\sigma S_{fold}$, where N is the number of folds, S_{fold} is the area of a single fold and σ is surface charge density.

One can write σ as $\sigma = \rho h$ where ρ is the 3-D charge density and h is the thickness of the layer. This gives the estimate $Q = N\rho h S_{fold}$ giving the estimate $\rho = Q/NhS_{fold}$ for the charge density. The numerical value for $h = 20$ μm and $S_{fold} = 10^{-2}$ m^2 is $\rho = 10^{-2}e/\AA^3$. Roughly every one hundredth atomic volume of $\AA^3$, would be charged.

The claimed value of energy density 400 Wh/kg $\sim 1.3 \times 10^6$ J/kg. The amount of energy per proton rest energy m_pc^2 is $E/m_pc^2 = 1.4 \times 10^{-11}$ and corresponds to .014 eV and roughly one half of thermal energy at room temperature. This makes $0.014A$ $eV/\AA^3$ if there are A protons per this volume. Note that the energy scale for membrane potential is 50 meV: $A \simeq 5$ would give this value. The difference for the energies of the states -O^- + dark proton and -OH is in the same energy range [L15], which suggests that Pollack effect is involved.

REFERENCES

Cosmology and Astro-Physics

[E1] Nottale L Da Rocha D. Gravitational Structure Formation in Scale Relativity, 2003. Available at: https://arxiv.org/abs/astro-ph/0310036.

Biology

[I1] The Fourth Phase of Water: Dr. Gerald Pollack at TEDxGuelphU, 2014. Available at: https://www.youtube.com/watch?v=i-T7tCMUDXU.

[I2] Pollack G. *Cells, Gels and the Engines of Life*. Ebner and Sons, 2000. Available at: https://www.cellsandgels.com/.

[I3] Zhao Q Pollack GH, Figueroa X. Molecules, water, and radiant energy: new clues for the origin of life. *Int J Mol Sci*, 10:1419–1429, 2009. Available at: https://tinyurl.com/ntkfhlc.

[I4] Pollack GH Zheng J-M. Long-range forces extending from polymer-gel surfaces. *Phys Rev E*, 68:031408–, 2003. Available at: https://tinyurl.com/ntkfhlc.

Neuroscience and Consciousness

Books related to TGD

[K1] Pitkänen M. Geometric Theory of Bio-Harmony. In *Genes and Memes: Part II. https://tgdtheory.fi/tgdhtml/Bgenememe2.html*. Available at: https://tgdtheory.fi/pdfpool/harmonytheory.pdf, 2023.

Articles about TGD

[L1] Pitkänen M. Pollack's Findings about Fourth phase of Water : TGD View. Available at: https://tgdtheory.fi/public_html/articles/PollackYoutube.pdf., 2014.

[L2] Pitkänen M. Pollack's mechanism and photosynthesis. Available at: https://tgdtheory.fi/public_html/articles/pollackphoto.pdf., 2016.

[L3] Pitkänen M. Teslaphoresis and TGD. Available at: https://tgdtheory.fi/public_html/articles/teslaphoresis.pdf., 2016.

[L4] Pitkänen M. About the Correspondence of Dark Nuclear Genetic Code and Ordinary Genetic Code. Available at: https://tgdtheory.fi/public_html/articles/codedarkcode.pdf., 2018.

[L5] Pitkänen M. An overall view about models of genetic code and bio-harmony. Available at: https://tgdtheory.fi/public_html/articles/gcharm.pdf., 2019.

[L6] Pitkänen M. Some comments related to Zero Energy Ontology (ZEO). Available at: https://tgdtheory.fi/public_html/articles/zeoquestions.pdf., 2019.

[L7] Pitkänen M. A model of protocell based on Pollack effect. Available at: https://tgdtheory.fi/public_html/articles/pollackoparin.pdf., 2020.

[L8] Pitkänen M. How to compose beautiful music of light in bio-harmony? https://tgdtheory.fi/public_html/articles/bioharmony2020.pdf., 2020.

[L9] Pitkänen M. Comparison of Orch-OR hypothesis with the TGD point of view. https://tgdtheory.fi/public_html/articles/penrose.pdf., 2022.

[L10] Pitkänen M. How animals without brain can behave as if they had brain. https://tgdtheory.fi/public_html/articles/precns.pdf., 2022.

[L11] Pitkänen M. About tessellations in hyperbolic 3-space and their relation to the genetic code . https://tgdtheory.fi/public_html/articles/tessellationH3.pdf., 2023.

[L12] Pitkänen M. About long range electromagnetic quantum coherence in TGD Universe. https://tgdtheory.fi/public_html/articles/hem.pdf., 2023.

[L13] Pitkänen M. Pollack Effect and Some Anomalies of Water. https://tgdtheory.fi/public_html/articles/pollackwater.pdf., 2023.

[L14] Pitkänen M. Pollack effect, lightnings and ball lightnings. https://tgdtheory.fi/public_html/articles/balllightning.pdf., 2023.

[L15] Pitkänen M. Quartz crystals as a life form and ordinary computers as an interface between quartz life and ordinary life? https://tgdtheory.fi/public_html/articles/QCs.pdf., 2024.

[L16] Pitkänen M. A new experimental demonstration for the occurrence of low energy nuclear reactions. https://tgdtheory.fi/public_html/articles/LENRagain.pdf., 2025.

[L17] Pitkänen M. A refined view of the phenomenology of hadron physics and p-adic mass calculations. https://tgdtheory.fi/public_html/articles/padmass2025.pdf., 2025.

[L18] Pitkänen M. Could computers be living and move? https://tgdtheory.fi/public_html/articles/liquidmetallife.pdf., 2025.

[L19] Pitkänen M. Could life have emerged when the universe was at room temperature? https://tgdtheory.fi/public_html/articles/earlylife.pdf., 2025.

[L20] Pitkänen M. Some TGD inspired comments about biocatalysis. https://tgdtheory.fi/public_html/articles/pollackbio.pdf., 2025.

[L21] Pitkänen M. The recent view of TGD inspired theory of consciousness and quantum biology. https://tgdtheory.fi/public_html/articles/consc2025.pdf., 2025.

[L22] Pitkänen M. Answers to the questions of Vasileios Basios and Marko Manninen in Hypothesis Refinery session of Galileo Commission. https://tgdtheory.fi/public_html/articles/MarkoBasios.pdf., 2026.

[L23] Pitkänen M. Does the notion of Teichmüller element cure the problem of p-adic mass calculations due to the slight failure of Lorentz invariance? `https://tgdtheory.fi/public_html/articles/padmass2026.pdf`., 2026.

[L24] M. Manninen, M. Pitkänen, and V-E. Saari. Donut Lab SSB VTT - Comparative Solid-State Battery Analysis V1. 2026. Available at: `https://www.researchgate.net/publication/401216563_Donut_Lab_SSB_VTT_-_Comparative_Solid-State_Battery_Analysis_V1`. .