

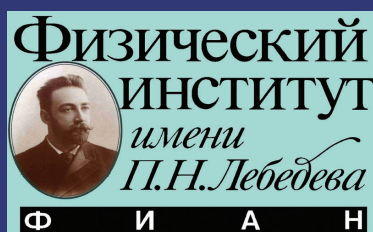
# Physics–Uspekhi



**May 2025**  
**Volume 68, Number 5**

**Translation of the Russian journal**  
**Успехи физических наук, Uspekhi Fizicheskikh Nauk**  
**May 2025, Volume 195, No. 5**

БАЗИС



# PHYSICS- USPEKHI

ISSN 1063-7869 (Print)  
ISSN 1468-4780 (Online)

CODEN: PHUSEY

## Uspekhi Fizicheskikh Nauk

**Uspekhi Fizicheskikh Nauk (UFN)** (*Успехи физических наук* (*УФН*), [www.ulfu.ru](http://www.ufn.ru)) publishes reviews of the current state of the most topical problems in physics and in associated fields under the general headings: reviews of topical problems, physics of our days, instruments and methods of investigation, methodological notes, from the history of physics, conferences and symposia, personalia, physics news on the Internet, and bibliography. The journal was founded in 1918 and is published monthly.

**Editor-in-Chief** Oleg V Rudenko

**Managing Editor** Maria S Aksent'eva

**Advisory Board** Evgenii B Aleksandrov  
Fazly I Ataullakhanov  
Yurii V Gulyaev  
Sergei P Denisov  
Lev M Zelenyi  
Olga A Kocharovskaya  
Gennadii N Kulipanov  
Aleksandr G Litvak  
Gennadii A Mesyats  
Rashid A Sunyaev  
Aleksandr R Khokhlov  
Anatolii M Cherepashchuk

**Editorial Board** Petr I Arseev  
Vasily S Beskin  
Aleksandr E Bondar'  
Vadim V Brazhkin  
Mikhail A Vasil'ev  
Mikhail I Vysotskii  
Igor M Dremin  
Aleksandr M Zheltikov  
Genrikh R Ivanitskii  
Dmitrii I Kazakov  
Vitalii V Kveder  
Nikolai N Kolachevskii  
Zakhar'ii F Krasil'nik  
Evgenii A Kuznetsov  
Sergei A Nikitov  
Vladimir F Obratsov  
Pavel N Pakhlov  
Konstantin A Postnov  
Vladimir I Ritus  
Grigori I Rubtsov  
Mikhail V Sadvovskii  
Aleksandr M Sergeev  
Boris M Smirnov  
Dmitrii R Khokhlov  
Maria V Chekhova  
Evgenii M Churazov

## Physics – Uspekhi

**Physics–Uspekhi (Advances in Physical Sciences)** is the English edition of the Russian monthly journal *Uspekhi Fizicheskikh Nauk*. Translation into English started with Russian volume 66. From 1958 until 1992 the journal was published by American Institute of Physics under the title *Soviet Physics–Uspekhi* and in 1993 under its current title *Physics–Uspekhi*. Since 1994 *Physics–Uspekhi* has been published jointly by Uspekhi Fizicheskikh Nauk and Turpion Ltd. From the beginning of 1996 *Physics–Uspekhi* is being translated, typeset and edited in Moscow by Uspekhi Fizicheskikh Nauk (UFN), from 2009 published by Uspekhi Fizicheskikh Nauk, Moscow.

**Scientific Editors**  
MS Aksent'eva, VL Derbov, A M Semikhatov

**English Language Editor**  
K Franchuk

**Scientific and Staff Editors**  
MS Aksent'eva, EA Frimer, TB Larionova,  
EV Zakharova

**Desk Editors**  
AV Bobkov, N V Gribkova, MA Morgunova

**Online services**  
The electronic version of the journal is available at <http://ufn.ru/en/> and <http://iopscience.org/phu>. All questions regarding online access should be sent to customer services at [ufn@ufn.ru](mailto:ufn@ufn.ru) and [customerservices@iopublishing.org](mailto:customerservices@iopublishing.org)

**All rights reserved**  
No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form, or by any means, electronic, mechanical, photographic, recording, or otherwise, without the prior permission of *Uspekhi Fizicheskikh Nauk*.

**Editorial Office:**  
P N Lebedev Physical Institute, RAS,  
Leninskii prospekt 53, 119991 Moscow, Russian Federation  
Tel. (7-499) 132 62 65, (7-499) 190 34 52  
Tel./Fax (7-499) 190 42 44.  
E-mail: [ufn@ufn.ru](mailto:ufn@ufn.ru)

## Contents

### INTERNATIONAL YEAR OF QUANTUM SCIENCE AND TECHNOLOGY

455	<b>Optical quantum memory in atomic ensembles: physical principles, experiments, and potential of application in a quantum repeater</b> S.A. Moiseev, M.M. Minnegaliev, K.I. Gerasimov, E.S. Moiseev, A.D. Deev, Yu.Yu. Balega	431
478	<b>Laser separation of boron isotopes: research results and options for technological implementation</b> G.N. Makarov	452
519	<b>Spectra of collective excitations of particles in normal and superfluid liquids</b> V.V. Brazhkin	490
543	<b>Magnetically controlled spin light-emitting diode</b> M.V. Dorokhin, M.V. Ved', P.B. Demina, Yu.M. Kuznetsov, A.V. Kudrin, A.V. Zdoroveyshchev, D.A. Zdoroveyshchev, N.V. Baidus, I.L. Kalentyeva	512
557	<b>Superradiant quantum phase transition in a semiconductor at room temperature: myth or reality?</b> P.P. Vasil'ev	525
565	<b>Personalia Aleksandr Evgen'evich Bondar' (on his 70th birthday)</b>	532
567	<b>Physics news on the Internet: May 2025</b> Yu N Eroshenko	534

◇ ◇ ◇

### In the next issue

*Ising superconductivity*  
S.G. Ovchinnikov

*The Physical Sciences Division of the Russian Academy of Sciences in solving the problems of scientific and technological development of the Russian Federation (Scientific Session of the General Meeting of the Physical Sciences Division of the Russian Academy of Sciences (P.N. Lebedev Physical Institute of the Russian Academy of Sciences, December 9, 2024)):*  
contribution by I.V. Zalivako et al.; F.V. Khan et al.

*Graphene-based supercapacitors*  
A.V. Eletskii, K.L. Dao

*Scaling of anomalous Hall effect as a method to determine percolation threshold and metal–insulator transition in magnetic nanocomposites with intergranular interaction*  
S.N. Nikolaev et al.

*Asymptotic theory of classical tracer transport in inhomogeneous and nonstationary media. Hamilton's formalism*  
P.S. Kondratenko, L.V. Matveev

*Aleksandr Sergeevich Sigov (on his 80th birthday)*

*On the microscopic approach to describing spin torques in two-dimensional Rashba ferromagnets*  
I.S. Burmistrov

*New books on physics and related sciences: June 2025 (E.V. Zakharova)*

*Physics news on the Internet: June 2025 (Yu.N. Eroshenko)*