

Proceedings of the International Conference



DAY^S on DIFFRACTION 2011

May 30 – June 3, 2011

St. Petersburg, Russia

Proceedings of the International Conference “Days on Diffraction” 2011
May 30 – June 3, 2011, St. Petersburg, Russia

Edited by **O.V. Motygin** (Institute of Problems in Mechanical Engineering)
A.S. Kirpichnikova (University of Glasgow)
A.P. Kiselev (St. Petersburg Department of V.A. Steklov Mathematical Institute)
M.V. Perel (St. Petersburg State University)

Organizing Committee of the Conference

V.M. Babich /Chair/, A.S. Kirpichnikova /Secretary/, T.V. Vinogradova /Visas/,
N.V. Zalesskaya /Accommodation/, I.V. Andronov, P.A. Belov, N.Ya. Kirpichnikova,
A.P. Kiselev, Yu.S. Kivshar, M.A. Lyalinov, O.V. Motygin, M.V. Perel, A.M. Samsonov,
V.P. Smyshlyayev, R. Stone, V.N. Troyan, N. Zhu

Conference e-mail: diffraction11@gmail.com
Web site: <http://www.imi.ras.ru/~dd/index.php>

The conference is sponsored by



Russian Foundation
for Basic Research



IEEE Russia (Northwest)
Section AP/ED/MTT
Joint Chapter



Russian Academy of
Sciences



Optical Society of
America

Preface

“Days on Diffraction” is an annual conference taking place in St. Petersburg since 1968. The event is organized in May–June by St. Petersburg University, St. Petersburg Department of Steklov Mathematical Institute and Euler International Mathematical Institute of the Russian Academy of Sciences.

About 190 scientists come from different parts of the world to participate in “Days on Diffraction” 2011; the Organizing Committee thanks all of them. Of special gratitude are the authors of extended abstracts submitted to the Proceedings; 40 of them (selected by peer-review) are published in the present issue.

Electronic version: Printed version:
IEEE Catalog No.: CFP11489-ART CFP11489-PRT
ISBN: 978-1-4577-1579-2 978-1-4577-1578-5

© IEEE, 2011

CONTENTS

Eron L. Aero, Anatolii N. Bulygin, Yurii V. Pavlov	Functionally invariant solutions of triple sine-Gordon equation	5
Mikhail V. Altaisky, Natalia E. Kaputkina	Scale-dependent corrections to Casimir effect	11
Leonardo A. Ambrosio, Hugo E. Hernández-Figueroa	Emphasizing the metamaterial behavior of the Mie scattering coefficients and Debye series for negative refractive index spherical particles	15
Lutz Angermann, Vasyl V. Yatsyk	Modeling and analysis of wave scattering and generation on cubically polarisable layered structures	21
Lutz Angermann, Vasyl V. Yatsyk	Scattering and generation properties of cubically polarisable layers with negative and positive cubic susceptibility of the medium	27
V.M. Babich, N.V. Mokeeva, B.A. Samokish	Diffraction of a plane wave by a transparent wedge. Calculation of the diffraction coefficients of wave scattered by vertex of the wedge	33
Amira Bensouissi, Noureddine M'Hadbi, Michel Rouleux	Andreev reflection and the semiclassical Bogoliubov–De Gennes Hamiltonian: resonant states ...	39
V. V. Borzov, E. V. Damaskinsky	Differential equations for polynomials defined by recurrence relations with periodic coefficients ...	45
Mikhail Cherkay, Sergey Vakulenko	Control of energy and synchronization of coupled oscillator system	51
Vitalii N. Chukov	On violation of Rayleigh and Bragg laws of scattering	55
George V. Filippenko	The energy analysis of shell–fluid interaction	63
A. Frolov, E. Kartchevskiy	Generalized modes of optical fiber	67
Evgeny A. Gorodnitskiy, Maria V. Perel	The Poincaré wavelet transform: implementation and interpretation	72
Elena F. Grekova	Small perturbations of the spherical prestressed state in a nonlinear isotropic elastic reduced Cosserat medium: waves and instabilities	78
Vladimir A. Gusev, Ruslan A. Zhostkov	Analytical solutions for diffraction problem of nonlinear acoustic wave beam in the stratified atmosphere	83
Timur Z. Ismagilov, Andrey I. Kuzmin	Modelling photonic crystal waveguides using finite volume method	87
Anton V. Kozlov, Vladimir G. Mozhaev	Exact solutions for wave resonances in rectangular pyramidal cavity	92
I.P. Krasnov	About problem of interaction of field and substance in classical electrodynamics	98
Victor F. Kravchenko, Dmitry V. Churikov	Atomic functions in nonparametric estimations of probability density functions and their derivatives	103
Victor F. Kravchenko, Dmitry V. Churikov	Two-dimensional analytical Kravchenko–Rvachev wavelets in digital signal and image processing	106

Alexander V. Kudrin, Anna S. Zaitseva, Tatyana M. Zaboronkova, Catherine Krafft	
Electrodynamic characteristics of a strip loop antenna located on the surface of a gyrotrropic plasma column	111
A.G. Kyurkchan, N.I. Smirnova	
About one new method of solving diffraction problems	117
Denis Lafarge, Navid Nemati	
Theory of wave propagation and dispersion in fluid-saturated porous media allowing for spatial dispersion	122
Vladimir S. Makin, Ruslan S. Makin	
Diffraction limit overcoming by laser-matter interaction in optics	128
Vladimir S. Makin, Ruslan S. Makin	
Lateral relativistic electron beam synergetic creation and transport by petawatt laser radiation ..	133
Peter G. Malischewsky	
Seismological implications of impedance-like boundary conditions	137
Sergey G. Moiseev, Marina S. Yavtushenko, Anton P. Anzulevich	
Quarter-wave splitter based on heterogeneous composite with prolate silver nanoparticles	141
Maria V. Perel, Mikhail S. Sidorenko	
Effects associated with a saddle point of the dispersion surface of a photonic crystal	145
Maria V. Perel, Dmitry Yu. Zaika	
Asymptotics of surface plasmons on curved interface	149
Alexandr B. Plachenov	
Stability conditions and explicit formulae for basic mode of two classes of rotating two-mirror optical cavities	157
Alexander K. Popov	
Nonlinear electromagnetics in multi-domain negative-index metamaterials	162
Rapoport Yu.G., Grimalsky V.V.	
Nonlinear surface 2D plasmons and giant second harmonic generation	168
Andrey V. Shanin	
Diffraction series on a sphere and conical asymptotics	174
Anatoly P. Sukhorukov, Daria O. Ignatyeva	
Diffraction of wave beams in inhomogeneous metamaterials	180
Andrei B. Utkin	
Causal model of launching an X wave by a superluminal rectilinear current pulse	186
S.N. Vdovichev, A.A. Fraerman, B.A. Gribkov, S.A. Gusev, A.Yu. Klimov, V.V. Rogov	
Phenomena of changing Fraunhofer diffraction pattern of Josephson junction by magnetic field of ferromagnetic dots	193
Nadezhda K. Vdovicheva, Alexandr N. Reznik, Ilya A. Shereshevskii	
Numerical method for the inverse problem of near field microscopy of layered media	195
N.F. Yashina, T.M. Zaboronkova	
Electromagnetic surface waves guided by the boundary between bi-anisotropic composite and dielectric media	201
Michel Zamboni-Rached, Hugo E. Hernández Figueroa	
Non-diffracting beams resistant to attenuation in absorbing media	205
Marina G. Zhuchkova, Daniil P. Kouzov	
Transmission of Rayleigh wave through a surface crack in elastic half-space	212
Author index	215