

# Physics–Uspekhi



*Russian Academy of Sciences*

**January 2024**  
**Volume 67, Number 1**

**Translation of the Russian journal**  
**Успехи физических наук, Uspekhi Fizicheskikh Nauk**  
**January 2024, Volume 194, No. 1**



# PHYSICS- USPEKHI

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

CODEN: PHUSEY

## Uspekhi Fizicheskikh Nauk

**Uspekhi Fizicheskikh Nauk (UFN)** (*Успехи физических наук* (*УФН*), [www.ufn.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  
Aleksei 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 Dremine  
Aleksei M Zheltikov  
Genrikh R Ivanitskii  
Dmitrii I Kazakov  
Vitalii V Kveder  
Nikolai N Kolachevskii  
Zakharii F Krasil'nik  
Evgenii A Kuznetsov  
Sergei A Nikitov  
Vladimir F Obraztsov  
Pavel N Pakhlov  
Konstantin A Postnov  
Vladimir I Ritus  
Grigorii I Rubtsov  
Mikhail V Sadovskii  
Aleksandr M Sergeev  
Boris M Smirnov  
Robert A Suris  
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, AM Semikhatov

**English Language Editor**  
K Franchuk

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

**Desk Editors**  
AV Bobkov, NV Gribkova, MA Morgunova

**Publisher:**  
ANO Redaktsiya zhurnala *Uspekhi Fizicheskikh Nauk* (UFN)  
Leninskii prospekt 15, Moscow, Russia, 117071

**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  
[ufn@ufn.ru](mailto:ufn@ufn.ru)

**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

**Production Department:**  
Shchukinskaya 12, kor. 1, 123182 Moscow, Russian Federation  
Tel. (+7-499) 190 34 52. Tel./Fax (7-499) 190 42 44.  
E-mail: [ufn@ufn.ru](mailto:ufn@ufn.ru)

## Contents

|     |                                                                                                                                                                                                                                                                                               |            |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
|     | <b>300th ANNIVERSARY OF THE RUSSIAN ACADEMY OF SCIENCES</b>                                                                                                                                                                                                                                   | <b>1</b>   |
| 1   | <b>Optical-to-terahertz switches: state of the art and new opportunities for multispectral imaging</b><br>D S Ponomarev, A E Yachmenev, D V Lavrukhin,<br>R A Khabibullin, N V Chernomyrdin, I E Spektor,<br>V N Kurlov, V V Kveder, K I Zaytsev                                              | <b>3</b>   |
| 23  | <b>Spin-fluctuation transitions</b><br>S V Demishev                                                                                                                                                                                                                                           | <b>22</b>  |
| 48  | <b>New approaches to molecular laser separation of uranium isotopes</b><br>G N Makarov                                                                                                                                                                                                        | <b>44</b>  |
| 60  | <b>Experiments at the Super Charm-Tau factory</b><br>M N Achasov, V E Blinov, A V Bobrov, D A Bodrov,<br>A E Bondar', V S Vorobiev, D S Gorbunov, V P Druzhinin,<br>D A Epifanov, A S Kuzmin, I B Logashenko, D V Matvienko,<br>A V Nefediev, P N Pakhlov, G V Pakhlova, V E Popov, T V Uglov | <b>55</b>  |
| 77  | <b>On effective range expansion in a multichannel system and compositeness of near-threshold resonance</b><br>A V Nefediev                                                                                                                                                                    | <b>71</b>  |
| 86  | <b>A N Kolmogorov's 1934 paper is the basis for explaining the statistics of natural phenomena of the macrocosm</b><br>G S Golitsyn                                                                                                                                                           | <b>80</b>  |
| 97  | <b>Photonics and optics</b> (Scientific session of the Reporting Meeting of the Physical Sciences Division of the Russian Academy of Sciences, May 22, 2023): contribution by V V Dudelev et al.; S Yu Mironov, E A Khazanov                                                                  | <b>91</b>  |
| 103 | <b>Physics news on the Internet: January 2024</b><br>Yu N Eroshenko                                                                                                                                                                                                                           | <b>104</b> |

◇ ◇ ◇

## In the next issue

### TO THE 40TH ANNIVERSARY OF THE PROKHOROV GENERAL PHYSICS INSTITUTE, RUSSIAN ACADEMY OF SCIENCES

*40 years of the Prokhorov General Physics Institute,  
Russian Academy of Sciences*  
S V Garnov

*Electrophysics of carbon 1D structures obtained in a laser experiment:  
models and demonstration*

S V Garnov, D V Abramov, D N Bukharov, T A Khudaiberganov,  
K S Khor'kov, A V Osipov, S V Zhirnova, A O Kucherik, S M Arakelyan

*Hollow-core optical fibers: current state and development prospects*

A D Pryamikov, A V Gladyshev, A F Kosolapov, I A Bufetov

*Generation of terahertz radiation in the plasma of optical gas breakdown*

A A Ushakov, P A Chizhov, V V Bukin, S V Garnov

*Acoustic properties of the sea bottom and their effect on long-range sound  
propagation on the Arctic shelf*

A A Lunkov, V A Grigorev, V G Petnikov

*Modern physical methods and technologies in agriculture*

S V Gudkov, R M Sarimov, M E Astashev, R Yu Pishchalnikov,  
D V Yanykin, A V Simakin, A V Shkirin, D A Serov, E M Konchekov,  
N G Gusein-Zade, V N Lednev, M Ya Grishin, P A Sdvizhenskii,  
S M Pershin, A F Bunkin, M Kh Ashurov, A G Aksenov,  
N O Chilingaryan, I G Smirnov, D Yu Pavkin, D O Hort,  
M N Moskovskiy, A V Sibirev, Ya P Lobachevsky,  
A S Dorokhov, A Yu Izmailov

*Personalia*

*Physics news on the Internet: February 2024*