

Fifty-Five Years in Physics: From Classical Foundations to Modern Cosmology

A Personal Journey Through Questions, Doubts, and the Search for a Coherent World

Vladimir S. Netchitailo

netchitailo.vs@gmail.com

Abstract

This paper is a personal account of a life in physics, spanning more than five decades of study, research, and reflection. My scientific path began with a deep appreciation for the internal consistency of classical physics, which offered not only precise descriptions of natural phenomena but also a sense of logical completeness. As my work expanded into other areas of theoretical physics and, eventually, cosmology, that early sense of clarity was increasingly challenged by the growing complexity—and, at times, ambiguity—of modern theoretical constructs.

Throughout these years, I was repeatedly drawn to questions that seemed resistant to conventional interpretation. Among them were the dynamics of small solar system bodies and the nature of objects classified as interstellar, where observed non-gravitational effects often appeared difficult to reconcile with standard explanations. These were not isolated curiosities, but recurring signals that, in my view, pointed to deeper inconsistencies in widely accepted models.

The ideas presented in this work did not arise from a single breakthrough, but from a long and often nonlinear process of questioning assumptions, revisiting earlier conclusions, and seeking coherence across different domains of physics. The resulting cosmological perspective reflects this cumulative effort—an attempt to restore a sense of unity between fundamental physical principles and observational evidence.

I do not present these results as final answers. Rather, they represent the current stage of an ongoing inquiry shaped by experience, doubt, and persistence. If this work has a central purpose, it is to encourage a careful reexamination of familiar assumptions and to suggest that progress in cosmology may still depend on asking old questions in new ways.

1. Introduction

In 1964, I entered the Moscow Institute of Physics and Technology, marking the beginning of my lifelong journey in physics. During my final examination in General Physics, I presented a report on the question “*Why is the sky blue?*,” based on the theory of light scattering developed by Leonid Mandelstam. This work sparked my enduring interest in optics and the fundamental processes governing light-matter interaction.

In 1967, I began my research career at the Lebedev Physical Institute, joining the Oscillations Laboratory led by Alexander Prokhorov – Nobel Laureate in Physics. I graduated in 1970 with an MSc, defending a thesis on “*Nonlinear Light Scattering in Inhomogeneous Media.*” In 1974, I obtained my Ph.D. with a dissertation entitled “*Investigation of Light Scattering and Laser-Induced Damage in Crystals and Glasses.*”

From the outset, I have been drawn to original and sometimes unconventional ideas in physics. A notable example is the interpretation of atmospheric light scattering based on fluctuations, proposed by Leonid Mandelstam, which challenged the classical molecular scattering theory of Lord Rayleigh. It is remarkable that Lord Rayleigh ultimately acknowledged the validity of Mandelstam’s perspective. This example illustrates an important principle: progress in physics often requires reexamining established views in light of new physical insight.

In the following sections, I present a selection of original ideas and contributions that I have developed over 55 years of scientific work, spanning laser physics, condensed matter, and cosmology.

2. Interaction of High-Power Laser Radiation with Crystals and Glasses

2.1 Nonlinear Light Scattering

My investigations of a Laser-Induced Damage (LID) in transparent dielectrics showed that there is a correlation between Light Scattering (LS) in materials and their LID threshold: the higher the intensity of LS, the lower the LID threshold. It follows that different kinds of inclusions and defects inside of materials are responsible for LS and LID. Then, LS can be used as a Measure of optical purity of transparent dielectrics. Moreover, at laser radiation intensities I close to LID threshold I_1 : $I \lesssim I_1$ the nonlinear dependence of LS intensity from I was observed [1].

To explain this new effect, I developed a theory of nonlinear LS in inhomogeneous media considering various mechanisms of the nonlinearity of the refractive index: optical Kerr effect, heating, and electrostriction. Analytical expressions for LS intensity and spectrum were obtained. The observed experimental results were in good agreement with the developed theory [2], [3].

2.1 Thermal Instability as a Principal Concept in Laser-Induced Damage

The concept of thermal instability in LID associated with absorbing inclusions has been proposed in our work [4]. It has been shown that the heating of inclusions produced by laser radiation has a character of thermal explosion at intensities higher than some critical value. Local temperature in the inclusion region turns out to be very high ($\sim 10^4 K$), giving rise to thermal radiation with a maximum intensity in the UV spectral region. This radiation being absorbed by the ambient matrix leads to its photoionization. As a result, absorption spreads to the inclusion vicinity, which was primarily transparent.

A detailed analysis of these processes [5] indicates that laser heating of the inclusions and accompanying photoionization encourage thermal instability in the matrix, resulting in the catastrophic macrodamage. The critical intensity that gives rise to this instability corresponds to I_1 . The observed experimental results were in good agreement with the developed theory [4], [5].

It is worth noting our work went against the prevailing linear theory of laser-induced thermal destruction of transparent dielectrics containing absorbing inclusions. That theory explained the role of foreign inclusions in LID of transparent materials, but it could not explain a catastrophic behavior of a process of macrodamage development inside of transparent dielectrics under laser irradiation.

The obtained scientific results were used in the development of the High-Power Laser Optics made of extremely pure Fused Silica and became a chapter in Cycle of Research on “*Laser-Induced Damage to Glasses*” that won the prestigious Komsomol award in 1979.

3. Interaction of High-Power Laser Radiation with Optical Polymers

3.1 Accumulation Effect in Laser-Induced Damage

At laser intensities below the single-shot damage threshold ($I < I_1$), catastrophic damage does not occur immediately. However, irreversible microscopic changes may accumulate in both inclusions and the surrounding matrix. These include the formation of color centers and radicals, which increase the effective absorption of subsequent laser pulses.

As a result, damage may occur after a certain number of pulses N , defining a multi-shot damage threshold I_N . This accumulation effect demonstrates that thermal instability remains the governing mechanism not only for single-shot but also for multi-shot LID, with defect generation playing a decisive role.

In 1976, I proposed a novel method for studying multi-shot LID based on monitoring nonlinear light scattering in the interaction region. Using this approach, we experimentally observed the accumulation of irreversible changes in sapphire crystals and various glasses subjected to repeated sub-threshold laser pulses. The process culminated in visible damage after a critical number of pulses [6].

The accumulation effect proved to be particularly pronounced in optical polymers, where it can occur at intensities as low as $I \lesssim 0.01 I_1$, significantly limiting their application in laser optics [7-16].

3.2 Role of Viscoelastic Properties in Polymer Damage

Polymers differ fundamentally from crystals and glasses due to their higher thermal expansion coefficients and lower tensile strength. Our theoretical analysis, based on coupled thermal conductivity and elasticity equations, showed that thermoelastic stresses in polymers can reach critical levels at relatively low temperatures (~ 100 °C).

This explains why the damage threshold of polymers is substantially lower than that of inorganic materials. It also implies that the LID mechanism in polymers is strongly influenced by their viscoelastic properties. By modifying these properties—specifically by reducing brittleness and increasing plasticity through the introduction of plasticizers—we were able to significantly increase a multi-shot damage threshold I_N [7-9].

3.3 Decisive Role of Vibrational Cross-Relaxation

In 1982, I proposed a method for suppressing defect formation through vibrational cross-relaxation [10]. The idea is to introduce low-molecular additives (LMAs) that reduce the lifetime of excited vibrational states in macromolecules, thereby preventing the formation of radicals.

This approach contradicted the widely accepted assumption that vibrational relaxation in solids is extremely fast. Nevertheless, experimental implementation demonstrated remarkable effectiveness: the multi-shot damage threshold increased by more than two orders of magnitude [11-16].

Beyond laser resistance, this method also led to significant improvements in resistance to gamma [17] and ultraviolet radiation [18],[19], as well as enhanced stability of laser dyes embedded in polymer matrices. The concept of vibrational cross-relaxation thus provides a powerful and broadly applicable tool for improving the thermal, photochemical, and radiation stability of materials.

3.4 Technological Outcomes

The conducted research resulted in several important technological developments:

- Creation of a new class of physically modified optical polymers for high-power laser applications [20]
- Development of efficient plastic-host dye lasers for medical use [21]
- Fabrication of polymer-based laser optical elements for diverse applications [22].

These achievements formed the basis of my Doctor of Sciences dissertation, *“Interaction of High-Power Laser Radiation with Optical Polymers,”* defended in 1987 at the Institute of General Physics under the leadership of Alexander Prokhorov.

4. Solid-State Physics

4.1 Diffusion of Point Defects in Solid-Phase Reactions

In my work on solid-phase chemical reactions, I solved the problem of “trap diffusion,” in which a mobile component diffuses and reacts with an immobile one. Analytical and numerical solutions were obtained for the displacement of the reaction front X_f and its profile.

It was shown that X_f obeys the diffusion law having a coefficient of the reaction-front displacement D_f equals to: $D_f = 2 \frac{N_0}{C_0} D$ (N_0 and C_0 are the equilibrium concentration of the first component and the initial concentration of the second component, respectively). This coefficient differs fundamentally from the intrinsic diffusion coefficient D , as it depends on the ratio of N_0 and C_0 . This distinction had been largely overlooked in previous studies.

Experimental verification was achieved in corundum crystals doped with titanium, where the propagation of the $Ti^{3+} \rightarrow Ti^{4+}$ transformation front was measured under controlled conditions [23].

4.2 Nonlinear Diffusion of Low-Molecular Additives in Polymers

To ensure long-term stability of polymer materials, it is essential to control the evaporation of LMAs. Contrary to conventional assumptions, I demonstrated that diffusion in such systems is inherently nonlinear and must be described by a concentration-dependent D and finite surface evaporation rates.

The analysis showed that, at early stages, mass loss follows a linear time dependence ($p(t) \sim t$) [24], rather than the classical square root law. Experimental studies using PMMA with LMA – ethanol confirmed this prediction and validated the nonlinear diffusion model.

4.3 Theory of Free Volume in Polymers

To address inconsistencies in existing free-volume theories, I introduced a new model based on strongly overdamped structural elements—“relaxators.” Unlike oscillatory models, relaxators exhibit aperiodic motion characterized by minimal relaxation times.

Using the fluctuation–dissipation theorem, I derived that the free volume scales with temperature T as $T^{3/2}$, in agreement with experimental observations. The predicted value of the free volume at the glass transition temperature also matches measured data, resolving discrepancies in earlier models [25].

4.4 Theory of Relaxation Spectra

I further developed a “spatial” approach to relaxation phenomena, in contrast to traditional energy-barrier models. In this framework, relaxation times are governed by available fluctuation volume rather than activation energy. The resulting expression for the relaxation time:

$$\tau = \tau_0 \exp(f_d^{-1})$$

(where τ_0 is the minimum relaxation time and the value of a specific available fluctuation volume f_d is based on the fluctuation-dissipation theorem [25]) provides a physically meaningful description of relaxation spectra and resolves inconsistencies found in conventional approaches. The theory shows good agreement with experimental data for polymer systems [26].

These results were successfully applied in the development of a polymer passive Q-switch for laser range finders, demonstrating exceptional long-term stability across wide temperature ranges.

5. Transformative New Cosmology

5.1 Transition to Cosmology

After more than three decades of research in laser physics, condensed matter, and solid-state physics, I turned my attention to cosmology. This transition was driven by a long-standing interest in fundamental questions concerning the origin, structure, and evolution of the World. I approached these problems from the standpoint of classical physics, guided by the conviction that many unresolved issues in cosmology may admit physically transparent explanations without recourse to speculative assumptions.

Over the past two decades, this perspective has led to the development of a framework I call the World-Universe Model (WUM). The model represents a natural extension of classical physical reasoning to cosmological scales and is intended to provide a self-consistent and physically grounded description of the World. Detailed formulations and derivations are presented in my publications [27].

5.2 Hypersphere World–Universe Model

5.2.1 Assumptions

WUM is based on the following primary assumptions:

- The World is a finite, boundless 3D hypersphere whose 4D Nucleus expands along a fourth spatial dimension at a speed equal to the gravitodynamic constant c .
- The Eternal Universe generates Universe-Created Matter (UCM) continuously within the Nucleus. Ordinary Matter is a byproduct of the self-annihilation of Universe-Created Particles (UCPs).
- The Cosmic Medium acts as an active agent in all physical phenomena.
- All macro- and micro-properties of the World are governed by two fundamental parameters: the dimensionless Rydberg constant α that later was named “fine-structure constant,” and the dimensionless, time-varying quantity Q (Dirac’s Large Number).

5.2.2 Principal Points

- **Beginning.** The World originated from a fluctuation in the Eternal Universe, forming a 4D Nucleus. Its initial radius was equal to the fundamental length scale $a = 1.7705645 \times 10^{-14} m$. The 3D hypersphere, which is the World in WUM, has no preferred centers or boundaries.
- **Expansion.** The Nucleus expands along the fourth spatial dimension, increasing its radius R at speed c , while its hyperspherical surface stretches uniformly. Crucially, this model eliminates the need for dark energy to explain cosmic expansion.
- **Creation of Matter.** Matter arises from a process analogous to sublimation, where surface formation is energetically favored. UCM is generated in the 4D Nucleus and transported into the World by UCPs, whose self-annihilation produces Ordinary Matter.

This process drives expansion, matter creation, and the arrow of time, independent of the Cosmic Medium, and proceeds homogeneously across the hypersphere.

- **Content of the World.** The World consists of the Medium and macroobjects (MOs), with total energy density equal to the critical density throughout its evolution. The Medium contributes two-thirds and MOs one-third at all times.

UCPs account for 92.8% of the energy density, while ordinary particles contribute 4.8% in the Medium and 2.4% in MOs.

- **Rotational Fission.** Angular momentum in MOs originates from rotational fission of overspinning prime objects. Part of the rotational momentum is transferred to satellites, implying that the prime object’s rotational momentum exceeds the satellites’ orbital momentum.

In WUM, prime objects are UCM cores of superclusters, which accumulate large rotational angular momenta before the emergence of luminous structures, defining a prolonged **Dark (invisible) Epoch**.

- **Dark Epoch.** Extending from 14.22 Byr to ~ 0.45 Byr (for the Laniakea Supercluster), this phase contains only UCM macroobjects.
- **Luminous Epoch.** Since ~ 13.77 Byr, luminous MOs have formed through explosive rotational fission of overspinning supercluster core. This process resembles a “firework” of satellite formation, with total angular momentum conserved. No preferred rotation directions exist at any scale.
- **Macroobjects Shell Model.** MOs have UCP-based cores surrounded by shells containing both UCPs and Ordinary particles. Weak interactions ensure structural integrity.
- **UCM Reactors.** MO cores function as reactors fueled by UCPs, producing all elements, radiation, and compositions via self-annihilation. Nucleosynthesis occurs within MOs throughout their evolution.
- **Formation of Structure.** Superclusters are the primary structures. MOs form in parallel around distinct cores, creating a finite, boundless “patchwork” of luminous superclusters ($\gtrsim 10^3$) emerging at different times and locations. The distribution is inhomogeneous, anisotropic, and non-simultaneous, with structure forming top-down—from superclusters to galaxies, extrasolar systems, and smaller bodies.
- **Evolution.** Structure formation is ongoing: new superclusters, galaxies, and stars continue to form, while stellar sizes increase. The Medium’s temperature asymptotically approaches absolute zero.

5.3 Predictions of WUM

WUM provides a self-consistent, time-dependent set of cosmological parameters, including the gravitational parameter, Hubble parameter, age of the World, microwave background radiation (MBR) temperature, and intergalactic plasma concentration.

Their interdependence enables predictive calculations, many of which were confirmed between 2015 and 2018. Notably, WUM allows precise determination of quantities previously accessible only through measurement, such as MBR temperature.

The discovery of a supermassive compact object at the Galactic center (Nobel Prize in Physics 2020, R. Genzel, and A. Ghez) supports a key WUM prediction: *macroobjects possess dark matter cores surrounded by shells of dark and baryonic matter*.

5.4 Explained Problems

WUM offers explanations for several outstanding problems:

- Angular momentum in galaxies and extrasolar systems—arising from rotational fission.
- Hubble tension—due to observations across different superclusters; the Hubble parameter should be derived from MBR data.
- Missing baryons—accounted for by intergalactic plasma.
- Fermi bubbles—interpreted as UCPs clouds emitting gamma radiation.
- Galaxy morphology—elliptical and spiral forms result from rotational fission.
- Coronal heating—explained by UCP-based plasma structure.
- Internal heating of Solar System bodies—due to UCPs self-annihilation in cores.
- Matter-antimatter asymmetry—resolved since antimatter is not produced.
- Black-body MBR spectrum—arising from thermo-equilibrium with intergalactic plasma.
- Wave-particle duality—wavelength is an ensemble property, not intrinsic to individual particles.

5.5 Supporting Observations

- Microwave background radiation and intergalactic plasma support the Cosmic Medium concept.
- The Laniakea Supercluster ($\sim 10^{17} M_{\odot}$) hosts the Milky Way and $\sim 100,000$ galaxies without requiring an initial singularity.
- The Milky Way's orbital angular momentum exceeds its rotational momentum.
- High mass-to-light ratios in superclusters indicate substantial UCM.
- The furthest galaxy JADES-GS-z14-0 (~ 13.5 billion light-years away) aligns with WUM predictions of galaxies up to ~ 13.8 billion light-years away.

The **Cosmic Medium**, **Universe-Created Matter**, and **Angular Momentum** form the three central pillars of WUM, representing a change in basic assumptions in cosmology and classical physics.

6. Conclusion

The Hypersphere World–Universe Model is consistent with the fundamental concepts of the World. The model successfully describes the primary cosmological parameters and their interrelationships. WUM enables precise calculation of values that were previously determined only through experiment and makes verifiable predictions.

The strong agreement between calculated values and observational data provides considerable confidence in the model. The significant experimental results and observations achieved in astronomy over recent decades should be analyzed through the lens of WUM.

In light of recent discoveries by the James Webb Space Telescope, the achievements of WUM, and the enduring relevance of Dirac's proposals over the past 88 years, the time has come to initiate a fundamental transformation in astronomy, cosmology, and classical physics.

Acknowledgements

I express my deep gratitude to Alexander Prokhorov and Alexander Manenkov for their pivotal influence on my scientific development.

I offer special acknowledgment to Paul Dirac, whose visionary ideas continue to inspire this work, and to Nikola Tesla for his enduring scientific legacy.

I am grateful to my co-authors—A. S. Belichenko, D. A. Gromov, Yu. K. Danileiko, K. M. Dyumaev, V. Ya. Khaimov-Mal'kov, A. A. Manenkov, A. P. Maslyukov, G. A. Matyushin, A. M. Prokhorov, and A. S. Tsaprilov—for their collaboration and contributions.

I thank Christian Corda for publishing related manuscripts, and Robert Kuhn, Nicholas Percival, and Harry Ricker for their valuable comments, which helped improve the clarity and scope of this work.

Finally, I express my deepest gratitude to my wife, Anna Netchitailo, for her unwavering support over many years, and to my son, Ilya Netchitailo, whose thoughtful questions and early contribution helped shape the development of this model.

References

- [1] Danileiko Yu. K., Khaimov-Mal'kov V. Ya., Manenkov A. A., Nechitailo V. S. (1970) Nonlinear Light Scattering on Small Inhomogeneities in Corundum Crystals. *JETP*, **59**, 1083 (in Russian).
- [2] Danileiko Yu. K., Khaimov-Mal'kov V. Ya., Manenkov A. A., Nechitailo V. S. (1971) Nonlinear Scattering of Light in Inhomogeneous Media. *JETP*, **60**, 1245 (in Russian).
- [3] Danileiko Yu. K., Khaimov-Mal'kov V. Ya., Manenkov A. A., Nechitailo V. S. (1971) Nonlinear Scattering of Light in Inhomogeneous Media. *Proc. of the Sec. Intern Conf. on Light Scat. in Solids. Paris. July 19-23. P 194.*
- [4] Danileiko Yu. K., Khaimov-Mal'kov V. Ya., Manenkov A. A., Nechitailo V. S., Prokhorov A. M. (1972) A Role of Absorbing Inclusions in Laser Damage Mechanism to Transparent Dielectrics. *JETP*, **63**, 1030 (in Russian).
- [5] Danileiko Yu. K., Manenkov A. A., Nechitailo V. S. (1978) On the Mechanism of Laser-Induced Damage to Transparent Materials Due to Thermal Explosion of Absorbing Inhomogeneities. *Kvant. Elect.* **5**, 194 (in Russian)
- [6] Danileiko Yu. K., Manenkov A. A., Nechitailo V. S. (1976) Prethreshold Phenomena in Laser Damage Mechanism to Optical Materials. *Kvant. Electron.* **3**, 438 (in Russian).
- [7] Aldoshin M. I., Gerasimov B. G., Manenkov A. A., Nechitailo V. S. (1979) A Decisive Role of Viscoelastic Properties of Polymers in the Mechanism of Laser-Induced Damage. *Kvant. Electron.* **6**, 1866 (in Russian).
- [8] Manenkov A. A., Nechitailo V. S., Tsaprilov A. S. (1981) Analysis of Laser Damage Mechanism to Transparent Polymers Associated with Viscoelastic Properties. *Kvant. Electron.* **8**, 838 (in Russian).
- [9] Dyumaev K. M., Manenkov A. A., Maslyukov A. P., Matyushin G. A., Nechitailo V. S., Tsaprilov A. S. (1982) Investigation of the Effect of Viscoelastic Properties of the Matrix and Plasticizer Type on the Damage Laser Resistance of Transparent Polymers. *Kvant. Electron.* **10**, 1318 (in Russian).
- [10] Nechitailo V. S. (1982) Mechanisms of Laser-Induced Damage in Transparent Polymer Materials. *Izvestiya Acad. Nauk SSSR, Ser. Fiz.* **46**, 1194 (in Russian).
- [11] Manenkov A. A., Matyushin G. A., Nechitailo V. S., Prokhorov A. M., Tsaprilov A. S. (1983) Statistics of Laser-Induced Damage in Transparent Polymers. *Kvant. Electron.* **10**, 1360 (in Russian).

- [12] Manenkov A. A., Matyushin G. A., Nechitailo V. S., Prokhorov A. M., Tsaprilov A. S. (1983) On the Nature of the Accumulation Effect in Laser-Induced Damage to Optical Materials. *Opt. Eng.* **22**, 400.
- [13] Dyumaev K. M., Manenkov A. A., Maslyukov A. P., Matyushin G. A., Nechitailo V. S., Prokhorov A.M. (1985) Mechanisms of Optical Breakdown and Damage to Transparent Polymers. *Izvestiya Acad. Nauk SSSR, Ser. Fiz.* **49**, 1084 (in Russian).
- [14] Dyumaev K. M., Manenkov A. A., Maslyukov A. P., Matyushin G. A., Nechitailo V. S., Prokhorov A.M. (1987) Recent Progress in Understanding Fundamental Mechanisms of Laser Induced Damage in Optical Polymers. *NBS Spec. Publ.* **756**, 105.
- [15] Manenkov A. A., Matyushin G. A., Nechitailo V. S., Prokhorov A.M. (1988) About Accumulation Effect in Laser-Induced Damage to Optical Materials. *Izvestiya Acad. Nauk SSSR, Ser. Fiz.* **52**, 1788 (in Russian).
- [16] Manenkov A. A., Nechitailo V. S. (1990) Physics of Multishot Laser Damage in Optical Materials. *SPIE* **1441**. Laser-Induced Damage in Optical Materials: 1990. P 392.
- [17] Belichenko A. S., Dyumaev K. M., Manenkov A. A., Maslyukov A.P., Matyushin G.A., Nechitailo V.S., Prokhorov A. M. (1986) On the Mechanism of Polymer Destruction under UV and γ -Radiation: Influence of Low-Molecular Additives Caused by Vibrational Cross-Relaxation. *Doklady Acad. Nauk SSSR*, **286**, 89 (in Russian).
- [18] Dyumaev K. M., Manenkov A. A., Maslyukov A. P., Matyushin G. A., Nechitailo V. S., Prokhorov A.M. (1987) Modified Polymers and Perspectives of their Application in Laser Optics. *Izvestiya Acad. Nauk SSSR, Ser. Fiz.* **51**, 1387 (in Russian).
- [19] Dyumaev K. M., Manenkov A. A., Maslyukov A. P., Matyushin G. A., Nechitailo V. S., Prokhorov A.M. (1992) Dyes in Modified Polymers: Problems of Photostability and Conversion Efficiency at High Intensities. *J. Opt. Soc. Am.* **B9**, 143.
- [20] Dyumaev K. M., Manenkov A. A., Maslyukov A. P., Matyushin G. A., Nechitailo V. S., Prokhorov A.M. (1981) Transparent Polymers as a New Class of Optical Materials for Lasers. *Laser Induced Damage in Optical Materials: 1981*. NBS Spec. Publ. **638**, 31.
- [21] Gromov D. A., Dyumaev K. M., Manenkov A. A., Maslyukov A. P., Matyushin G. A., Nechitailo V. S., Prokhorov A.M. (1985) Efficient Plastic-Host Dye Lasers. *J. Opt. Soc. Amer.* **2**, 1028.
- [22] Manenkov A. A., Nechitailo V. S. (1992) Polymer Laser Optics. *Izvestiya Acad. Nauk SSSR, Ser. Fiz.* **56**, 188 (in Russian).
- [23] Akul'onok E. M., Danileiko Yu. K., Khaimov-Mal'kov V. Ya., Manenkov A. A., Nechitailo V. S., Lebedeva T. P. (1978) Diffusion of Point Defects Participating in Solid-Phase Chemical Reactions (Trap Diffusion): Demonstration for the $Ti^{3+} \rightarrow Ti^{4+}$ Transition in Corundum. *J. Solid State Chemistry*, **26**, 17.
- [24] Dyumaev K. M., Maslyukov A. P., Matyushin G. A., Nechitailo V. S. (1984) Nonlinear Diffusion of Low-Molecular Additives in Polymers. *Doklady Acad. Nauk SSSR*, **279**, 130 (in Russian).
- [25] Nechitailo V. S. (1991) Theory of Free Volume in Polymers. *J. Fiz. Khim.* **65**, 1979 (in Russian).
- [26] Nechitailo V. S. (1991) Theory of Relaxation Spectra. *Doklady Acad. Nauk SSSR*, **321**, 963 (in Russian).
- [27] Netchitailo V. S. (2026) World-Universe Model. *Journal of High Energy Physics, Gravitation and Cosmology*. https://www.scirp.org/journal/articles?searchcode=Vladimir+S.+Netchitailo&searchfield=authors_complete&page=1.