



LABORATORY OF INFORMATION TECHNOLOGIES

The investigations performed at the Laboratory of Information Technologies (LIT) during 2013 in the framework of JINR's field of research "Networks, Computing, and Computational Physics" were focused on two first-priority themes, namely, "Information, Computer and Network Support of the JINR's Activity" and "Mathematical Support of Experimental and Theoretical Studies Conducted by JINR". The cooperation with other JINR laboratories involved the participation of the LIT staff in research work within 25 themes of the JINR Topical Plan for research and international cooperation.

The JINR Central Information and Computer Complex (CICC) provides the largest share to the

Russian Data Intensive Grid (RDIG) contribution to the global WLCG/EGEE/EGI grid infrastructure which provides a virtual organization support within international projects, the LHC experiments included. During 2013, the CICC ran almost 5 million tasks, the overall CPU time exceeding 130 million hours (in HEPSpec06 units). The JINR grid site is one of the most effective Tier-2 level sites in the WLCG (Worldwide LHC Computing Grid) infrastructure.

In 2013, based on the JINR CICC, a prototype of the CMS data processing centre of the Tier-1 level was created.

NETWORKING, COMPUTING, AND INFORMATION SUPPORT OF JINR ACTIVITY

During 2013, important work was carried out toward strengthening the reliable operation and achieving further development of the JINR networking and information infrastructure. The key components of this infrastructure are the telecommunication data links, the local area network, the CICC and the primary software, the grid-technology environment included, integrating the information resources of the Institute in a unified environment accessible to all users.

JINR Telecommunication Data Links. In 2013, reliable work of the high-speed computer communication channel Dubna–Moscow was secured. The connection with scientific networks and Internet used the following telecommunication links: CERN (10 Gbps), RBnet (10 Gbps), Moscow scientific networks (10 Gbps), RUNet (10 Gbps), RadioMSU (10 Gbps), and E-arena (10 Gbps). The throughput of the reserve data link was increased to 10 Gbps in 2013.

Table 1 summarizes the distribution, over the JINR subdivisions, of the incoming and outgoing traffics (if the incoming traffic exceeded 3 TB).

Table 1

Subdivision	Incoming, TB	Outgoing, TB
LIT	79.40	42.95
VBLHEP	65.93	47.59
DLNP	60.08	153.07
FLNP	34.28	88.31
Administrative Management Offices	17.07	66.57
BLTP	15.23	15.3
Remote access node	14	2.65
University "Dubna"	11.99	16.42
FLNR	11.87	2.68
JINR's Hotel & Restaurant Complex	11.57	1.54
LRB	9.56	1.69
Joint-Stock Company "Dedal"	5.99	0.583
Recreation centre "Ratmino"	3.25	1.51

Table 2

Scientific and educational networks	File exchange (p2p)	Web-resource	Social networks	Multimedia	Software	Dubna nets
91%	6.98%	1.24%	0.69%	0.06%	0.03%	0.0%

In 2013, the amount of the overall incoming JINR traffic, including the general access servers, Tier-1 and CICC, was 2656.35 TB. The weights of the various incoming traffic categories are shown in Table 2.

JINR Local Area Network (LAN). In 2013, the work was focused on the further improvement of the JINR LAN performance as well as on the provision of users with some supplementary possibilities.

The construction of the 10-Gb backbone network was completed: all the JINR laboratories and subdivisions were connected to the JINR 10-Gb optical network through switches with 10-Gb network interfaces Cisco Catalyst 3560E-12D. A virtual platform technology was grasped for network servers securing a set of standard services to the JINR network management and was implemented for Super-Micro servers and InfiniBand switches. In frames of the LAN user support, the capabilities of the mail- and proxy-services have been expanded. The authorization service of the JINR central computer complex was transferred to LDAP-registration, and decisions were analyzed concerning the authorization of other JINR services with a unified access password. VoIP-telephony with the opportunity of voice connection with JINR from any point of the world was put into operation in 2013. The JINR Content Server has been put into operation. It allows one to complete the construction of the system of videoconferencing enabling real-time record and reproduction of streaming video.

In 2013, the JINR LAN included 7368 network elements and 11593 IP addresses; 3884 users are registered within the network; there were more than 1500 users of mail.jinr.ru service as well as 1301 users of digital libraries and 864 remote VPN users.

JINR Central Information and Computing Complex. At present the CICC computing farm comprises 2560 64-bit central processors and a data storage system with a total capacity of 1800 TB. The central CICC network router is connected to the main border router of the JINR network at 10 Gb Ethernet.

A project of modernization of the systems of electric power supply and precision air-conditioning in the JINR CICC has been worked out; its realization will begin in the first quarter of 2014.

The computing facilities and storage systems are managed by a basic software (BS) that provides a way for using the CICC resources both by international projects for distributed computing (WLCG, FUSION, BIOMED, HONE, PANDA, CBM, BES, NICA/MPD, etc.) and by local JINR users.

The basic CICC operating system is OS Linux (the distribution Scientific Linux — SL6 with architecture x86_64). The CICC is supplied with a set of freely distributed compilers for various programming languages (C/C++/Fortran, etc.) which are standard compilers for the Unix-like OS. The Intel compilers are complemented with effective tools for developing multi-threaded code supporting the OpenMP standard. For the development of parallel programs using the MPI (Message Passing Interface) package, MPI libraries are established for the programming languages C, C++ and Fortran.

A special batch server and work nodes provide batch processing of jobs either launched from the interactive machines by local users or received from the global WLCG environment. The storage and update of the user certificates for the protection of user resources and tasks within grid systems are secured by the service X509 PX (ProXy). This is the main method of monitoring the registered users in the WLCG project. The distributed file system CVMFS (CernVM File System) which is installed and stored on the CERN servers, is fully supported on the cluster. It provides access to the software of the collaborations ALICE, ATLAS, CMS, LHCb, and BES.

Two systems of storage and access to data dCache and XROOTD, enable the data handling both for the local JINR users and for the WLCG users and collaborations. Two implementations of the XROOTD data access system provide the necessary user interfaces to data for three international collaborations: ALICE, PANDA, and CBM. All the storage systems are implemented under the hardware data protection mechanism RAID6.

A few CICC specialized machines support the local and outer users within the international collaborations of the projects NICA/MPD and PANDA.

Table 3

Laboratory/group	CPU time, kSi2K · h	Astronomical time, kSi2K · h	Number of jobs
MPD	1390015.86	1399986.59	64770
LRB	972527.78	96827.22	1158
BLTP	835919.13	793977.43	7190
LIT	454857.09	86331.86	1713
DLNP	363724.39	218444.15	8917
COMPASS	193236.73	195613.12	8764
VBLHEP	187185.90	196224.81	3952
BES	110510.37	116310.71	35680
FLNP	71114.43	71436.82	352
FLNR	20127.82	414.77	25
PANDA	1660.02	14308.12	94688

Table 3 provides the 2013 summary on the use of the CICC by the JINR subdivisions and user groups, except for the tasks within the grid projects.

JINR Grid Environment. In 2013, outstanding work was carried out within the global large-scale grid projects “Worldwide LHC Computing Grid” (WLCG, <http://lcg.web.cern.ch/LCG/>) and “European Grid Infrastructure” (EGI-InSPIRE — Integrated Sustainable Pan-European Infrastructure for Researchers in Europe, <http://www.egi.eu/projects/egi-inspire/>). The JINR CICC, entering the global grid infrastructure as a grid site JINR-LCG2, provides support to the computations within 8 virtual organizations (alice, atlas, biomed, cms, dteam, fusion, hone, lhcb) and offers possibilities for using grid resources for the experiments BES and PANDA.

Special mention is to be made of the JINR grid site T2.RU.JINR, which is a Tier-2-level centre within the global CMS computer infrastructure and one of the 8 grid sites of this structure within the RDMS CMS collaboration. This enables both physical data modeling and complete analysis of real physical data on the JINR CICC resources in strict compliance with the procedures defined within the global grid infrastructure of the CMS experiment [1].

The prototype of a CMS Tier-1-level centre was created at LIT based on the JINR CICC. The CMS Tier-1 centre will be part of the global system for processing experimental data and event simulation data coming from the Tier-0-level centre (CERN) as well as from Tier-1- and Tier-2-level centres of the global WLCG grid system for the CMS experiment [2]. For the time being, the Tier-1 prototype comprises 1200 64-bit processors, a 660-TB storage system and a 72-TB tape storage. In the near future the storage will be expanded up to 2000 TB.

The maintenance of the grid site at JINR is done through 22 servers under the EMI2/EMI3 system (WLCG middleware). Table 4 summarizes data on using the JINR CICC infrastructure by VO within the RDIG/WLCG/EGI.

Table 4

VO	CPU time, HEPspec06 · h	Number of jobs
atlas	46 784 736	2 727 612
cms	33 328 168	903 071
alice	24 070 600	665 274
lhcb	23 180 600	225 182
biomed	2 214 388	263 086
bes	420 768	42 727
hone	338 352	21 548
fusion	307 160	17 930
ops	1148	113 897
Total	130 645 920	4 980 327

In 2013, the modeling of the data storage and processing system for the NICA accelerator complex

was actively pursued. The software package GridSim was chosen as a platform for the simulation model of the system. The created system allows one to perform various computer experiments with the objects under study without the need of their physical realization. The simulation process allows the definition of the minimally required equipment for data transfer, processing and storage to evaluate the necessary performance margins of the equipment making possible the desired future development prospects, to test the functionality of the system revealing its bottlenecks [3].

A modern approach to the creation of cloud autonomous grid infrastructures, intended for solving various problems in the field of cloud and grid technologies, was proposed and implemented [4]. Carrying out research, development, tests and training in the field of grid technologies using production grid infrastructures looks less effective from the viewpoint of the goal achievement rate and use of hardware resources than solving similar tasks on specialized complexes. On the basis of the developed approach, a specialized cloud complex in the CICC structure (comprising both software and hardware components) was created.

Information and Software Support. In 2013, work was in progress on the modernization, filling in with information and development of visualization means for representing the retrieval results in the repository of scientific publications and documents of the open access JINR Document Server (JDS) (<http://jds.jinr.ru/>), an electronic archive-repository developed in the framework of the international programme Open Access Initiative (OAI) on the basis of the CDS Invenio software (Fig. 1). One of the goals of creating JDS is to provide a mechanism of evaluating the efficiency of the scientific efforts of the JINR staff. To this purpose, new applications for JDS are developed using the methods of information visualization and statistical data acquisition, which allow one to extend the efficiency of using JDS and to estimate the scientific activity [5].

A pilot project was undertaken on the joint exploitation of the information systems ADB2 (JINR) and APT EVM (Earned Value Management) system (CERN) for the NICA project management by a BCWP (budgeted cost of work performed) method. Within the ADB system, a functional module has been elaborated and implemented for the control of the hierarchical structure of the work (WBS) within the NICA project, the accounting of the project expenses was implemented under observance of the approved WBS, and reports were prepared concerning the plan-fact analysis of the finance indicators of the NICA project.

During 2013, work was in progress on the actualization of the software environment, databases and contents of the LIT/JINR information sites <http://lit.jinr.ru>, <http://www.jinr.ru>, <http://wwwinfo.jinr.ru> as well as on the support and modernization of administrative data-

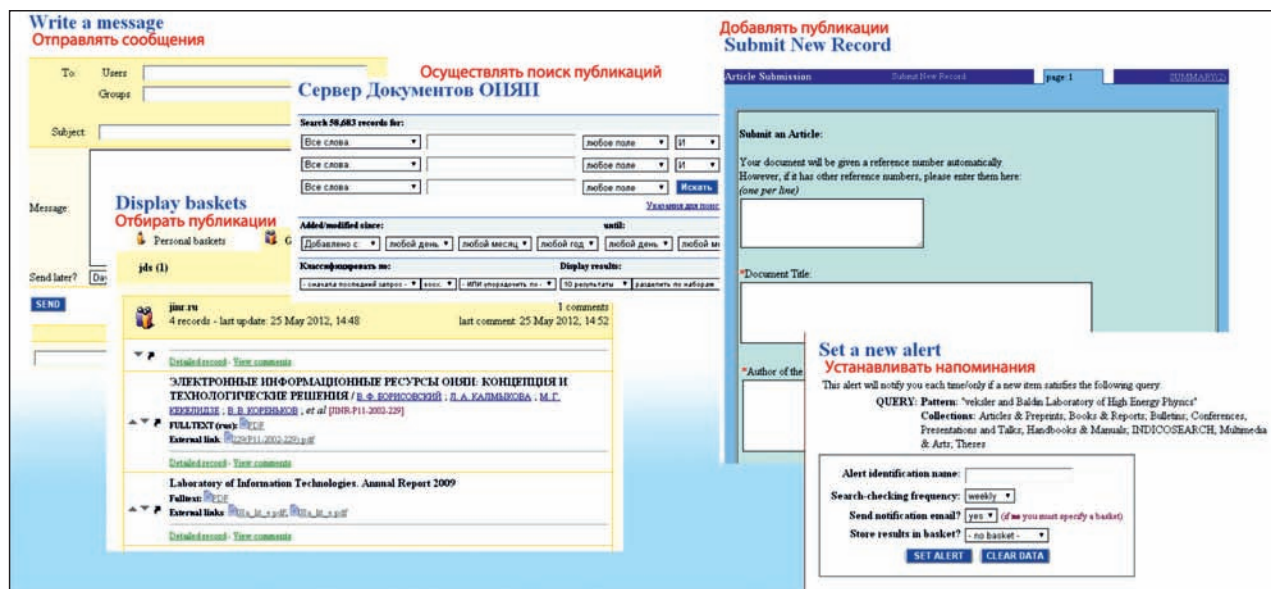


Fig. 1. User interfaces of the information services of the JDS repository of scientific publications. The interface allows users to search for publications, collect publications in “baskets”, direct information to other users, to make reminding, etc.

bases (in cooperation with the JINR STD AMS). For the JINR Management, the “System of the interactive formation of the topical plan for research in scientific organizations (using the JINR as an example)” was developed and prepared for testing and launching in pre-production operation.

In 2013, active work was conducted on the creation and storage of electronic documents related to the scientific and administrative activity of the Institute and LIT, according to the conception formulated by the JINR Scientific-Organizational Department (information on the operation of the JINR basic facilities, the sessions of the JINR Scientific Council, etc.), and the provision of the Internet access to them. In continuation of the previous efforts, work was conducted on the development, creation, and support of information websites, sites of various conferences, workshops, symposia (FLNP — RCM-3, DLNP — RCRC-2014, LIT — RCDL-2014), as well as the organization of hosting websites upon the request of the organizers (the site of the JINR

Publishing Department, the site of the weekly journal “Dubna”, etc.) or upon the requests of the JINR Laboratories: FLNP (ISINN), FLNR (IASEN-2013), VBLHEP (on the project E&T-RAW) and others.

In view of the rapid development of the programming technologies for parallel calculations, in particular MPI, this tendency has found its reflection in the JINRLIB program library as well. The following strategy of paralleling has been formulated: the library program prepared for work in the MPI environment should function successfully at any amount of NP parallel processes involved in solving an applied task. This idea has been successfully realized at paralleling some JINRLIB programs. Besides, the Library site was reconstructed: its design was changed; a new section was added for the programs with the use of the MPI technology. In order to improve the quality of statistics of using the programs, a counter of the amount of downloads has been added to the site frequency counter.

MATHEMATICAL SUPPORT OF EXPERIMENTAL AND THEORETICAL STUDIES CONDUCTED BY JINR

One of the main objectives of this research field at LIT is to provide the mathematical, algorithmic and software support of the experimental and theoretical research underway at JINR. In 2013, the results obtained by LIT researchers were published in 2 monographs and in more than 170 papers, 72 articles being published in peer-reviewed journals. Fifty-eight reports were presented at Russian and international conferences. Below there is a brief report of some results obtained.

Within the ATLAS experiment, the service WebEmon was implemented on the base of WebIS. It is a service of Web-access to the Event Monitoring service of DAQ ATLAS which realizes the monitoring of event acquisition (raw data events). The previous version, Event Dump, could work only within the TDAQ. The WebEmon environment allows users, by utilizing HTTP inquiries, to receive separate events in XML format. To make WebEmon functional, an event converter

from a raw event format into XML was realized. The new service works in TDAQ ATLAS. As part of work on the remote monitoring in the ATLAS experiment, a new component WEBIS-EXT has been developed to provide a way of receiving information updates from the IS server ("subscribe" for information), located inside Point1, through WEB. From early July to September the component was on a test WEB server for Point1 in ATLAS. After successful testing, it has been transferred to the standard WEB server for Point1 in ATLAS.

For the CMS experiment, within the Detector Performance Group (DPG) of this experiment on cathode-strip chambers (CSC) (V. Palchik, LIT staff member, is a co-head of this group) using data of proton-proton collisions, the efficiency of the local reconstruction and spatial resolution of CSC has been estimated. A new algorithm of the track-segment reconstruction in CSC was developed. The results of this work were reported at CMS meetings and international conferences.

For the CBM experiment, a general structure of the geometrical database of the experiment has been developed. A program was implemented for converting the magnet geometry into the developed database. User Requirements Document has been designed for a component database.

The opportunity of registration of the $J/\psi \rightarrow e^+e^-$ decays generated in AuAu collisions has been investigated at a beam energy of 25 GeV/nucleon at the CBM installation (Darmstadt, Germany). To extract signal events in the conditions of a dominating background, special criteria of selection have been developed and an optimal thickness of the target has been chosen. An effective technique of determining critical borders for the specified criteria of selection has been suggested. It is shown that the used criteria allow collecting reliably and

quickly a comprehensible statistics of the $J/\psi \rightarrow e^+e^-$ decays [6].

In a vicinity of effective mass for electronic (or hole) states of spheroidal quantum points in the presence of external fields, schemes of the perturbation theory have been constructed within the Kantorovich method and adiabatic method. The eigenvalues and eigenfunctions obtained in both analytical and numerical form are applied to the analysis of spectral and optical characteristics of spheroidal quantum points in a homogeneous electric field [7].

Research has been performed on the entangled spin evolution of two heavy constituents of the bound state of driving in a strong laser field in the framework of quasi-classical approximation. The motion of the bound state as a whole was analyzed in a classical way by using an exact solution to the Newton motion equations obtained beyond the framework of a standard dipole approximation with a full account of the magnetic field effects. At the same time, the evolution of the spin constituents exposed to a laser field was described in a quantum mechanical way. The spin matrix of density was defined as a solution to von Neumann equations with an effective Hamiltonian describing a spin-laser interaction along a classical trajectory of the bound state. Based on the obtained solution, the evolution of concurrence of the spins which initially were in an uncorrelated or maximally entangled Verner state was calculated [8].

The processes of scattering and decay of ^{11}Li at a proton energy of 60–80 MeV/nucleon have been investigated on the basis of a hybrid model of the microscopic optical potential. It was shown that within this approach it is possible to reproduce the experimental data on elastic scattering. The influence of spin-orbital

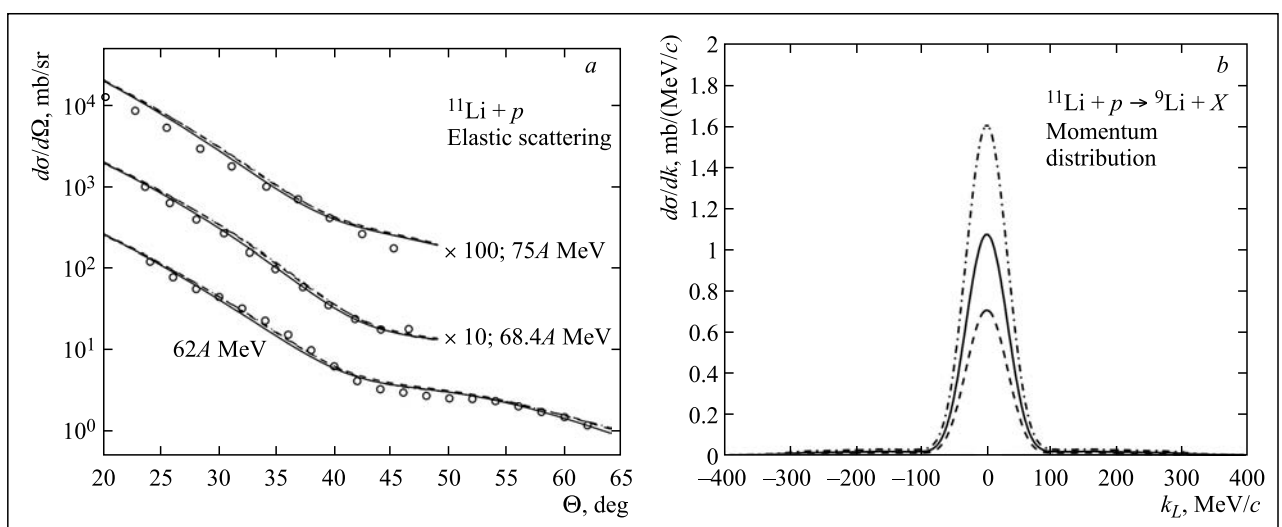


Fig. 2. *a*) Differential cross sections for $^{11}\text{Li} + p$ elastic scattering calculated using two forms of the ^{11}Li density, obtained within the Dynamical Cluster Model (solid line) and Large Scale Shell Model (dashed line). *b*) Predictions of the momentum distributions of ^9Li fragments from breakup reactions $^{11}\text{Li} + p \rightarrow ^9\text{Li} + X$ within the DCM cluster model

potential on the agreement with experimental data was studied. Predictive calculations of full cross sections of the reaction and pulse distributions of the ^{11}Li decay products have been performed. On the basis of the dynamic two-cluster model of ^{11}Li , a one-particle density of this nucleus was constructed [9]. The results are presented in Fig. 2.

The MPI implementation of the method of 2D and 3D computations of the evolution of temperature fields and the dynamics of phase transitions in materials bombarded with high-energy heavy ions and pulsed ion beams has been developed. Description of the thermal physical processes was carried out in the framework of a modified thermal spike model based on a system of two coupled equations of heat conductivity describing thermal processes in electron and ion subsystems of the irradiated target, respectively. The numerical solution to these equations is performed in a cylindrical coordinate system both in an axially symmetric case (2D) and taking into account symmetry breakdown (3D). Simulation of the dynamics of phase transitions was realized in the framework of the enthalpy approach. It is shown that the results of the numerical simulations are in agreement with known experimental estimates of sizes of tracks produced in the samples irradiated with heavy ions [10].

The collisions of nanoclusters with a metallic solid surface have been simulated by the molecular dynamics method, and dependences of the penetration depth of the cluster atoms into the material upon the energy of the beam projectile particles, the size of the nanoclusters and the frequency of the pulse source of the nanoclusters have been studied. The dependence of thickness of the surface layer in terms of the new structure

which is produced as a result of the irradiation of the material with nanoparticles upon the above-mentioned parameters of the beam of projectile nanoclusters has been investigated. The dependence of penetrating of the cluster atoms in the target material and the thickness of a deposited layer upon the quantity of atoms in the incoming clusters, the frequency of the pulse source in case of an irradiation with the cluster beams has been found. It is shown that there is a dependence of characteristics of various energy modes (soft landing, droplet spreading and implantation) upon the number of atoms in the incoming clusters. The investigated problems can be of interest for the production of materials of the surface layer with new physical and chemical properties, essentially distinct from those of the basic material [11].

Kinematically complete theoretical calculations and experimental data for the transfer ionization in $\text{H}^+ + \text{He}$ collisions at 630 keV/u have been reported. The experiment and theory are compared at the most detailed level of fully differential cross sections in the momentum space. This allows one to unambiguously identify contributions from the shake-off and binary encounter mechanisms of the reaction. It is shown that the simultaneous electron transfer and ionization are highly sensitive to the quality of the trial initial-state wave function of helium [12].

Differential cross sections (MDCS) have been calculated for the vertical photo-double ionization of diatomic nitrogen with coincidence detection of the ejected electrons, for fixed and random orientations of the inter-nuclear axis, using a correlated product of two two-center continuum Coulomb functions for the description of the two ejected electrons, which satisfies exact asymptotic conditions. To check the approach,

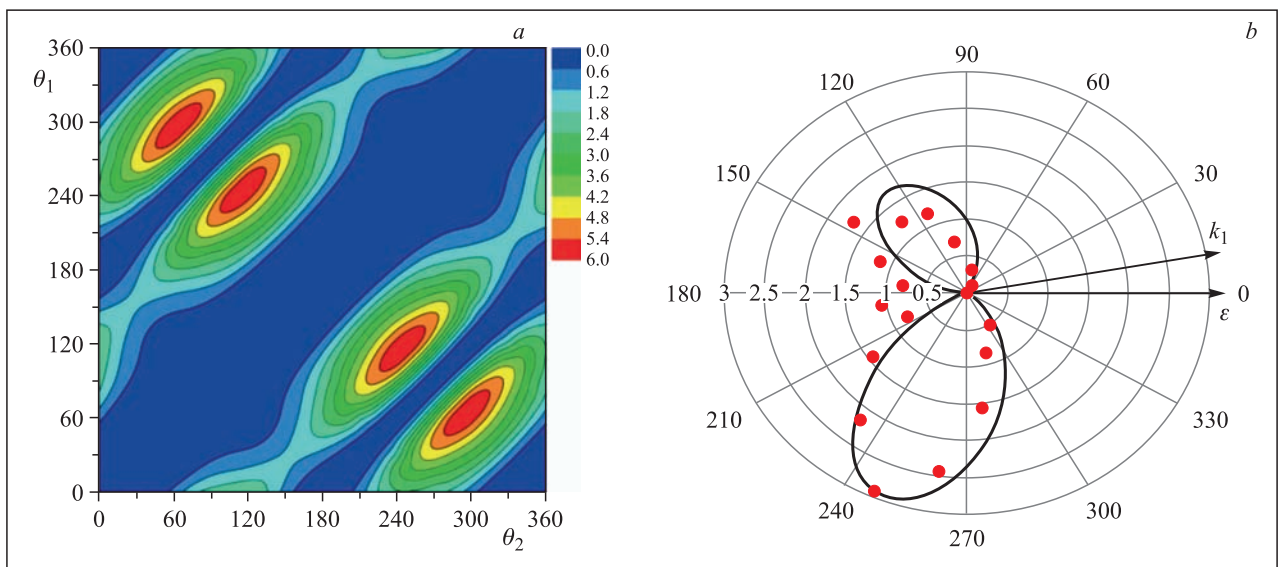


Fig. 3. The results of numerical simulations of the full differential cross section in the plane of scattering angles (a) and comparison of theoretical predictions with experimental data for the hydrogen molecule (b)

cross sections of photo-double ionization of the diatomic hydrogen were calculated for which extensive experimental and theoretical results are available. The results on diatomic hydrogen evidence the significant influence of the initial state electron correlations in the target (Fig. 3). In the case of diatomic nitrogen, the photo-double ionization of the $^3\sigma_g$ orbital resulting in $^1\sigma_g$ state of the residual N_2^{2+} ion was only considered. The obtained results are in agreement with the symmetry properties of the MDCS and give the optimal electron ejection angles. A comparison was also made with the results obtained by a Gaussian parametrization method [13].

A mathematical model of reparation of wrongly coupled DNA bases in bacterial cells *Escherichia coli* has been developed. The key ways of implementation of this mechanism are quantitatively described on the basis of present-day experimental data. Five basic ways of removing mistakes with participation of different DNA exonucleases are tracked in detail. The developed model will find wide application to the problem of studying the radiation-induced mutagenesis [14].

A continuous analogy of the Newton method with inner iteration has been proposed for solving a system of linear algebraic equations. The implementation of the inner iterations is carried out in two ways. The first fixes the number of inner iterations in advance, while the second one uses an inexact Newton method for solving a linear system of equations that arises at each stage of outer iterations. Some new choices of the iteration parameter and of the forcing term which ensure the convergence of the iterations have been proposed. The method with inner iteration is quadratically convergent, and therefore it can compete with other iterations such as successive over relaxation with an optimal relaxation parameter for a strictly diagonally dominant system. Moreover, the proposed method is applicable not only for the system with a strictly diagonal domi-

nant matrix, but also for a system the matrix of which is not Hermitian and non-positive definite [15].

Two new high-accuracy finite-difference schemes have been developed for the numerical solution of the initial boundary-value problem of Burgers equation. The Burgers equation is a one-dimensional analogue of the Navier–Stokes equation describing the liquid dynamics and it possesses all its mathematical properties. Besides, the Burgers equation belongs to the class of a few partial derivative nonlinear equations the analytical solution of which are known, a property which allows using it as a test model for the comparison of the features of various numerical methods. The first scheme, intended for a numerical solution of the equation of heat conductivity, has the sixth order of approximation in the spatial variable and the third order in the time variable. The second scheme is used for finding a numerical solution to the Burgers equation on the basis of the connection between the equation of heat conductivity and the Burgers equation. The scheme also has a sixth order of approximation on the spatial variable. The numerical results obtained using test examples are in good agreement with the analytical solutions of the Burgers equation and reproduce the expected order of approximation of the suggested schemes [16].

A boundary method of weighed residuals with discontinuous basis functions has been developed for solving, with high accuracy, linear elliptic boundary-value problems with respect to scalar or vector functions. The method is a generalization of the least squares method with t -elements. The obtained projective-mesh schemes show the 7th degree of accuracy in the scalar case for two- and three-dimensional polynomials, while in the vector case the 6th degree of accuracy is reached. A high rate of the hp -convergence of the approximated solutions is demonstrated using examples of some model two- and three-dimensional linear problems of magnetostatics [17].

INTERNATIONAL COOPERATION

The research work at the Laboratory is carried out in close cooperation with scientists and specialists of the JINR Member States as well as of many research centres of other countries. Some examples of such cooperation should be particularly stressed.

In cooperation with German researchers, a two-dimensional numerical model has been developed in view of nonlinear properties of materials for research on the distributions of current and magnetic field as well as for calculation of losses in superconductors on the basis of the finite element method and software pack-

age Comsol Multiphysics. The developed model has been successfully applied to designing and assembling superconducting cables of complex configuration [18].

In cooperation with Bulgarian scientists, a numerical research has been performed on the complexes of localized structures in two dynamic systems described by the damped-driven nonlinear Schrödinger (NLS) equation and the double sine-Gordon equation (2SG). The numerical analysis is based on continuation of corresponding stationary solutions on parameters and a numerical solution linearized eigenvalue problem for the

analysis of stability and bifurcations. Multisoliton complexes of NLS were investigated for a case of weak and zero dissipation. The properties of multifluxon solutions of 2SG were analyzed depending on the second harmonic parameter [19].

In cooperation with Romanian researchers, within the anisotropic non-diagonal Bianchi type-II, VIII and IX space-time models, it has been shown that the off-diagonal components of the corresponding metric impose severe restrictions on the components of the energy momentum tensor. The loop quantum cosmology of the Bianchi type-II string cosmological model

in the presence of a homogeneous magnetic field has been studied in [20].

In cooperation with French scientists, the coupled dynamics of low-lying modes and various giant resonances were studied with the help of the Wigner function moments method on the basis of time-dependent Hartree–Fock equations in the harmonic oscillator model including spin-orbit potential plus quadrupole–quadrupole and spin–spin residual interactions. New low-lying spin-dependent modes were analyzed. Special attention was paid to the spin scissors mode [21].

CONFERENCES AND MEETINGS

The 4th School on Information Technologies “Grid and Advanced Information Systems” was held at JINR on April 22–26 under the auspices of the Joint Institute for Nuclear Research and the European Organization for Nuclear Research. The organizers were the JINR Laboratory of Information Technologies and the Advanced Information Systems Group at CERN General Infrastructure Services Department. The goal of the School is to share the knowledge gained and expanded at JINR and at CERN in the field of modern information technologies, thus attracting and preparing students to work in this field. More than 50 students from the leading universities of Moscow and Moscow Region attended the event: MEPI, MIPT, MPEI, the Baumann State Technical University, Dubna University, as well as students from the University of Science and Technology in Krakow, Poland.

The traditional two-day Workshop on Computer Algebra was held at the Laboratory of Information Technologies on May 21–22. More than 30 scientists from universities and scientific institutes of Bucharest, Moscow, St. Petersburg, Ivanovo, and Dubna took part in this Workshop. Twenty-eight reports were presented.

The 7th International Conference “Mathematical Modeling and Computational Physics” (MMCP 2013) was held on July 8–12 at the Laboratory on Information Technologies. The Conference was organized by LIT, the Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences (Moscow), the Institute of Experimental Physics of the Slovak Academy of Sciences, the Technical University, and the Pavol Jozef Safarik University (Kosice, Slovakia). The scientific programme of the Conference was devoted to the use of distributed and parallel computing in science and technology; mathematical methods and tools of modeling

complex systems; computational biophysics, chemistry and bioinformatics; mathematical methods and software for experimental data processing; methods and programs of computer algebra, quantum computing and applications. The Conference was attended by more than 200 scientists and specialists from 13 countries and from numerous Russian scientific centres and universities. A total of 34 plenary, more than 120 section and 25 poster reports were made. It should be emphasized that an important fraction of the reports presented at the Conference were made by LIT specialists in collaboration with scientists from different JINR Member-State institutes. This demonstrates the significance of ongoing investigations at LIT and the interest in them shown by the researchers from those countries.

The 24th International Symposium on Nuclear Electronics & Computing (NEC’13) was held on September 9–16 in Varna, Bulgaria. The Symposium was organized by the Joint Institute for Nuclear Research, the European Organization for Nuclear Research (CERN) and the Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences (Sofia). 2013 is the jubilee year of NEC: fifty years since the first conference, held in Budapest in 1963. The Symposium was attended by 100 scientists from 13 countries, with 25 participants being under 35. Participation of young scientists was supported by special grants afforded by JINR and CERN. The companies IBM and Quantum also provided their sponsorships. A separate section on the opening day of the Conference was devoted to the new experimental complexes ELI-NP, NICA and DRIBs-III. The Symposium attendees heard 54 lectures and 33 posters; 19 lectures and 17 posters were presented by JINR employees. Thirteen lectures and 11 posters were made by young scientists.

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