

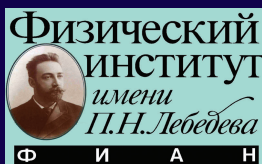
# Physics–Uspekhi

Advances in Physical Sciences



**February 2016**  
**Volume 59, Number 2**

Translation of the Russian journal  
**Успехи физических наук, Uspekhi Fizicheskikh Nauk**  
February 2016, Volume 186, No. 2



**Turpion**

**IOP Publishing**



# PHYSICS- USPEKHI

ISSN 1063-7869 (Print)

ISSN 1468-4780 (Online)

CODEN: PHUSEY

## Uspekhi Fizicheskikh Nauk

**Editor** Leonid V Keldysh  
**First Deputy Editor** Valery A Rubakov  
**Associate Editors** Lev P Pitaevskii, 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  
Aleksandr A Kaplyanskii  
Olga A Kocharovskaya  
Gennadii N Kulipanov  
Aleksandr G Litvak  
Gennadii A Mesyats  
Rashid A Sunyaev  
Vladimir E Fortov  
Aleksei R Khokhlov  
Anatolii M Cherepashchuk

## Editorial Board

Petr I Arseev  
Vasily S Beskin  
Aleksandr E Bondar'  
Vadim V Brazhkin  
Sergei V Bulanov  
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  
Zakhar'ii 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

## Scientific and Staff Editors

MS Aksent'eva, EA Frimer, TB Larionova,  
TP Romanova, EV Zakharova

**Uspekhi Fizicheskikh Nauk** (Успехи Физических Наук, [www.ulf.n.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.

## Physics – Uspekhi

### Scientific Editors

MS Aksent'eva, A Radzig, A M Semikhatov

### English Language Editor

K Franchuk

### Desk Editors

AV Bobkov, N V Gribkova, OV Morgunova

**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, printed by Page Bros, Norwich, UK.

**Institutional subscription information** (volume 59, 2016, monthly) For all countries, except the United States, Canada, Central and South America, the subscription rates are: Print + Online (1958 – 2016) £ 1840; Online only (1958 – 2016) £ 1656; Single issue £ 185. Delivery is by air-speeded mail from the UK.

**Orders, back issues, change of address to: Physics–Uspekhi**, Journals Subscription Fulfilment, IOP Publishing, Temple Circus, Temple Way, Bristol BS1 6HG, United Kingdom

For the United States, Canada, Central and South America, the subscription rates are: Print + Online (1958 – 2016) US \$3311; Online only (1958 – 2016) US \$ 2980; Single issue US \$ 331. Delivery is by transatlantic airfreight and onward mailing. **United States Postal Identification Statement** *Physics – Uspekhi*, volume 59, published monthly. Periodicals Postage Paid at Continental Station, PA and additional mailing offices. POSTMASTER: Send orders, address changes to *Physics – Uspekhi*, IOP Publishing, PO Box 320, Congers, NY 10920-0320, USA.

**Online services:** Since 2008 electronic access to the journal content is hosted by IOP Publishing. All subscriptions to the journal include electronic access dating from the first English translation volume. The electronic version of the journal is available at <http://iopscience.org/phu>. All questions regarding online access should be sent to customer services at [custserv@iop.org](mailto:custserv@iop.org) or [custserv@turpion.ru](mailto:custserv@turpion.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  
Tel. (7-499) 132 62 65, (7-499) 132 63 48, (7-499) 190 34 52  
Tel./Fax (7-499) 190 42 44. E-mail: [ufn@ufn.ru](mailto:ufn@ufn.ru)

## Contents

	<b>150th anniversary of the birth of P N Lebedev</b>	<b>107</b>
113	<b>System of convective thermals as a generalized ensemble of Brownian particles</b> A N Vulfson, O O Borodin	<b>109</b>
125	<b>Energetics and stochastic dynamics of intraneuron transport</b> Yu M Romanovsky, V P Trifonenkov	<b>121</b>
146	<b>Energy–momentum tensor of the electromagnetic field in dispersive media</b> I N Toptygin, K Levina	<b>141</b>
159	<b>“As I deeply understand the importance and greatly admire the poetry of experiment...” (on the eve of P N Lebedev’s anniversary)</b> R N Shcherbakov	<b>153</b>
169	<b>P N Lebedev’s “Factory of Young Physicists” and Saratov University</b> V M Anikin	<b>162</b>
175	<b>Ultracold atoms and their applications</b> (Scientific session of the Physical Sciences Division of the Russian Academy of Sciences, 28 October 2015):	<b>167</b>
176	<b>Ultracold lanthanides: from the optical clock to a quantum simulator</b> G A Vishnyakova, A A Golovizin, E S Kalganova, V N Sorokin, D D Sukachev, D O Tregubov, K Yu Khabarova, N N Kolachevsky	<b>168</b>
183	<b>Fermi liquid-to-Bose condensate crossover in a two-dimensional ultracold gas experiment</b> T V Barmashova, K A Martiyanov, V B Makhlov, A V Turlapov	<b>174</b>
193	<b>Ultraprecise optical frequency standards based on ultracold atoms: state of the art and prospects</b> A V Taichenachev, V I Yudin, S N Bagayev	<b>184</b>
206	<b>Spectroscopy of cold rubidium Rydberg atoms for applications in quantum information</b> I I Ryabtsev, I I Beterov, D B Tretyakov, V M Entin, E A Yakshina	<b>196</b>
221	<b>Aleksandr Nikolaevich Skrinsky (on his 80th birthday)</b>	<b>209</b>
223	<b>Gennadii Andreevich Mesyats (on his 80th birthday)</b>	<b>211</b>
174	<b>Physics news on the Internet</b> Yu N Eroshenko	<b>214</b>

◇ ◇ ◇

## In the next issue

### 60th anniversary of the Joint Institute for Nuclear Research (JINR)

*JINR: the initiator of future discoveries*

V A Matveev

*Neutrino physics and JINR*

V A Bednyakov, D V Naumov, O Yu Smirnov

*Neutron physics at the JINR — 60 years*

*of the I M Frank Neutron Physics Laboratory*

E V Lychagin, D P Kozlenko, P V Sedyshev, V N Shvetsov

*Experimental and theoretical JINR studies on the development of stochastic cooling of charged particle beams*

A O Sidorin, G V Trubnikov, N A Shurkhno

*Neutron diffraction on pulsed sources*

V L Aksenov, A M Balagurov

*Traps for storing charged particles and antiparticles in high precision experiments*

M K Eseev, I N Meshkov

*Physics news on the Internet*

