New Evidence on the Nature and Role of the Potential Vector in Maxwell's Equations and their role in biological regulatory processes

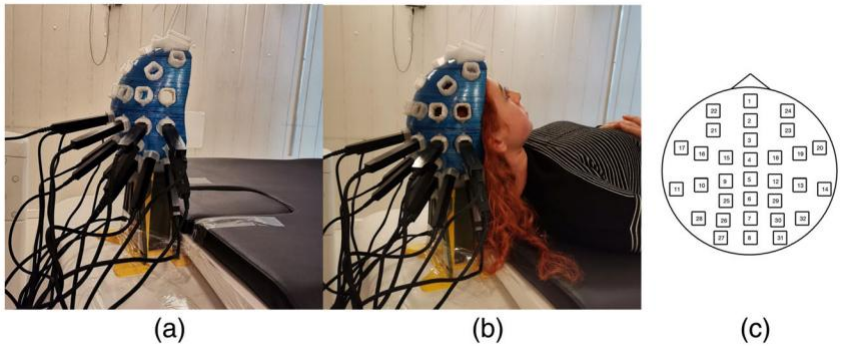
S.von Gratowski, Victor Koledov,
Kotel'nikov Institute of Radioengineering and Electronics
Russian Academy of Sciences
svetlana.gratowski@yandex.ru

Kotelnikov IRE RAS

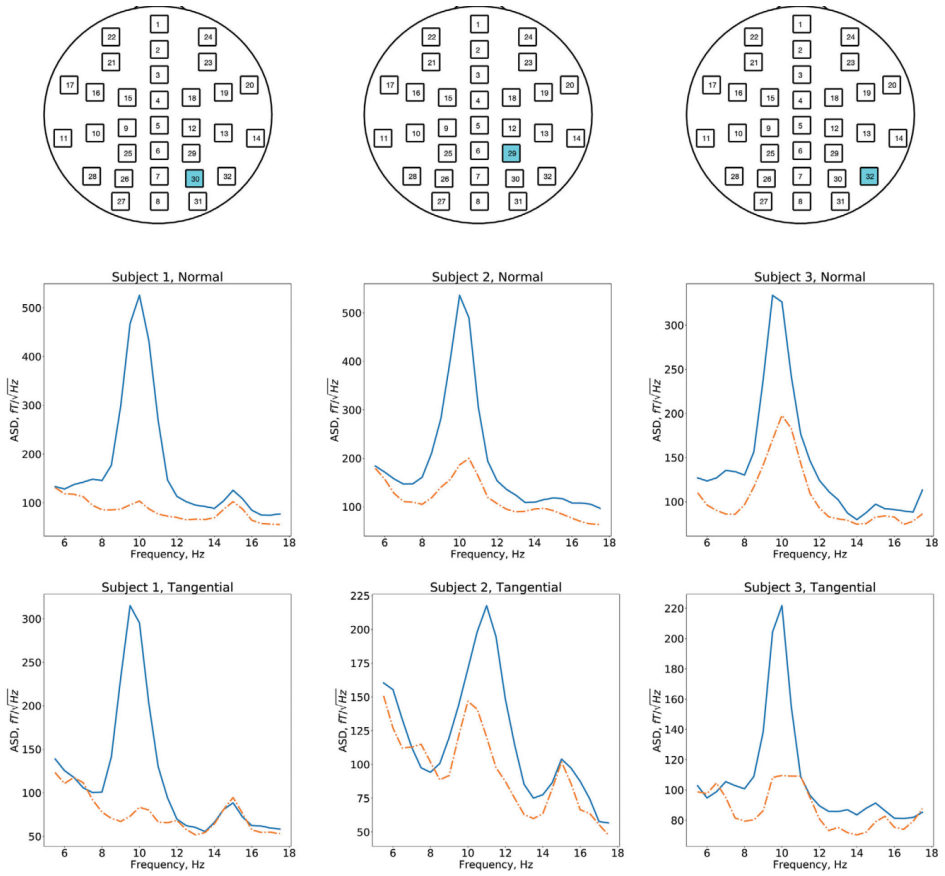
Evolution of MEG: A first MEG-feasible fluxgate magnetometer

N. Koshev, A. Butorina, P.Vetoshko et al.

Hum Brain Mapp. 2021;42:4844–4856.



The first solid-state sensor feasible for magnetoencephalography (MEG) that works at room temperature. The fluxgate magnetometer based on yttrium-iron garnet films (YIGM) has sensitivity **10^{-13} T**. In this feasibility study, we prove the concept of usage of the YIGM in terms of MEG by registering a simple brain induced field—the human alpha rhythm.

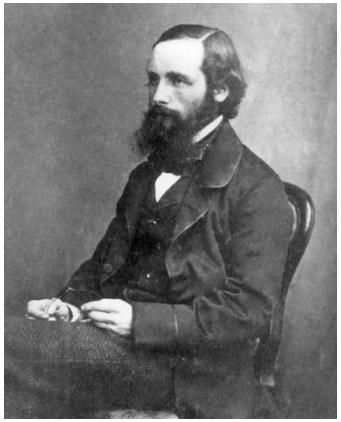


What about measurement of the magnetic field induced effects at $H = 0$?

Potential Vector of Electromagnetic Field is Basement of the Modern Theory of Field

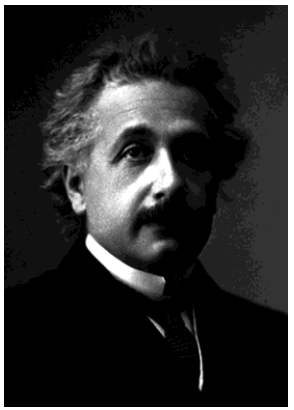
Michael Faraday

J.C. Maxwell

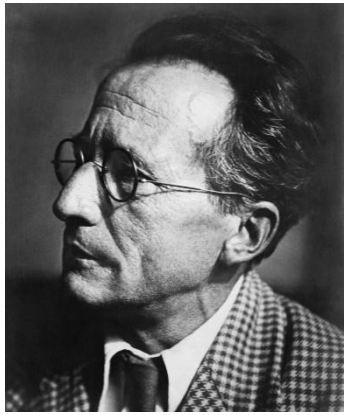


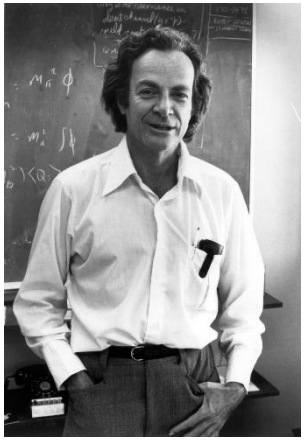
Hendrik Antoon Lorentz

Albert Einstein



Electric and magnetic fields Electrodynamics of moving bodies Theory of Relativity





Niels Bohr Ervin Shredinger Richard Feynman

4 D Vector Potential of the Electromagnetic Field

$$A^i = (\varphi, \mathbf{A}).$$

$$S = \int_a^b \left(-mc\, ds - \frac{e}{c} A_i dx^i \right).$$

principle of a least action

$$L = -mc^2 \sqrt{1 - \frac{v^2}{c^2}} + \frac{e}{c}\mathbf{A}\mathbf{v} - e\varphi$$

$$\partial L / \partial \mathbf{v} = \mathbf{P} = \frac{m\mathbf{v}}{\sqrt{1 - v^2/c^2}} + \frac{e}{c}\mathbf{A} = \mathbf{p} + \frac{e}{c}\mathbf{A}$$

Euler–Lagrange equation

Equation of Motion of the Particle in the Electromagnetic Field

$$\frac{d}{dt}\frac{\partial L}{\partial \mathbf{v}} = \frac{\partial L}{\partial \mathbf{r}},$$

$$\frac{d\mathbf{p}}{dt} = -\frac{e}{c}\frac{\partial \mathbf{A}}{\partial t} - e\,\mathrm{grad}\,\varphi + \frac{e}{c}[\mathbf{v}\,\mathrm{rot}\,\mathbf{A}]$$

$$\mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{A}}{\partial t} - \mathrm{grad}\,\varphi \qquad \mathbf{H} = \mathrm{rot}\,\mathbf{A}.$$

$$\frac{d\mathbf{p}}{dt} = e\mathbf{E} + \frac{e}{c}[\mathbf{v}\mathbf{H}] \qquad \Delta\mathbf{P} = -e/c\,\Delta\mathbf{A}$$

Change of **A** leads to change of **P**

Static Vector Potential A

$$U = \frac{1}{2}\int \mathbf{j}\cdot\mathbf{A}\,dV. \qquad U = \frac{1}{2}\int \rho\varphi\,dV.$$

$$\mathbf{A}(1) = \frac{1}{4\pi\varepsilon_0 c^2}\int \frac{\mathbf{j}(2)\,dV_2}{r_{12}}, \qquad \varphi(1) = \frac{1}{4\pi\varepsilon_0}\int \frac{\rho(2)}{r_{12}}\,dV_2.$$

$$\mathbf{B}(1) = \frac{1}{4\pi\varepsilon_0 c^2}\int \frac{\mathbf{j}(2)\times\mathbf{e}_{12}}{r_{12}^2}\,dV_2. \quad \mathbf{E}(1) = \frac{1}{4\pi\varepsilon_0}\int \frac{\rho(2)\,\mathbf{e}_{12}}{r_{12}^2}\,dV_2.$$

$$\mathbf{H} = \mathrm{rot}\,\mathbf{A}.$$

Vector potential **A** exists whenever **H** exists, but not vice versa

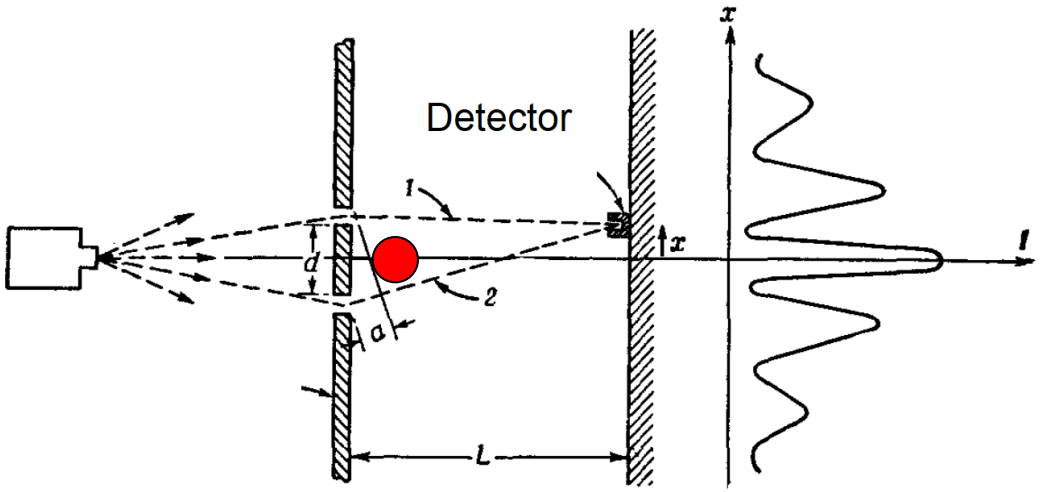
Schrödinger Equation in Magnetic Field

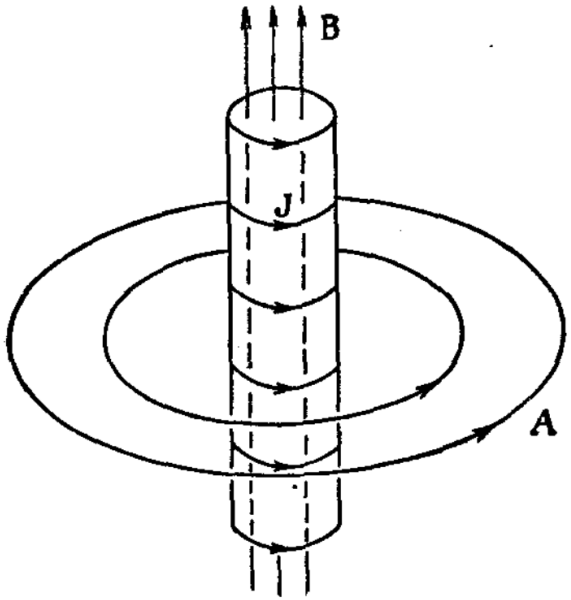
$$\frac{1}{2m}\left(\hat{\mathbf{p}} - \frac{e}{c}\hat{\mathbf{A}}\right)^2 \Psi_n(\mathbf{r}) = E_n \Psi_n(\mathbf{r}), \qquad (3)$$

$$\psi_{n,k_y}(x) = \frac{1}{\sqrt{2^n n! \pi^{1/2} l_H}} e^{-\frac{(x-k_y l_H^2)^2}{2l_H^2}} H_n\left(\frac{(x-k_y l_H^2)}{l_H}\right), \qquad (7)$$

$$E(n, k_z) = \frac{\hbar^2 k_z^2}{2m} + \hbar\omega_c\left(n + \frac{1}{2}\right), \qquad (1)$$

Aharonov and Bohm Effect





$\hat{C}_1 e^{i\Phi_1}$ $\hat{C}_2 e^{i\Phi_2}$

$\delta = \Phi_1 - \Phi_2$

$\delta = \frac{a}{\lambda\!\!\!^{-}}$.

$a = \frac{x}{L} d$

$\delta = \frac{x}{L} \frac{d}{\lambda\!\!\!^{-}}$

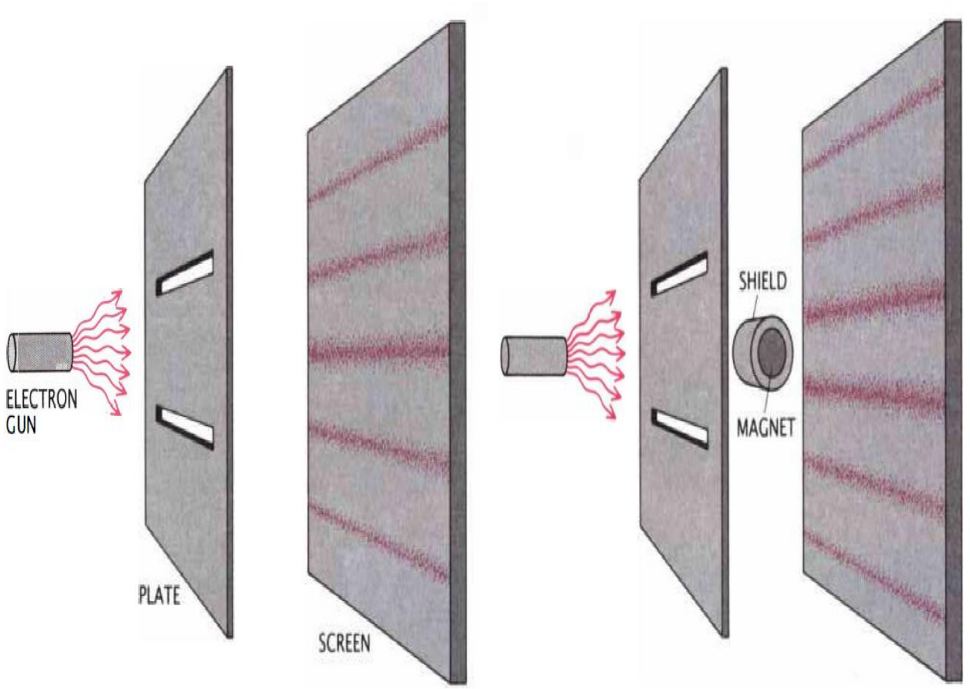
$\lambda\!\!\!^{-} = \hbar / p$ H = 0

$$\mathbf{A}(1) = \frac{1}{4\pi\varepsilon_0 c^2} \int \frac{\mathbf{j}(2)\, dV_2}{r_{12}},$$

$$\delta = \Phi_1 (B = 0) - \Phi_2 (B = 0) + \frac{q}{\hbar} \int_{(1)} \mathbf{A} \cdot d\mathbf{s} - \frac{q}{\hbar} \int_{(2)} \mathbf{A} \cdot d\mathbf{s}.$$

Aharonov Bohm effect

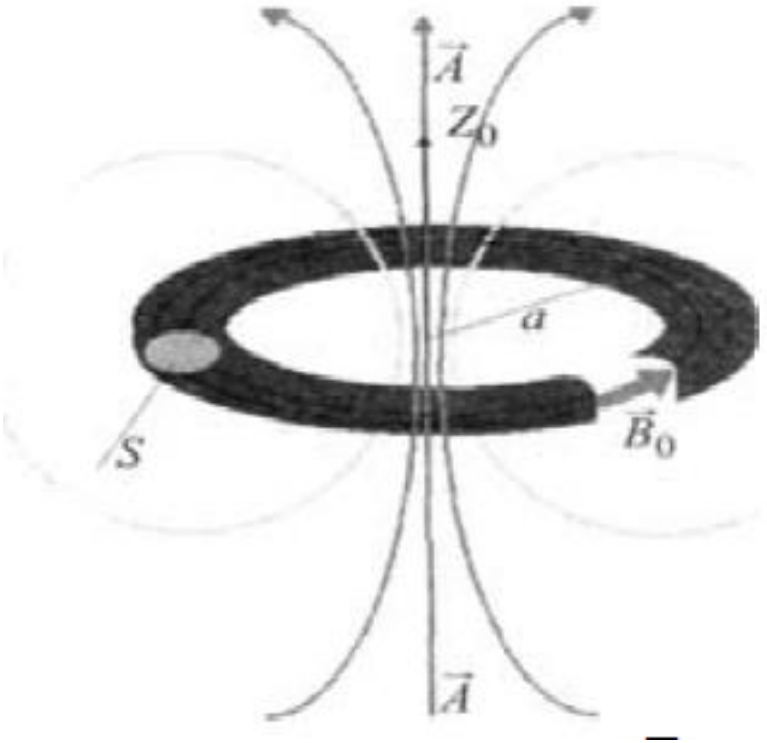
The Aharonov Bohm effect manifests itself in the form of displacement of the electron wave bands during Interference on 2 slots of electron waves in vacuum.



Imry, Y., & Webb, R. A. (1989). Quantum interference and the Aharonov-Bohm effect. Scientific American, 260(4), 56-65.B. .

Vector potential A Generation Principal

There are numerous reports on biological effects caused by weak and superweak magnetic fields. At the same time, the extremely small intensity of the primary act of exposure to the object speaks rather about the informational than the forceful nature of the influence of the field. There are also experiments in which the outer magnetic field is reduced to zero. However, hypotheses about the physical of these physical phenomena cannot be recognized as convincing.



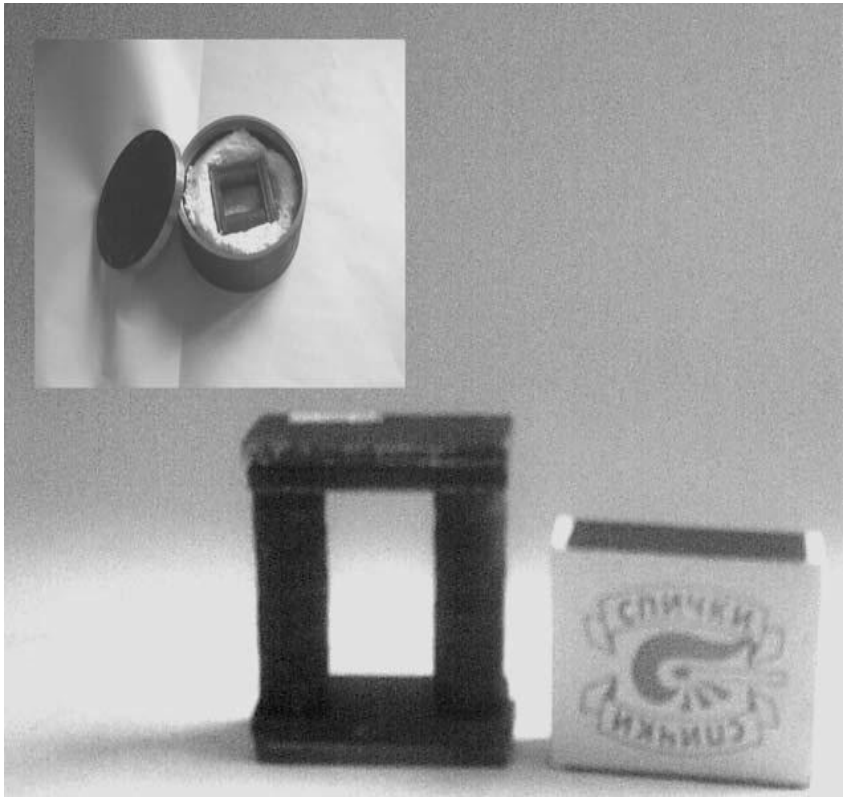
Апельцин, В. Ф., Полетаев, А. И., & Трухан, Э. М. (2019). МАГНИТНЫЙ ВЕКТОРНЫЙ ПОТЕНЦИАЛ КАК МОДУЛЯТОР ХИМИЧЕСКИХ И БИОЛОГИЧЕСКИХ ПРОЦЕССОВ. *Актуальные вопросы биологической физики и химии*, *4*(4), 550-557.

Vector potential Generation device

One of the hypotheses to explain these effects is the effect of the vector potential of the electromagnetic field on these biological or medical bjects.

$$\Delta\varphi = (e/\hbar)\int \mathbf{A}\,\mathbf{dr}\,,$$

As we see the vector potential associated with the phase. In the case of a wave function, the phase ψ does not affect the distribution of the electron density ρ (ρ = | ψ |^2) of the individual electron.



Аносов, В. Н., & Трухан, Э. М. (2003). Новый подход к проблеме воздействия слабых магнитных полей на живые объекты. In Доклады Академии Наук (Vol. 392, No. 5, pp. 689-693).

Bio-information – sources, imprinting into water, erasure, measurements

Table 1 Bio-information – sources, imprinting into water, erasure, measurement

Sources of frequency bio-information	*Imprinting a frequency into water*	*Erasing a frequency imprint in water*	*Measuring a frequency imprint in water*
1 Whole Body Field 2 Acupuncture Meridians 3 Chakra Points 4 Chemical Signature 5 Scattered Light & Images.	1 Proximity 2 Succussion 3 Momentum Impulse 4 Permanent Magnet 5 Ferrite Toroid(s) 6 Toroid (A-field) 7 Solenoid (A-& B-fields) 8 Caduceus and Möbius coils (torsion & radial A-fields) 9 Vortex (angular momentum) 10 Digitally (7-voltage impulses) 11 Chirality (L-& D-) 12 Light scatter. 13 Arithmetic & Logic Functions 14 Chemically 15 Heart Chakra 16 Qi – Intention.	1 Closed Steel Box. 2 Imprinting 'nil-potent' Frequency 3 Prime Number Dilutions.	1 Pair of electrodes to differential amplifier. 2 Single electrode (detects A-field). 3 Dowsing Response (μHz to THz) 4 Modulated light scatter & its images.

Smith, C. W. (2015). Electromagnetic and magnetic vector potential bio-information and water. Homeopathy, 104(04), 301-304.

Vector potential effect on Water

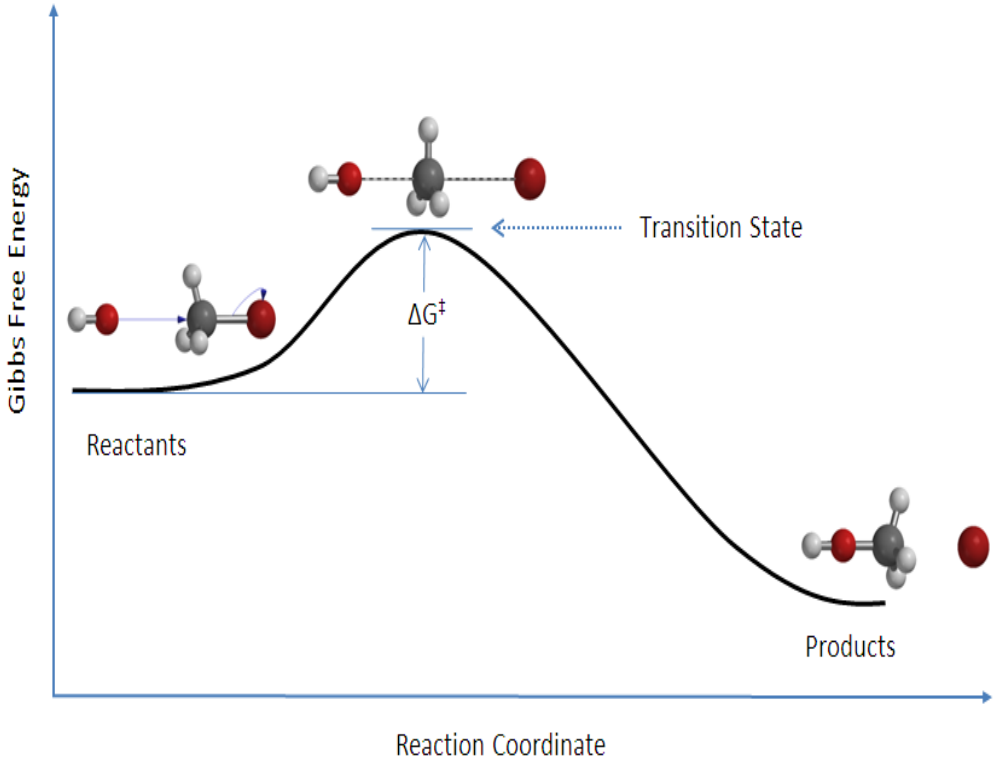
A possible object of exposure to vector potential can be water, which is an essential environment for biochemical and biophysical processes. The restructuring of the water structure caused by a violation of equilibrium conditions on an intracellular scale occurs mainly by tunneling protons along intermolecular hydrogen bonds. This process can also be the objects of the vector potential, changing the speed and direction of the process, as well as the fate of the biochemical cell system.

Апельцин, В. Ф., Полетаев, А. И., & Трухан, Э. М. (2019). МАГНИТНЫЙ ВЕКТОРНЫЙ ПОТЕНЦИАЛ КАК МОДУЛЯТОР ХИМИЧЕСКИХ И БИОЛОГИЧЕСКИХ ПРОЦЕССОВ. Актуальные вопросы биологической физики и химии, 4(4), 550-557.

Water and vector potential

Thus these **purely quantum phenomena** can cause noticeable **macroscopic changes** in the state and behavior of living systems. At the same time, the primary act of exposure consists in changing the phase of individual ψ functions, has a **signal informational nature**. And the expected macroscopic effect is a strengthening of primary processes due to the energy springs of the object itself.

Therefore, an experimental study of the influence of the vector effect on live objects is an important fundamental and applied research.

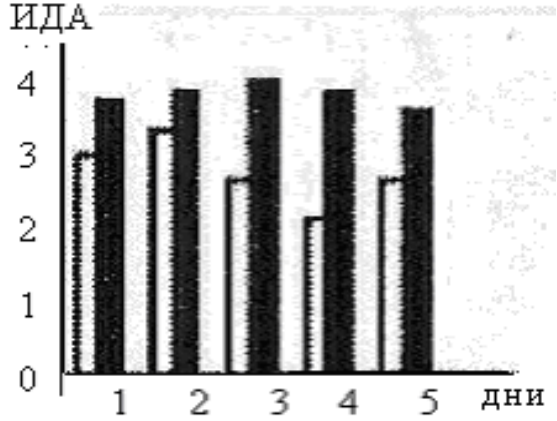


Reaction: $HO^- + CH_3Br \rightarrow [HO{---}CH_3{---}Br]^{\ddagger} \rightarrow CH_3OH + Br^-$

Апельцин, В. Ф., Полетаев, А. И., & Трухан, Э. М. (2019). МАГНИТНЫЙ ВЕКТОРНЫЙ ПОТЕНЦИАЛ КАК МОДУЛЯТОР ХИМИЧЕСКИХ И БИОЛОГИЧЕСКИХ ПРОЦЕССОВ. Актуальные вопросы биологической физики и химии, 4(4), 550-557.

Vector potential in life science experiments

Experimental results of the changing the motor activity index (IDA) of spirotoma infusories (*Spirostomus Ambicuum*) when the water-incubated infusories passed through the vector potential (dark columns) is added to a solution with incubated water infusories. Control is represented by light columns. (IDA - the number of intersections by infusories in the solution of the marker line in 5 minutes).



Changing the high speed of CO2 after exposure of the suspension for 20 minutes in the vector potential field.

Vector potential in life science experiments

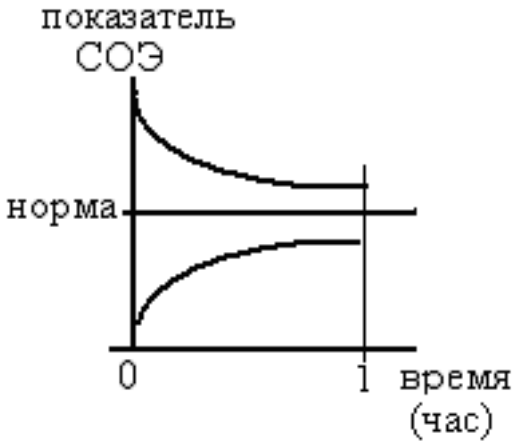
Experimental results of the effects of vector potential on the physical characteristics of the simplest living objects - the intensity of bioluminescence of living cells, the rate of sedimentation of erythrocytes, the mobility of hydrobionts, and the speed of a simple chemical reaction in solution.

Changing the differential absorption spectrum of the absorption of the physical (exposure in the vector potential) depending on the light wavelength

Болдырева, Л. Б. (2014). Квантовая нелокальность. Примеры применения в технике и биологии. Сложные системы, (1), 31-45

Vector Potential „Therapeutik“ effect on euritrocites sedimentation rate

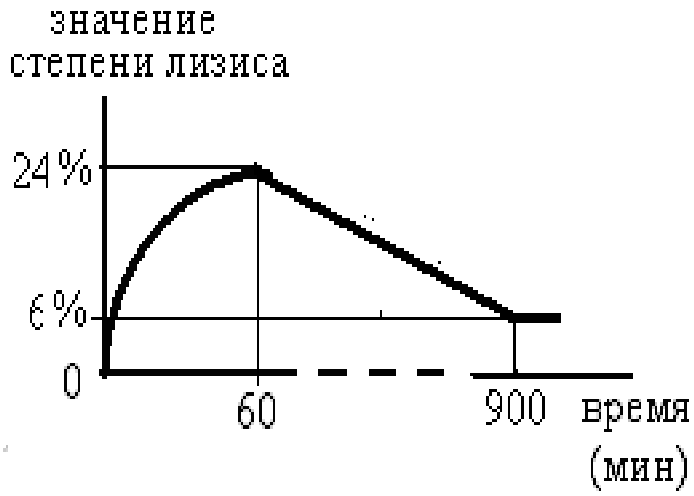
Experimental results of the Changes in the erythrocyte sedimentation rate (SE) in the test tube with the blood of the donor under the influence of vector potential. If the SE indicator was higher than the norm, then after processing by vector potential, it decreases (dependence 1), and if the norm is lower, then after processing by vector potential, it increases (dependence 2). That is, in these experiments, the effect of vectorpotential for blood was "therapeutic"



Trukhan E.M. Vozdeistvie slabykh magnitnykh polej na biologicheskuju aktivnost’ vodnoj fazy [Effects of weak magnetic fields on biological reactivity of water phase]. Komp’juternye issledovaniya i modelirovanie – Computer Research and Modeling, 2009, vol. 1, no. 1, pp. 101-108.

Vector potential in life science experiments

From the venous blood of a person was isolated lymphocytes according to the standard method of flotation in the density gradient. The suspension of these lymphocytes at 20-25 ° C was placed in the vector potential of 60 minutes. After exposure, the degree of lysis was changed compared with the control (6%). At the same time, 15 hours exposure did not lead to differences in the degree of lysis.



Новоселецкий В.Н., Абрамов В.Ю., Заико В.М. и др. Изучение влияния безроторного векторного потенциала на опосредованный ксеногенными антителами комплемент-зависимый лизис лимфоцитов человека in vitro // Труды Московского физико-технического института и НИИ трансплантологии и искусственных органов. Москва, 2004.

Conclusions

1. Even in the space where **H** =0 the change of mechanical impulse P of a classical particle can take place if **A** is changed.

2. The phase Φ of a charged quantum particle is changed due to **A** change, which can cause the observable interference effects.

3. Literature reports on the experimental works on the study of the action of **A** at **H**=0 seem to confirm its effects on biological objects and chemical substances and processes.

Garyaev Peter

Bulletin of Experimental Biology and Medicine, Vol. 143, No. 2, 2007 GENERAL PATHOLOGY AND PATHOPHYSIOLOGY

Effect of Electromagnetic Radiation Modulated by Biostructures on the Course of Alloxan-Induced Diabetes Mellitus in Rats

P. P. Garyaev, A. A. Kokaya*, I. V. Mukhina*,
E. A. Leonova-Garyaeva, and N. G. Kokaya*

Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 143, No. 2, pp. 155-158, February, 2007
Original article submitted May 29, 2006

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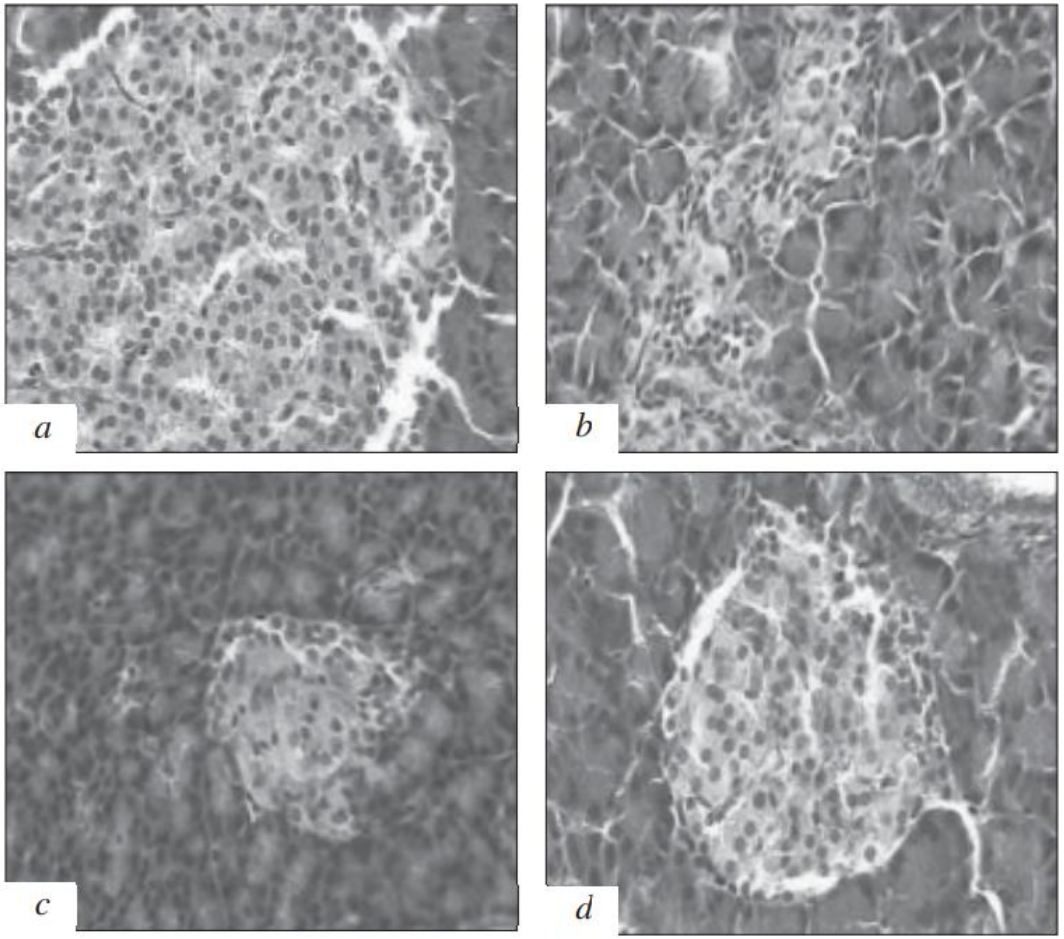
Exposure of rats with experimental diabetes mellitus to wide-band electromagnetic radiation generated by He-Ne laser and modulated by the pancreas and spleen is informing and phenomenological method prolonging animal life span, normalizing blood glucose level, and promoting regeneration of the pancreas.

Wide-band electromagnetic radiation was generated by He-Ne laser and modulated by biological struc tures by our technology. He-Ne laser (2 MW po wer, of 632.8 nm wavelength) has two superposed orthogonally linearly polarized single-frequency radiation modes. Fresh preparations of the pancreas or spleen from a newborn Wistar rat were applied onto a slide and placed on the optical axis of laser beam. The slide with the preparation was adjusted to provide partial reflection of the beam into the laser resonator. Due to this multipassage mode, the preparation acts as an optical correlator and regu lates the distribution of secondary modes of the laser.

Two spatially separated modes with perpen dicular polarization were used for registration of the correlation signal. Optical signals were recorded and transferred into electric circuit regulating laser generation regime, in which mode intensities were compensated best of all. In this regimen, the laser generates WER depending on the exposed biopre paration. The distance between the preparation and laser active element was 11 cm. Laser beam pho tons at counter-current beams were modulated by the preparation, including modulation by two or thogonally polarized components of radiation

Pancreatic tissue structure of rats



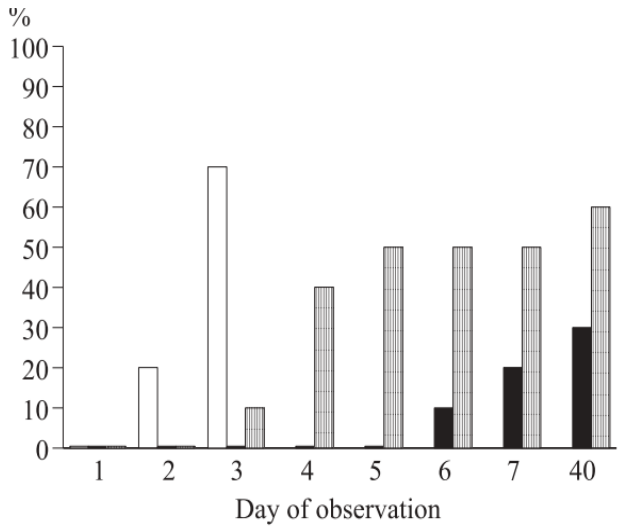


Fig. 1. Effect of WER exposure on the mortality of animals (%) with alloxan DM. Light bars: group 1; dark bars: group 2; cross-hatched bars: group 3.

Fig2. Langerhans islets. a) intact rats; b) control, after alloxan injection in a dose of 200 mg/kg; c) group 2 rats on day 7 after alloxan injection in a dose of 200 mg/kg and 1 day after WER exposure; d) group 2 rats 1.5 months after alloxan injection and WER exposure. Hematoxylin and eosin staining, ×400