

ISSN 2312-4334

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

East European Journal of Physics

No 3. 2019

2019

East European Journal of Physics

EEJP is an international peer-reviewed journal devoted to experimental and theoretical research on the nuclear physics, cosmic rays and particles, high-energy physics, solid state physics, plasma physics, physics of charged particle beams, plasma electronics, radiation materials science, physics of thin films, condensed matter physics, functional materials and coatings, medical physics and physical technologies in an interdisciplinary context.

Published quarterly in hard copy and online by V.N. Karazin Kharkiv National University Publishing.
ISSN 2312-4334 (Print), ISSN 2312-4539 (Online)

The editorial policy is to maintain the quality of published papers at the highest level by strict peer review.

Approved for publication by the Academic Council of the V.N. Karazin Kharkiv National University (September 30, 2019, Protocol No. 9).
EEJP registered by the order of Ministry of Education and Science of Ukraine № 747 of 13.07.2015, and included in the list of scientific specialized editions of Ukraine, which can be published results of dissertations for the Ph.D. and Dr.Sci. degree in physical and mathematical sciences.

Editor-in-Chief

Azarenkov N.A., V.N. Karazin Kharkiv National University, Kharkiv, Ukraine

Deputy editor

Girka I.O., V.N. Karazin Kharkiv National University, Kharkiv, Ukraine

Executive Secretary

Hirnyk S.A., V.N. Karazin Kharkiv National University, Kharkiv, Ukraine

Editorial Board

Adamenko I.N., V.N. Karazin Kharkiv National University, Ukraine

Akulov V.P., City University of New York, USA

Antonov A.N., Institute of Nuclear Research and Nuclear Energy, Sofia, Bulgaria

Barannik E.A., V.N. Karazin Kharkiv National University, Ukraine

Beresnev V.M., V.N. Karazin Kharkiv National University, Ukraine

Bereznoy Yu.A., V.N. Karazin Kharkiv National University, Ukraine

Bizyukov A.A., V.N. Karazin Kharkiv National University, Ukraine

Bragina L.L. STU Kharkiv Polytechnical Institute, Ukraine

Broda B., University of Lodz, Poland

Budagov Yu.A., Joint Institute of Nuclear Research, Dubna, Russia

Dovbnia A.M., NSC Kharkiv Institute of Physics and Technology, Ukraine

Dragovich B.G., University of Belgrade, Serbia

Duplij S.A., Center for Information Technology (ZIV), Westfälische Wilhelms-Universität Münster, Münster, Germany

Garkusha I.E., NSC Kharkiv Institute of Physics and Technology, Ukraine

Gofman Yu., Jerusalem College of Technology, Israel

Grekov D.L., NSC Kharkiv Institute of Physics and Technology, Ukraine

Karnaukhov I.M., NSC Kharkiv Institute of Physics and Technology, Ukraine

Khodusov V.D., V.N. Karazin Kharkiv National University, Ukraine

Kondratenko A.N., V.N. Karazin Kharkiv National University, Ukraine

Korchin A.Yu., NSC Kharkiv Institute of Physics and Technology, Ukraine

Krivoruchenko M.I., Institute for Theoretical and Experimental Physics, Moscow, Russia

Lazurik V.T., V.N. Karazin Kharkiv National University, Ukraine

Mel'nik V.N., Institute of Radio Astronomy, Kharkiv, Ukraine

Merenkov N.P., NSC Kharkiv Institute of Physics and Technology, Ukraine

Neklyudov I.M., NSC Kharkiv Institute of Physics and Technology, Ukraine

Noterdaeme J.-M., Max Planck Institute for Plasma Physics, Garching, Germany

Nurmagambetov A.Yu., NSC Kharkiv Institute of Physics and Technology, Ukraine

Onyschenko I.M., NSC Kharkiv Institute of Physics and Technology, Ukraine

Ostrikov K.N., Plasma Nanoscience Centre Australia, Clayton, Australia

Peletminsky S.V., NSC Kharkiv Institute of Physics and Technology, Ukraine

Pilipenko N.N., NSC Kharkiv Institute of Physics and Technology, Ukraine

Radinschi I., Gheorghe Asachi Technical University, Iasi, Romania

Slyusarenko Yu.V., NSC Kharkiv Institute of Physics and Technology, Ukraine

Smolyakov A.I., University of Saskatchewan, Saskatoon, Canada

Shul'ga N.F., NSC Kharkiv Institute of Physics and Technology, Ukraine

Tkachenko V.I., NSC Kharkiv Institute of Physics and Technology, Ukraine

Voyevodin V.M., NSC Kharkiv Institute of Physics and Technology, Ukraine

Yegorov O.M., NSC Kharkiv Institute of Physics and Technology, Ukraine

Editorial office

Department of Physics and Technologies, V.N. Karazin Kharkiv National University

Kurchatov av., 31, office 402, Kharkiv, 61108, Ukraine

Tel: +38-057-335-18-33,

E-mail: eejp@karazin.ua,

Web-pages: <http://periodicals.karazin.ua/eejp> (Open Journal System)

Certificate of State registration No.20644-10464P, 21.02.2014