CV+List recent publication

PERSONAL INFORMATION

Name: Vilchynskyi (Vilchinskii) Stanislav
Nationality: Ukraine
Date of birth: 27 March 1964
ORCID: https://orcid.org/0000-0002-9294-9939
Scopus Author ID: 56962724900
INSPIRE: https://inspirehep.net/authors/3081621
Academic age: 33 years

EDUCATION

- ▷ 2003 Doctor Habilitat in theoretical physics. Taras Shevchenko national Kyiv university, Ukraine
- ▷ 1993 Ph.D. in theoretical physics. Institute for Theoretical Physics of Ukraine Academy of Sciences
- ▷ 1990 Master in physics. Kyiv State Taras Shevchenko University, Ukraine

CURRENT POSITION

- ▷ 07/2003- -since **Head of the Quantum Field Theory and Cosmomicrophysics department** Taras Shevchenko national university (TSNU), Kyiv, Ukraine.
- ▷ 01/02/2017 – since, **Team leader SHiP collaboration, CERN, Switzerland**

PREVIOUS POSITIONS

- ▷ 1993 — 1995 **Junior Research Scientist, Senior Research Scientist**
  Institute for Theoretical Physics of Ukraine Academy of Sciences, Kiev, Ukraine
- ▷ 1995 — 1998 **Assistant Professor of physics**
  Taras Shevchenko national university, Kiev, Ukraine
- ▷ 07/1998 — 06/2003 **Associate Professor of the Quantum Field Theory department** Taras Shevchenko national university (TSNU), Kyiv, Ukraine
- ▷ 01/02/2022 — 31/03/2025 **Professeur (mi-temps) of department de Physique Theorique**
  Universite de Geneve, Geneva, Switzerland

INSTITUTIONAL and others RESPONSIBILITIES

▷	1993 – 1998	Organiser of a Theory Colloquium at Institute for Theoretical Physics of Ukraine
▷	1995 – 2003	Vice-Dean of Physics Faculty, TSNU, Kiev, Ukraine
▷	2007 – present	Vice-President of the National Ukraine Physics Olimpiad
▷	2006 – present	Member of the executive board of Institute for Theoretical Physics of Ukraine
▷	2007 – 2023	Science Team Leader of the National team of Ukraine on the International Physics Olympiads (IPhO)
▷	2008 – 2022	Member of the Teaching Commission, TSNU, Kiev
▷	22.02.2022 –08.03. 2025	President of National Research Foundation of Ukraine (https://nrfu.org.ua/en/)
▷	01.09.2025 – since	Member of Scientific Committee of the National Council of Ukraine for the Development of Science and Technology (https://sci-com.org.ua)

SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

▷	1993 — 1998	**11 Master students** Institute for Theoretical Physics of Ukraine Academy of Sciences, Kiev, Ukraine
▷	1998 — 2003	**1 PhD, 13 Master students** TSNU, Kiev, Ukraine
▷	2003 — present	**2 postdocs, 7 PhD students, 27 Master students** TSNU, Kiev, Ukraine

TEACHING ACTIVITIES

▷	1993 — 1998	Advanced courses on quantum field theory and cosmology Institute for Theoretical Physics of Ukraine
▷	1998 — 2003	Lectures on Linear Algebra, Analitical and Diferential Geometry, High Temperature Field Theory, Quantum Field Theory, Advanced Quantum Mechanics TSNU, Kiev, Ukraine
▷	2003 — present	Lectures on Quantum Mechanics, Quantum Field Theory, Advanced Quantum Mechanics, General Relativity and Cosmology, Physics of massive neutrinos TSNU, Kiev
▷	2011 — present	Lectures on different advanced topics at International Schools

MAJOR COLLABORATIONS

- ▷ PI in Ukrainian scientific group that in collaboration with the scientists of Geneva Center of Scientific Data (IDS, Switzerland) during 2007-2010 established the first three Ukrainian scientific centers VIRGO (Virtual Roentgen and Gamma Observatory).
- ▷ PI in research project from Swiss SNF Testing fundamental physics on Cosmological scales (SCOPES grant N IZ770-152581 2010-2012).
- ▷ PI from Ukraine side in SCOPES research grant Magnetick Fields in Early Universe of the Swiss National Science Foundation, SCOPES grant N IZ732-13212 (2014-2016).
- ▷ PI in research project from Swiss SNF Complex Information Network Manipulation (SCOPES grant IZ74Z0-160497/1, 2016-2018).
- ▷ PI in Norwegian-Ukrainian long-term (2017-2020) scientific-educational project From Strong Interaction Matter to Dark Matter
- ▷ One of the Team Leaders of the *SHiP* collaboration (***S**earch for **Hi**dden **P**articles*), CERN
  `http://ship.web.cern.ch/ship`

INTERNATIONAL PRIZES AND AWARDS

1. Germany DAAD Fellowships, grant 322csE, (2001).
2. USA CRDF Grant TGP-1333, (2005).
3. Germany Academy of Science Deutsche Forschungsgemeinschaft Honour, (2006).
4. Germany Academy of Science Deutsche Forschungsgemeinschaft Honour, (2008).
5. Germany DAAD Fellowships, grant A 11/05264, (2011).
6. Swiss SNF Science International Research grant, N IZKOZ2-154984, (2014).
7. Germany DAAD Fellowships, grant 50015559, (2015).
8. Swiss SNF Science International Research grant, N IZSEZ0-186551, (2019).
9. Germany DAAD Bilateral Exchange of Academics, grant 57387479, (2020).
10. Swiss SNF Science International Research grant, N IZSEZ0 206908, (2022-2023).

Three MAJOR SCIENSE ACHIEVEMENTS

- **Achievement 1: Production of gauge fields during inflation, backreaction from them and generation of primordial scalar perturbations in case when gauge field interacts with the inflaton directly.**

  A novel method - the gradient expansion formalism for the description of gauge-field production during inflation was proposed and developed in [1,2,4]. It allows one to self-consistently take into account the backreaction of generated gauge fields on the inflationary background because it captures the nonlinear evolution of all physically relevant gauge-field modes at once. We employed the gradientexpansion formalism to study the strong backreaction regime in different models [1-4] and revealed an oscillatory behavior of the produced gauge fields and inflaton velocity which can be explained by the retardation between the inflaton evolution and the gauge-field response. We studied the gauge-field production in a generalization of the Starobinsky R^2-model with a nonminimal coupling of gauge fields to gravity [4]. In the Einstein frame, this model implies, in addition to an asymptotically flat inflaton potential, also a nontrivial form of kinetic and axial coupling functions which decrease in time and, thus, are potentially suitable for the generation of gauge fields with a scale-invariant or even red-tilted power spectrum.

  Having determined the background evolution, we considered the generation of primordial scalar perturbations in the case when the gauge field interacts with the inflaton directly (by means of generic kinetic and axial couplings) and via gravity [5]. For the first time, all possible scalar contributions coming from the inflaton, the metric, and the gauge field are taken into account. We derive a second-order differential equat;ion for the curvature perturbation, ζ, capturing the impact of the gauge field, both on the

background dynamics and on the evolution of scalar perturbations. The latter is described by a source term in the ζ equation, which is quadratic in the gauge-field operators and leads to non- Gaussianities in the curvature perturbations. We derive general expressions for the induced scalar power spectrum and bispectrum.

[1]. journal-article: E. Gorbar, K. Schmitz, O. Sobol and S. Vilchinskii"Gauge-field production during axion inflation in the gradient expansion formalism" Physical Review D, 2021, v. 104, id.123504. . DOI: https://doi.org/10.1103/PhysRevD.104.123504.

[2] journal-article: O. O. Sobol, E. V. Gorbar, and S. I. Vilchinskii "Backreaction of electromagnetic field and Schwinger effect in pseudoscalar inflation magnetogenesis" Physical Review D, 2019, v. 100, id.063523. DOI: https://doi.org/10.1103/PhysRevD.100.063523.

[3] journal-article: O. Sobol, E. V. Gorbar, M. Kamarpour and S. I. Vilchinskii "Influence of backreaction of electric fields and Schwinger effect on inflationary magnetogenesis" Physical Review D, 2018, v. 98, id. 063534. DOI: https://doi.org/10.1103/PhysRevD.98.063534

[4] journal-article: R. Durrer, O. Sobol and S. Vilchinskii "Backreaction from gauge fields produced during inflation" Physical Review D, 2023, v. 108, id.043540. DOI: https://doi.org/10.1103/PhysRevD.108.043540

[5] journal-article: R. Durrer, R. von Eckardstein , Deepen Garg , K. Schmitz, O. Sobol and S. Vilchinskii Scalar perturbations from inflation in the presence of gauge fields Physical Review D, 2024, v. 110, id.043533. . DOI: https://doi.org/10.1103/PhysRevD.110.043533.

- **Achievement 2: Particle production, anomaly-driven inverse cascade and inhomogeneities in a magnetized chiral plasma in the early Universe.**

  The theory of post-inflationary preheating with weak coupling and particle production were developed and investigated [1]. The role of inhomogeneities on the evolution of cosmic magnetic fields in a chiral plasma were studied [2, 3]. We find that 1) inhomogeneities of the chiral asymmetry by themselves do not prevent the anomaly- driven inverse cascade and, as in the homogeneous case, the magnetic helicity is transferred from shorter to longer wavelength helical modes of the magnetic field; 2) the evolution appears to be sensitive to the effects of diffusion and in the case when diffusion is negligible, the inverse cascade slows down considerably compared to the homogeneous scenario; 3) in the case of the primordial plasma the diffusion is substantial and efficiently suppresses chiral asymmetry inhomogeneities and as a result, the inverse cascade proceeds practically in the same way as in the chirally homogeneous model.

  [1] journal-article: I. Rudenok, Yu.Shtanov, S. Vilchinskii. "Post-inflationary preheating with weak coupling." Physics Letters, 2014 Section B: Nuclear, Elementary Particle and High-Energy Physics, 733, 193197. . DOI: https://doi.org/10.1016/j.physletb.2014.04.046.

  [2] journal-article: E.Gorbar, I. Shovkovy, S. Vilchinskii, I. Rudenok, A. Boyarsky, and O. Ruchayskiy Anomalous Maxwell equations for inhomogeneous chiral plasma. Physical Review D, 2016, v. 93, id.105028. https://doi.org/10.1103/PhysRevD.93.105028.

  [3] journal-article: E. Gorbar, I. Rudenok, I.Shovkoviy, S.Vilchinskii Anomaly driven inverse cascade and inhomogeneities in a chiral plasma in early Universe. Physical Review D, 2016, v.94, id. 103528. . DOI: https://doi.org/10.1103/PhysRevD.94.103528

- **Achievement 3: Superfluid Bose Liquid with Suppressed BEC and an Intensive Pair Coherent Condesate as a Model of superfluid bose-liquid ^4He**

  One introduces a model of the superfluid state of a Bose liquid with repulsion between bosons, in which at $T = 0$, along with a weak single-particle Bose-Einstein condensate, there exists an intensive pair coherent condensate, analogous to the Cooper condensate in a Fermi liquid with attraction between fermions [1]. A closed system of nonlinear integral equations for the normal and anomalous self-energy parts is derived and solved numerically, and a quasiparticle spectrum is obtained, which is in good agreement with the experimental spectrum of elementary excitations in superfluid helium-4. It is shown that the roton minimum in the spectrum is associated with the negative minimum of the Fourier component of the pair interaction potential [2].

  [1] journal-article: E. Pashitskii, S. Mashkevich, S. Vilchynskyy "Superfluid bose liquid with a suppressed BEC and an intensive pair coherent condensate as a model of ^4He." Physical Review Letters, 2002, 89(7). DOI: https://doi.org/10.1103/PhysRevLett.89.075301 .

[2] journal-article: E. Pashitskii, S. Vilchynskyy ."On the structure of the superfluid state and quasiparticle spectrum in a Bose liquid with a suppressed Bose-Einstein condensate." Journal of Low Temperature Physics, 2004, 134(34), 851 DOI: https://doi.org/10.1023/B:JOLT.0000013206.08699.a2

List publication for last 10 years

1. A. Naydenko, O. Sobol and S. Vilchinskii
   "Gauge-field energy density in inflationary kinetic-coupling models: QFT regularization versus horizon cutoffs" submitted to **Physical Review D**, 2026 v. ... , id. ... DOI: doi.org/....
   https://arxiv.org/2610.32599v1

2. A. Lysenko, O. Sobol and S. Vilchinskii
   "Vector dark matter production during inflation in the gradient-expansion formalism"
   Physical Review D, 2026 v. 113, id.063525 DOI: doi.org/10.1103/lpph-hrdr
   https://arxiv.org/abs/2509.24963

3. A. Aksoy *et al.* [SHiP Collaboration, CERN]
   "Measurement of di-muons from 400 GeV/c protons interacting in a thick molybdenum/tungsten target"
   Eur. Phys. J. C , 2026, 86:1231 https://doi.org/10.1140/epjc/s10052-026-16148-3

4. A. Chaika, S. Vilchynskii, O.Yakimenko
   "Sound-driven dynamics of pinned vortices in atomic BoseEinstein condensates"
   Low Temperature Physics, 2026, vol. 52, N.12, pp. 16041612.

5. D.Zharov, O. Sobol and S. Vilchinskii
   "ACT observations, reheating, and Starobinsky and Higgs inflation"
   Physical Review D, 2025 v. 112, id.023544. DOI: 10.1103/km3q-rm34
   https://arxiv.org/abs/2505.01129

6. R. Durrer, R. von Eckardstein , Deepen Garg , K. Schmitz, O. Sobol and S. Vilchinskii
   " Scalar perturbations from inflation in the presence of gauge fields"
   Physical Review D, 2024, v. 110, id.043533. DOI: https://doi.org/10.1103/PhysRevD.110.043533

7. C. Ahdida *et al.* [SHiP Collaboration, CERN]
   "Reconstruction of 400 GeV/c proton interactions with the SHiP-charm project"
   Eur. Phys. J. C , 2024, 84:562 https://doi.org/10.1140/epjc/s10052-024-12655-3

8. R. Durrer, O. Sobol and S. Vilchinskii
   " Backreaction from gauge fields produced during inflation"
   Physical Review D, 2023, v. 108, id.043540. DOI: https://doi.org/10.1103/PhysRevD.108.043540

9. R. Durrer, O. Sobol and S. Vilchinskii
   " Magnetogenesis in Higgs-Starobinsky inflation"
   Physical Review D, 2022, v. 106, id.123520. DOI: 10.1103/PhysRevD.106.123520

10. E. Gorbar, K. Schmitz, O. O. Sobol and S. Vilchinskii
    "Hypermagnetogenesis from axion inflation: Model-independent estimates"
    Physical Review D, 2022, v. 105, id.043530. DOI: 10.1103/PhysRevD.105.043530

11. C. Ahdida *et al.* [SHiP Collaboration, CERN]
    "The SHiP experiment at the proposed CERN SPS Beam Dump Facility"
    Eur. Phys. J. C , 2022, 82:486 https://doi.org/10.1140/epjc/s10052-022-10346-5

12. C. Ahdida *et al.* [SHiP Collaboration, CERN]
    "Track reconstruction and matching between emulsion and silicon pixel detectors for the SHiP-charm experiment" **Journal of Instrumentation (JINST)**, 2022, P03013 DOI: https://doi.org/10.1088/1748-0221/17/03/P03013

13. E. Gorbar, Y. Nikolaieva, S. Vilchynskii, O.Yakimenko
    "s- and p-superfluidity of Fermi atoms in BoseFermi mixtures"
    Low Temperature Physics, 2022, 48, N 9, pp. 750756.

14. E. Gorbar, K. Schmitz, O. Sobol and S. Vilchinskii
"Gauge-field production during axion inflation in the gradient expansion formalism"
Physical Review D, 2021, v. 104, id.123504. DOI:https://doi.org/10.1103/PhysRevD.104.123504

15. O. Sobol, E. Gorbar and S. I. Vilchinskii
"Generation of electromagnetic field nonminimally coupled to gravity during Higgs inflation"
Physical Review D, 2021, v. 104, id. 043509, DOI:https://doi.org/10.1103/PhysRevD.104.043509

16. C. Ahdida *et al.* [SHiP Collaboration, CERN]
"Sensitivity of the SHiP experiment to light dark matter"
Journal of High Energy Physics, 2021, .Article number: 199 (2021); DOI: 10.1007/jhep04(2021)199

17. C. Ahdida *et al.* [SHiP Collaboration, CERN]
"Sensitivity of the SHiP experiment to dark photons decaying to a pair of charged particles"
Eur. Phys. J. C, 2021, 81(5), 451; DOI: 10.1140/epjc/s10052-021-09224-3-y

18. A.Olashyn, Y.Kuriatnikov, S. Vilchynskii, O.Yakimenko
"Stable vortex in BEC dark matter", **Low Temperature Physics**, 2021, 47(8), pp. 684692

19. O. O. Sobol, A.V.Lysenko and S. I. Vilchinskii
"Gradient expansion formalism for magnetogenesis in the kinetic coupling model"
Physical Review D, 2020, v. 102, id.123512; DOI:https://doi.org/10.1103/PhysRevD.102.123512

20. O. O. Sobol, E. V. Gorbar, A. I. Momot, and S. I. Vilchinskii
"Schwinger production of scalar particles during and after inflation from the first principles"
Physical Review D, 2020, v. 102, id.023506; DOI:https://doi.org/10.1103/PhysRevD.102.023506

21. C. Ahdida *et al.* [SHiP Collaboration, CERN]
"Measurement of muon flux from 400 GeV/c protons interacting in thick molybdenum target" **European Physical Journal C**, 2020, (284) https://doi.org/10.1140/epjc/s10052-020-7788

22. O. O. Sobol, E. V. Gorbar, and S. I. Vilchinskii
"Backreaction of electromagnetic field and Schwinger effect in pseudoscalar inflation magnetogenesis"
Physical Review D, 2020, v. 100, id.063523. DOI:https://doi.org/10.1103/PhysRevD.100.063523

23. C. Ahdida *et al.* [SHiP Collaboration, CERN]
"The magnet of the scattering and neutrino detector for the SHiP experiment at CERN"
Journal of Instrumentation, 2020, 15(1), P01027

24. E. V. Gorbar, O. O. Sobol, and S. I. Vilchinskii
"Kinetic approach to the Schwinger effect during inflation"
Physical Review D, 2019, v. 100, id.123502. DOI:https://doi.org/10.1103/PhysRevD.100.123502

25. C. Ahdida *et al.* [SHiP Collaboration, CERN]
"Sensitivity of the SHiP experiment to Heavy Neutral Leptons"
Journal of High Energy Physics, 2019, v.4, p.77, https://doi.org/10.1007/JHEP04(2019)077.

26. C. Ahdida *et al.* [SHiP Collaboration, CERN]
"The experimental facility for the Search for Hidden Particles at the CERN SPS"
Journal of Instrumentation, 2019, v.14, no.09, P03025.

27. O. Chelpanova, Y. Kuriatnikov, S.Vilchinskii, O. Yakimenko
"Spatiotemporal vortex rings in atomic BE", **Low Temperature Physics**, 2019, 45(8).

28. O. O. Sobol, E. V. Gorbar and S. I. Vilchinskii
"Influence of backreaction of electric fields and Schwinger effect on inflationary magnetogenesis"
Physical Review D, 2018, v. 98, id. 063534. https://doi.org/10.1103/PhysRevD.98.063534

29. O. Matsyshyn, A. Yakimenko, V. Cheianov, E.Gorbar, S. Vilchinskii
" p-wave superfluidity in mixtures of ultracold Fermi and spinor Bose gases"
Physical Review A, 2018 , v.98, id.043620; DOI: 10.1103/PHYSREVA.98.043620

30. V.Biloshytskyi, O.Chelpanova, S.Vilchynskii, O.Yakimenko
"Analogues of Josephson junctions and Black Hole event horizons in atomic BEC"
Journal of Low Temperature Physics, 2018, v.44, p.1316-1325.

31. O.Sobol, E.Gorbar, S.Vilchinskii
"Magnetogenezis during inflation and preheating in the Starobinsky model"
Physical Review D, 2017, v. 95, id.083509. DOI: https://doi.org/10.1103/PhysRevD.95.083509

32. A. Akmete *et al.* [SHiP Collaboration, CERN]
"The active muon shield in the SHiP experiment"
Journal of Instrumentation, 2017, v.12, no.05, P05011.

33. I. Rudenok, E. Gorbar, A. Boiarskii, S.Vilchinskii
"Anomaly driven inverse cascade and inhomogeneities in a chiral plasma in early Universe"
Physical Review D, 2016, v.94, id. 103528. DOI: https://doi.org/10.1103/PhysRevD.94.103528

34. I.Rudenok, E.Gorbar, A.Boiarsky, S. Vilchinskii
"Anomalous Maxwell equations for inhomogeneous chiral plasma"
Physical Review D, 2016, v. 93, id.105028. DOI:https://doi.org/10.1103/PhysRevD.93.105028

35. K.Snizhko, K.Isaeva, S.Vilchinskii, O.Yakimenko
"Stochastic phase slips in toroidal Bose-Einshtein condensates."
Physical Review A, 2016, v. 94, id.063642.