„Fullerens like a Quantum Infinitesimal Potential Wells with State Bounded of Soft Donor for Transplutonides and Oxidation of Neptunium by Energetically Doped Plutonium and also via Extreme Energetically Cascade Hyperons or Neutrinos“

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Abstract:

Fullerens connected with extreme energetically cascade Ξ [ksí hyperons], hyperons Λ [lambda], Σ sigma [hyperons], Ω^- [omega minus], baryons N and ц [baryons]

For example, for mass resonances of $(\Omega)=M|\Xi^*/+\Delta m=3\ 000 + 300$= 3 300 m_e

We explicitly come with this classification of particles (here we understand all particles, stable quasiparticles and resonances)

Our work deals with combining quantum physics and quantum chemistry, because it is built on these first two evidently built on “a basic built stones” of high-energy particle physics. The extremely mass and energetical neutrinos were detected in recent time on Antarctica (project Ice Cube), ANITA (Antarctic Impulsive Transient Antenna) - financially supported by NASA. Next Project KM3NeT, underwater in the deepest point of the Mediterranean Sea near Italy/France.

We hope that cardinal solution of this particle puzzle will be brought by TRIDENT (the Chinese Neutrino Telescope), which is planned in principle as a next generation neutrino marine observatory to be located in the South China Sea (Pacific Ocean) at a depth of 3,5 kilometers and will cover a volume of

approximately 8 cubic kilometers, utilizing technology combination of advanced hDOMs, which combine photomultipliers tubes (PMTs) and silicon photomultipliers (SiPMs) to detect Cherenkov's light produced by neutrino interactions.
TRIDENT is expected to be completed around 2030.

Keywords: Fullerens, Cascade Hyperons, Baryons, Neutrinos, IceCube, ANITA, KM3NeT, TRIDENT, Neutrino Detectors, KATRIN, Talagrand Artificial Neural Networks, Uranium, Plutonium, Neptunium

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1. Introduction

Quantum physics and quantum chemistry with High-Energy-particle physics belong to the most progressive natural sciences during last few decades.

Although in principle, the Modern Physics and Particle Physics and Chemistry have many Nobel Prize winners, never forget mathematician physicists like **Paul Adrien Maurice Dirac** (8.8. 1902 – 20.10.1984) – British Scientist, theoretical physicist and mathematician known for his Dirac's equations and love to Manci Balazs, the extraordinary love of Dirac to **Paul Eugene Wigner's sister**. The great Hungarian physicist Wigner used to call him "my famous brother-in-law".

Erwin Schrödinger (12.8.1887 Wien – 4.1. 1961 Wien, Austria) was an Austrian theoretical physicist and mathematician, one of the builders of quantum mechanics QM, Nobel Prize winner in 1933 with **P.A.M. Dirac, Schrödinger** is best known for so called wave-function equation and famous mind experiment with "The Schrödinger Cat".

The Abel Prize is the "Nobel Prize for mathematicians ", it's named after the Norwegian mathematician **Niels Henrik Abel** (1802 – 1829). It comes with a monetary award of 7.5 million Norwegian Krones (NOK, about US$ 873 000 in 2025 increased from 6 million NOK in 2019).

The best mathematician of 2025 is **Masaki Kashiwara** (*30.1.1947 Júki, Ibaraki, Japan), who is a 78-year-old Japanese mathematician and professor at the Kyoto University Institute for Advanced Studies. Prof. Masaki Kashiwara was awarded the Abel Prize for "his Contributions to Algebraic Analyses and Theory of Representations, specifically for Development of Theory of D-modules and discovery of a crystalline base known for the solution of Tsurukamezan Problemma".

Abel Prize 2024 was awarded to French CNRS mathematician **Michel Pierre Talagrand** (*15.2.1952) French Mathematician working on the Theory of Probability for functional analyses and mathematical physics.

Comment no. 1: **CNRS** (Centre National De La Recherche Scientifique) => **National Center for Scientific Research** – the biggest agency Basic Science in Europe, Government Organisation.

M.P. Talagrand is best known for Talagrand's inequalities of concentration of izoperimetric inequalities for set product's probability spaces.
This inequality is one manifestation of the measure concentration phenomenon.

1.1.Spin Glasses or Gyroscopical Glasses:

Spin glasses in Condensed matter Physics are a magnetic state characterized by randomity. Their contributional significance is obvious especially in physics, chemistry and ANN (Artificial Neural Networks) and Information technology (ICT).

- Introduction (Figures of spin or gyroscopical glasses of M.R. Talagrand, sketched by the Authors of this paper)

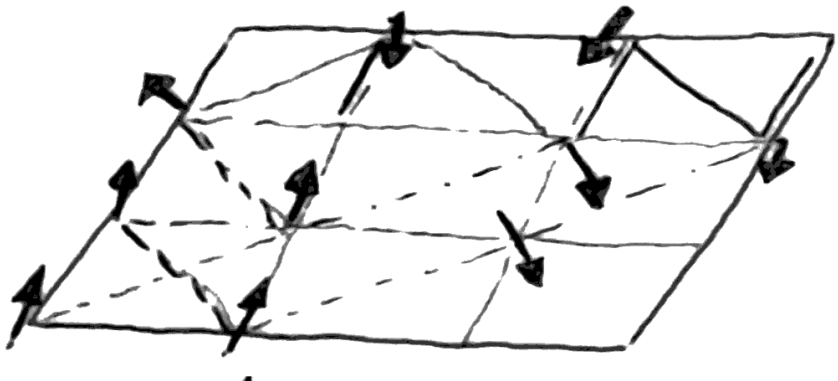


Fig 1 Schematic description of structure with randomity spin of spin glasses of Ferromagnetic Spin Glasser of ferromagnetic Spin Glasser

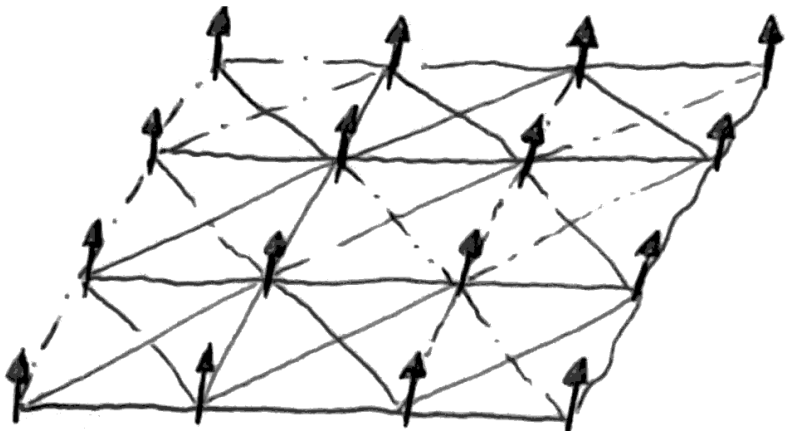
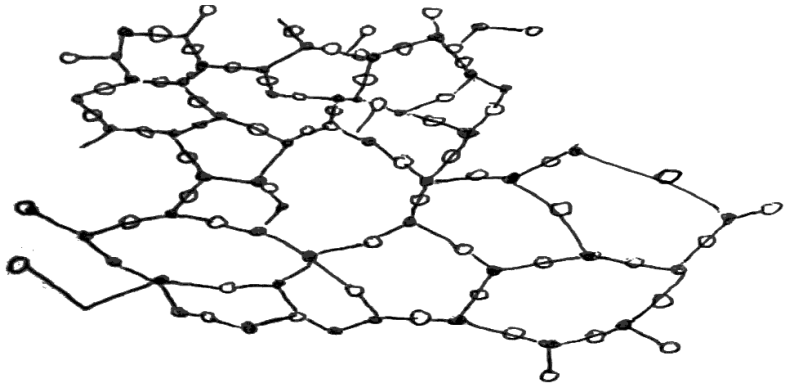


Fig 2 Coordinated structuries



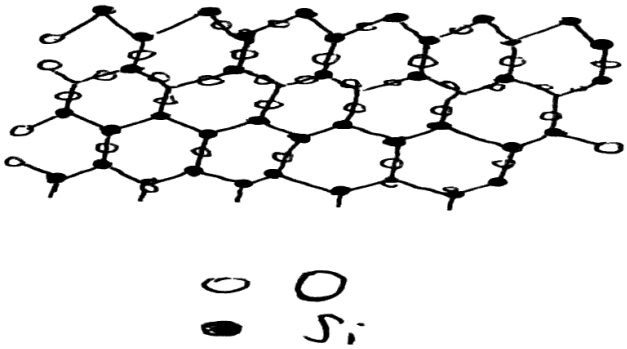


Fig 3 Glass (Amorphic SiO_2)

Fig 4 Quartz (Crystalline SiO_2)

- *O*
- *Si*

2. Highlights

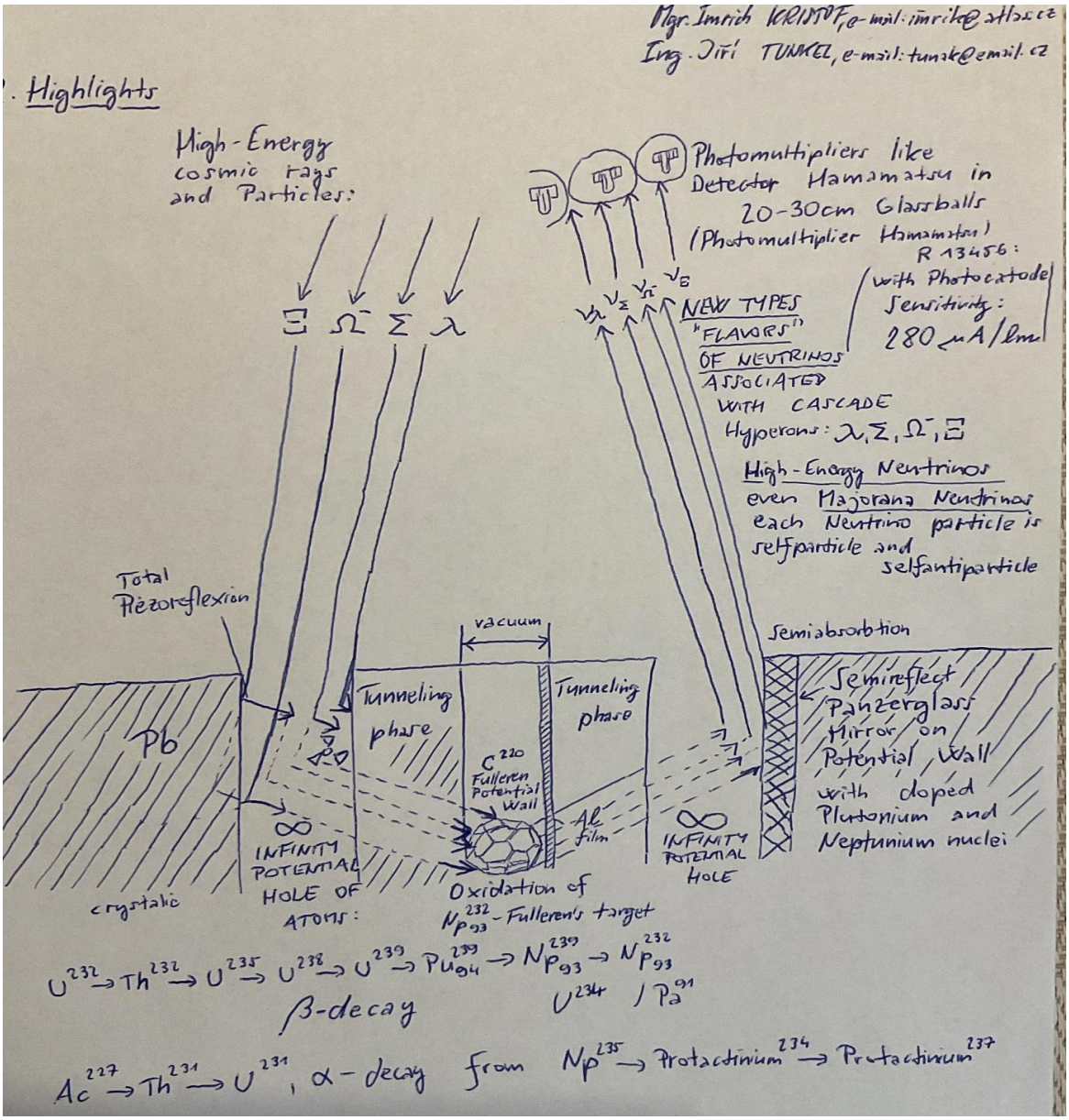
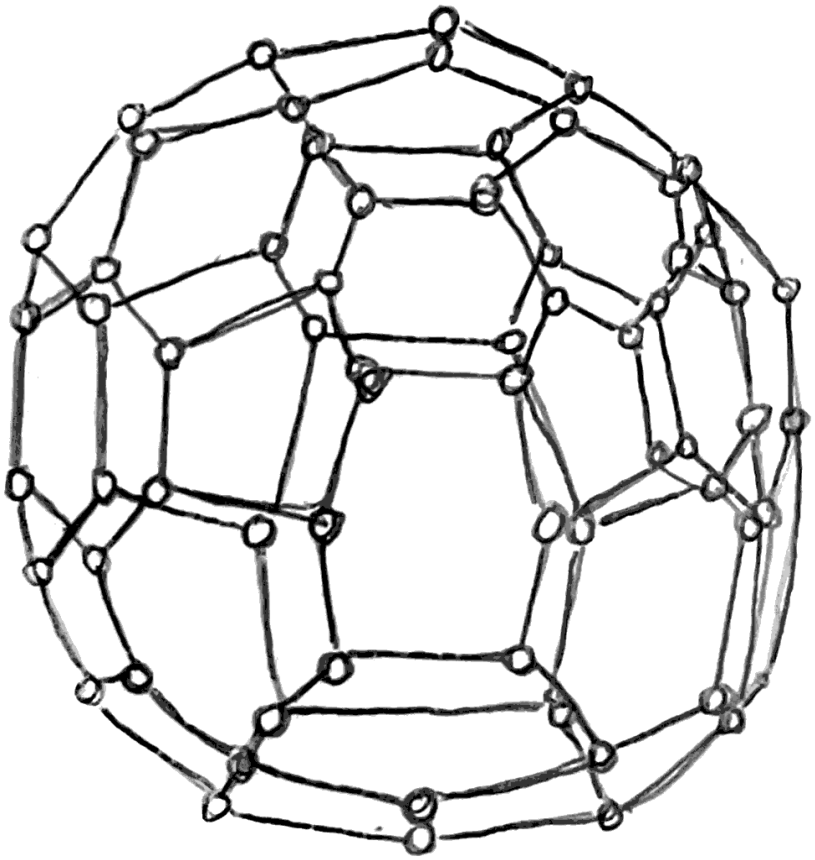


Fig 5 Scheme of High-Energy-Particles Detectors, according to the authors of the paper (Mgr. I Krištof and Ing. J. Tunkl)

Applications:
Biomolecular medical noninvasive analyses:
Fluorescent Spectrometry
NOx Analyses
Atomic Absorption Spectroscopy (AAS)
Raman Spectrometry
UV Spectroscopy

Fluorescent immunoanalyses
Flow cytometry
NO_x analyses

These types of Analytical Methods are used in Monitoring of Environment



2.1. Highlights and Methods 1.

Applications of H-E-P Detectors according to Fig. 5.:
Semiconductor Industry: Inspection of **Semiconductor Wafers**
Particle Counters
Neutrino Microscopes based on **Digital Holography** (Hungarian Physicist **Dennis Gábor**(1900-1979)

Comment no. 2.: START I (Strategic arms reduction treaty), bilateral USA and Soviet Union pact which was signed on 31 July 1991, proposed by American President Ronald Reagan and signed 31th July 1991 by George H.W. Bush and Mikhail Gorbatchov, which ended 5th December 2009. American President Barack Obama and Russian President Dmitrij Medvedev signed in Prague new treaty START (New START) 8th April 2010. Treaty entered into force 2011 with validity until 5th February 2021, which was extended 3th

February 2021 by Joe Biden and Vladimir Putin with validity to 4th February 2026. However, 21th February 2023, Russia suspended its participation, not withdrawing completely.

2.2. Soft donor for Transplutonides and Lanthanoides

Extractive recovery of transplutonium elements (TPE) e.g., Am and Cm, has been the topical subject of the Separation Science in the nuclear realm and can be achieved by using extractants during the Cold War before the the pacts START1 and START2 (New START) in 2010. The chlorinated Cobalt dicarbollide (abbreviated CCD), a bulky organic anion, was first suggested in former Czechoslovakia for isolation of Cs and Sr, then studied in cooperation with Russian and Czech Scientists and ultimately used in Russia for separation of ^{134,137}Cs, ^{90}Sr on large scale.

The big stategic focus nowadays is on quark conglomerate Toponium, consisting of top quarks and top antiquarks detected on LHC (Large Hadron Collider (CERN)) and American Fermilab (Batavia, Chicago) DUNE Project and ATLAS (Detector in CERN).

2.3. Highlights and Methods 2

The **Toponiums** are made by aiming accelerated proton beam to a target, which splits protons.
Toponium is probably the smallest particle composed of Baryon Matter.

The Russian Scientists like for example M.K. Chmutowa and **I.A.Lebeděv** achieved the original method of Separation of Transplutonium Elements by Oxidation-Extraction and Separation of Actinides and Lanthanides by Partition Countercurrent Chromatography.

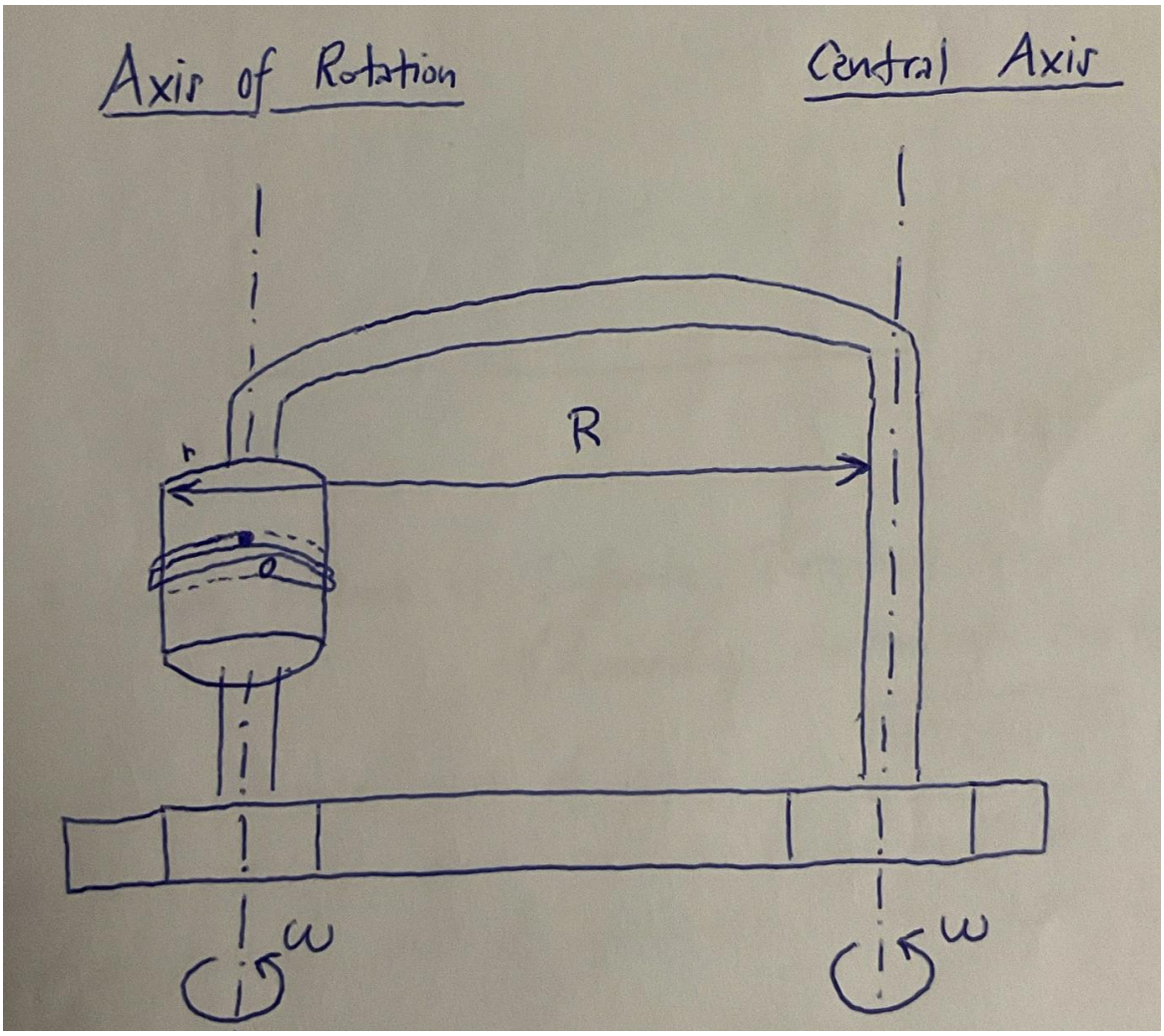


Fig 7 Sketch of Separation of actinides and Lanthanoides by Countercurrent chromatography
R – radius of revolution
r – radius of rotation
ω – revolution speed

2.4 Highlights and Methods 3

Particle in infinite deep Potential Well

In Natural Sciences we frequently encounter the situation, when the motion of a particle is limited within a subspace. For example, introduce an electron which is attacking atomic nucleus, limited in its motion in a region by nearby atomic nucleus of a concrete atom.

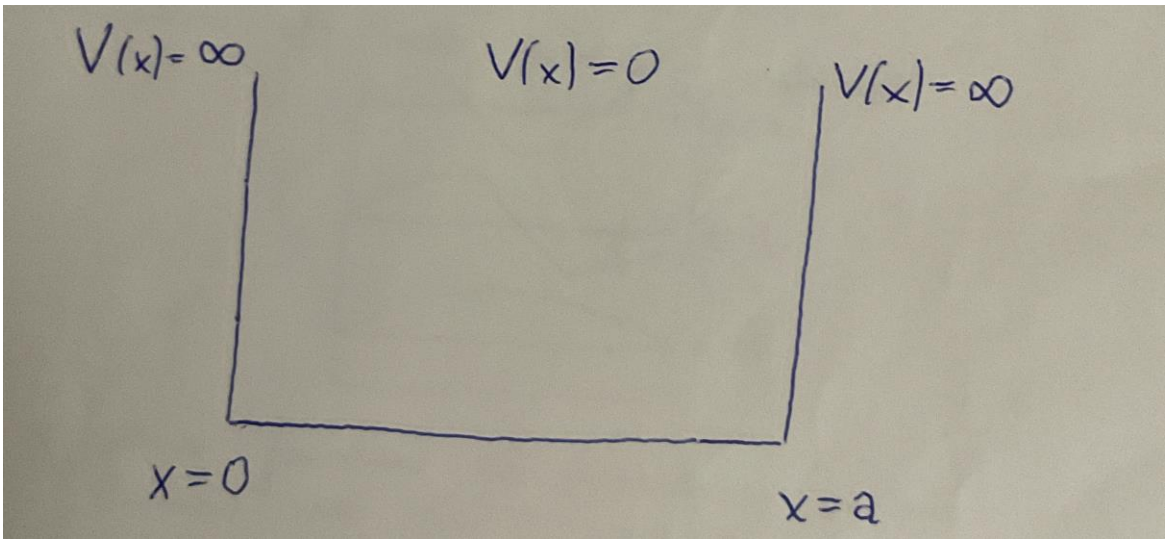


Fig 8 Simple scheme of Infinite Potential Well (According to the Authors of the paper)

For wave function particle out of hole is: *psi ψ(x) = 0* (1.1)

For x such, that x<0 and x>0 and x>a. Equation (1.2) is a definition of Reality, in which particle out of potential well cannot occur there.

We already have a solution of Schrödinger equation out of well, but we must define motion of particle in a well. In this case we are searching for the solution of the Schrödinger equation for this example.

$$\frac{-h^2}{2m}\frac{d^2\Psi(x)}{dx^2} = E\Psi(x) \tag{1.2}$$

For values of x, such that x <0, a>.

So, we are searching for a wave function, which is twice derived by itself and simultaneously multiplied by some constant. This function is an ordinary exponential $e^{\lambda x}$, where λ is a number which we must already have determined. After filling into (1.2) we get a polyneme for non-determined constant λ

$$\lambda^2 + \frac{2mE}{h^2} = 0 \tag{1.3}$$

After calculating this quadratic equation, we get:

$$\lambda^{=} \pm i\frac{\sqrt{2mE}}{h} = \pm ik \tag{1.4}$$

In this case, there are two solutions, e^{ikx} and e^{-ikx} where k element is marked as General solution is given as a linear combination of both particular solutions.

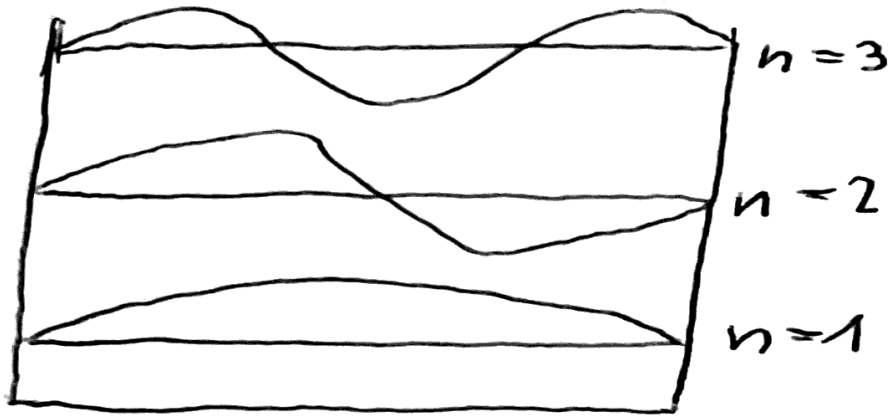


Fig 9. Wave functions for particles in an endless Potential Well for n=1,2,3,…

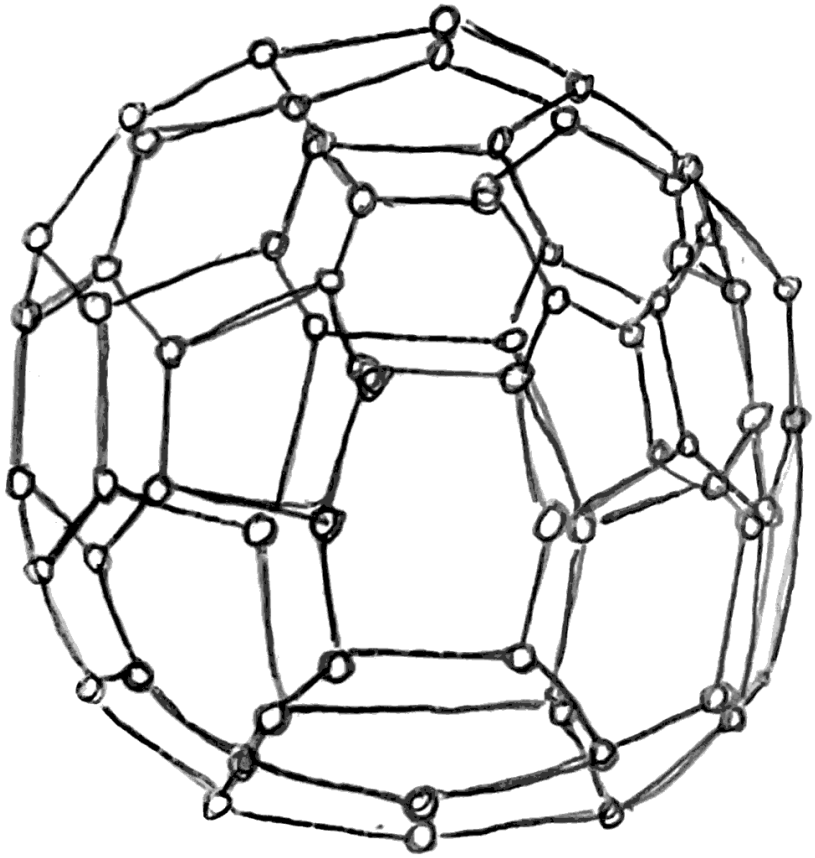


Fig 10. A sketch of the most beautiful fulleren C60 depicted as deep potential well (by Mgr. I. Krištof, Ing. J. Tunkl)

3. Current Experiments:

3.1. The Experiment KATRIN (Karlsruhe Tritium Neutrino)

KATRIN brings up to these days the most exact measuring of neutrinos. The neutrino is probably the most mysterious of all elementary particles.

The German team from KATRIN suggest that neutrinos have the maximum mass of 0,5-0,8 (eV).
Scientists have already had for long time non-direct evidence that these particles could be lighter than 1 (eV). But this is the first time, when it was proven by direct measuring (2019-2025)

3.2. The Fermilab Muon g-2 Experiment/ U.S.A Batavia

The experiment has concluded, announcing its final results with a precision of 127 parts per billion.
The measurement of the muon´s magnetic anomaly confirms earlier findings from 2021 and 2023, supporting evidence for potential "New physics" beyond the standard model. The experiment investigates the muons' "wobble" in a magnetic field, their magnetic field and their magnetic anomaly creating a subtle misting which is influenced by a simple prediction caused by Quantum effects (tunnelling**, Heisenberg Uncertainty Principle**, **Pauli's exclusion**, etc.) and potentially by undiscovered particles like for example in fig. 5 in this article: V_{λ} , V_{Σ} , $V_{\Omega-}$, V_{Ξ} (new 4 types of hyperrelativistics and hyperbaryonics Neutrinos), according to the authors of this paper.

3.3 ANITA (Antarctic Impulsive Transient Antenna)

Extraordinary radio pulses were detected on many measurement machines, installed on flying Balloons of NASA high above Antarctica. Radio waves and signals before they are reflected from Antarctic Ice, originally come from the underground of the Antarctic Continent. This is a direction which has not been explained until this day by Particle physics and which can suggest new types of particles or interactions which are unknown for the Standard Model (SM).

Nobel Prize Winner for Physics 2026 became on the 6th October Belgian-American Physicist **Francis HALZEN** (*23.3.1944, Tienen, Belgium – University of Wisconsin – Madison, USA). Motivation of Prize: “for decisive contribution for Neutrino Observatory IceCube and for discovery of (High Energy) Neutrinos of Astrophysical origin.”

He was the leading Scientist for Antarctic Ice Projects, older AMANDA, younger IceCube, which is nowadays the biggest world Neutrino Detector on South Pole, to depth in Antarctic Ice 1.5 km [The IceCube 1.5 x 1.4 km].

4. Summary

The new strategic focus of Applied Chemistry and High-Energy Particle Physics can bring new fields of view to crucial problems of Mathematics, Physics and Applied and Analytical Chemistry.

Mysterious High-Energy Particles of Hyperons and Baryons Λ, Σ, Ω- and Ξ could be the key to resolving not only Quantum-mechanical effects QCD, QFT, QED particles and fields theories, but also new geometrical (spatial) mathematical formalism.

Wide field of applications could lead to the birth of a new scientific discipline - Neutrinica with applications in optical, technical, medicinal, chemical, industrial, communication and energy nets, new types of traffic or teleportation branches.

Also, 3D hologram smartphone is not out of question in 10-15 years. Namely important facts are connected with Standard model of particles, where Neutrinos always surprise us.

Scientific data from many known experiments like Super-Hyper-Kamiokande, Sudbury (SNO), Antares, NESTOR, JUNO, NOVA, Baikal, Km3Net, ANITA, IceCube and others suggest these facts: Neutrinos can occur between 0,5-0,8 eV, 1,8 eV 18 eV ->180 eV, which depend on "flavors of neutrinos". The Research of Neutrinos is and will be epochally significant in the future of mankind.

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