



## Sull'origine del vettore potenziale e il suo ruolo nella materia condensata nell'acqua e nella vita

## On the origin of the potential vector and its role in condensed matter in water and in life science

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#### Moscow Kremlin from the windows of Kotelnikov IRE RAS







#### Institute Radioengineering & Electronics of Russian Academy of Sciences

Institute of Radioengineering and Electronics the Russian Academy of Sciences (IRE RAS) after Academician Kotelnikov was founded in 1953.

 Academician Kotelnikov – is the author of sampling theorem, he was forerunner of Nyquist and Shannon. This is on for the most important theorem in signal processing, informatics, cryptography, radio-electronics and many other sciences.
 The Institute is located in the building of the former Physics Department of the Moscow State University in Center of Moscow near Kremlin.



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

**Michael Faraday** 





**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 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 $\frac{d}{dt}\frac{\partial L}{\partial \mathbf{v}} = \frac{\partial L}{\partial \mathbf{r}},$ $\frac{d\mathbf{p}}{dt} = -\frac{e}{c}\frac{\partial\mathbf{A}}{\partial t} - e\operatorname{grad}\varphi + \frac{e}{c}[\mathbf{v}\operatorname{rot}\mathbf{A}]$ $\mathbf{E} = -\frac{1}{c} \frac{\partial \mathbf{A}}{\partial t} - \operatorname{grad} \varphi \quad \mathbf{H} = \operatorname{rot} \mathbf{A}$ $\frac{d\mathbf{p}}{dt} = e\mathbf{E} + \frac{e}{c}[\mathbf{vH}] \qquad \triangle \mathbf{P} = -e/c \triangle \mathbf{A}$ 6 Change of A leads to change of P

Static Vector Potential A  

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

$$\mathbf{A} (1) = \frac{1}{4\pi\epsilon_0 c^2} \int \frac{\mathbf{j}(2) \, dV_2}{r_{12}}, \qquad \phi (1) = \frac{1}{4\pi\epsilon_0} \int \frac{\rho(2)}{r_{12}} \, dV_2.$$

$$\mathbf{B} (1) = \frac{1}{4\pi\epsilon_0 c^2} \int \frac{\mathbf{j}(2) \times \mathbf{e}_{12}}{r_{12}^2} \, dV_2. \quad \mathbf{E} (1) = \frac{1}{4\pi\epsilon_0} \int \frac{\rho(2) \, \mathbf{e}_{12}}{r_{12}^2} \, dV_2.$$

$$\mathbf{H} = \operatorname{rot} \mathbf{A}.$$

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

#### Schrödinger Equation in Magnetic Field

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

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

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

## **Aharonov and Bohm Effect**



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

#### **Phase and interference**

Therefore, it is often erroneously believed that influencing the phase of the vector potential at all is not capable of providing physically measuring effect. However, with the interaction of two objects with ψ wave functions, their interference may occur, and as a result, the total electron density will depend on the phase difference  $\psi_1$ - $\psi_2$ . One of the most striking manifestations of this phenomenon is the effect of Aaronov Bohm.



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

#### **Aaronov Bohm effect**

The Aaronov 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 Principle**

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.

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

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

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Die Information

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)	1 Closed Steel Box. 2 Imprinting 'nil-potent' Frequency 3 Prime Number Dilutions.	<ol> <li>Pair of electrodes to differential amplifier.</li> <li>Single electrode (detects A-field).</li> <li>Dowsing Response (μHz to THz)</li> <li>Modulated light scatter &amp; its images</li> </ol>
	10 Digitally (7-voltage impulses) 11 Chirality (L-& D-) 12 Light scatter. 13 Arithmetic & Logic Functions 14 Chemically 15 Heart Chakra 16 Qi – Intention.		

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  $\psi$  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 Coordinate

 $\text{Reaction: HO}^{-} + \text{CH}_3\text{Br} \rightarrow [\text{HO}\text{---}\text{CH}_3\text{---}\text{Br}]^{\ddagger} \rightarrow \text{CH}_3\text{OH} + \text{Br}^{-}$ 

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. 16

#### 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 CO<sub>2</sub> 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 third-party 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.

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



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#### 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 vector potential for blood was "therapeutic"



Trukhan E.M. Vozdeistvie slabykh magnitnykh polej na biologicheskuju aktivnosť 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 комплементзависимый лизис лимфоцитов человека in vitro // Труды Московского физикотехнического 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.

3. 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.

 Thank you for attention!

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