

**INSTITUTE
OF EXPERIMENTAL PHYSICS**

**FACULTY OF PHYSICS
WARSAW UNIVERSITY**

REPORT 2003 - 2004

Warsaw 2005

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Table of Contents

Preface.....	2
Teaching activity	3
Division of Biophysics	5
Division of Nuclear Physics	14
Division of Nuclear Spectroscopy.....	21
Division of Optics	29
Division of Particles and Fundamental Interaction.....	35
Division of Physics Education	45
Division of Solid State Physics	49
Divison of Structure Research.....	60
Divison of Biomedical Physics	63
Divison of Structure and Lattice Dynamics.....	67
Symposium IEP 2004.....	70

PREFACE

Institute of Experimental Physics is a part of Faculty of Physics of Warsaw University and is one of the oldest and the largest Polish institutions involved in basic research in physics.

At present, the Institute employs 101 physicists (93 full positions), among them 41 professors. It has 69 PhD students who also assist in teaching. The technical and administration staff includes 63 persons (56 full positions). Of the ten divisions of the Institute, nine represent fields ranging from particle and nuclear physics, through condensed-matter physics and optics, to biophysics and medical physics, whereas one deals specifically with issues of teaching physics and training school teachers.

Thanks to years of efforts, the three divisions of condensed matter physics, and the divisions of optics and biophysics, accumulated equipment and experience which allow them to carry out most of their research in Warsaw. This is also true for two divisions of nuclear physics which carry on experiments at the cyclotron of the Warsaw University Heavy Ion Laboratory. The experimental work carried out in Warsaw, essential for training students and young researchers, is supplemented by active collaboration with foreign centres. The access to leading laboratories in Europe and elsewhere extends the research possibilities and allows us to realise many additional exciting projects. The particle physicists are in a special situation in that high energy physics experiments require very expensive equipment – accelerators and detectors. As a result they work in large international collaborative groups. Their experiments are carried out mainly at CERN (Geneva) and DESY (Hamburg). However, the analysis of data is performed in Warsaw as is the development of complex detector systems, for example for use in the future CERN Large Hadron Collider experiments. The division of medical physics, which has close links with hospitals and research laboratories in Poland and abroad, is involved mainly in the computer analysis of medical data and the modelling of biological processes important to medicine.

The present report covers the years 2003 and 2004.

The report, edited by Izabela Sosnowska, begins with a general presentation of the teaching activities of the Institute by Tomasz Matulewicz. This is followed by some detailed information on individual divisions. Finally, there is a report on the Symposium organized in December 2004 by the team led by Paweł Kowalczyk.

Warsaw, April 2005

Andrzej Twardowski

Teaching activities of the Institute (2003-2004)

Employees and Ph.D. students of the Institute of Experimental Physics participated in the teaching activities of the Faculty of Physics, covering approximately 50% of all teaching duties of the Faculty. All 86 full-time persons of the scientific staff (not on leave) were involved in teaching, helped by 5 retired persons employed on a part-time basis. Also 9 physicists of the technical staff (often holding a PhD in physics as well) and 43 out of 71 graduate students contributed to students training.

The Institute provided, among others:

- two-year basic courses in experimental physics (Mechanics, Electrodynamics, Waves and Optics, Thermodynamics, Introduction to Contemporary Physics) organised for students of physics, astronomy and, separately, for the College of Physics Teachers. The lectures for the students of physics and astronomy were realised at two levels: intended for 3-years studies leading to bachelor's degree and, more advanced, intended for 5-years studies leading to the master degree. All the lectures were illustrated with experimental demonstrations and were accompanied by student classes;
- lectures which constituted some introductions to specialised education (destined for third-year students) – on atomic, molecular and solid state physics or elementary particles and nuclear physics, also illustrated with experimental demonstrations and accompanied by student classes;
- specialised lectures destined for those students who had chosen the specialisation in experimental physics. An important part of their further education took place in the individual divisions of the Institute - appropriate for chosen specialisation (Institute organises 11 different specialisations concerning optics, solid state physics, nuclear and elementary particle physics, biophysics, medical physics, physics of environment protection and physics education);
- monographic lectures organised for the fourth and fifth-year students as well as Ph.D. students;
- some lectures which were believed to broaden students' horizons or to raise their fascination of physics – like e.g. "History of Physics" or "Physical Experiment in Extreme Conditions";
- laboratory classes of the basic level of education – i.e. Introductory Laboratory of Electrical Measurements, First Student Laboratory, Student Laboratory of Electronics, Second Student Laboratory, Laboratory of Physics Teaching and Laboratory of the Physical Methods of Environmental Research;
- computer courses on the basic level as well as teaching of programming languages;
- student laboratories of specialised studies – e.g. so called Third Student Laboratory which helped students to smoothly undertake experimental research activities or in the case of specialisation of biophysics - Laboratory of Biochemistry, Laboratory of Physical Chemistry and Laboratory of Biophysics;
- various seminars, some of which had more general character and served as an aid for students to choose the specialisation of their M.Sc. studies (like "Seminar of Contemporary Physics"), while others were thought to conduct students through very specialised subjects;
- supervision of M.Sc. theses as well as Ph.D. theses.

As usually, the teaching activities of the Institute were not limited to training students of the Faculty of Physics. Some lectures and classes were organised for students of other faculties of Warsaw University (Chemistry, Biology, Mathematics, Interdepartmental Studies of Environment Protection - MSOŚ and Interdepartmental Studies of Mathematical and Natural Science - MISMaP). New lectures on general physics, illustrated by experimental demonstrations, were started for students of Geology and Geography in 2004. We also

contributed to the training of pupils and schoolteachers as well as we supervised some other educational activities - like workshops for exceptionally talented children.

In the Institute during that period of time 78 students made their M.Sc. theses, 33 got their B.Sc. degree (licentiate), 19 colleagues received their Ph.D. and 5 - the D.Sc. (habilitation). The President of Poland awarded the professor title to 3 of our colleagues.

Tomasz Matulewicz

DIVISION OF BIOPHYSICS

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Scientific Staff (total): 16 persons

ETA (Engineers, Technicians, Administration): 6 persons

Number of grants in 2003 - 2004: 7

SCIENTIFIC ACTIVITY

Areas of scientific activity:

Structure, dynamics, and specific intermolecular interactions of proteins, nucleic acids and their components. Physical basis of molecular mechanisms of gene expression and regulation: initiation of protein biosynthesis, intracellular transport, electron and proton transfer, enzymology: phosphorolysis, oxidation, and phosphorylation. Relationship between physico-chemical properties of mutagenic, antiviral and antitumor agents and their biological activity; drug design. Proteomics. Protein folding.

Methods:

Experimental: molecular spectroscopy (UV VIS and IR absorption, steady state, time resolved, and stopped-flow fluorescence, phosphorescence, NMR), X-ray diffraction, calorimetry, mass spectrometry, molecular photophysics, organic and physical chemistry, biochemistry, genetic engineering. Theoretical: classical, Brownian, and quantum molecular dynamics (MD), molecular (computer) modelling, quantum chemistry.

Main achievements:

1. Complex studies on the role of the 5' terminus of messenger ribonucleic acid (mRNA 5' cap) in translation, *i. e.* protein synthesis, in eukaryotic cell, have been performed *via* exploit of various approaches, biophysical, chemical and biological. We employed emission spectroscopy and calorimetry to study interactions of various cap analogues with eukaryotic protein translation factors eIF4Es. Fluorescence titration provided precise values of the equilibrium association constants, and hence, by van't Hoff relation, the thermodynamic parameters of the complexes formation, changes of standard Gibbs free energy, enthalpy, entropy, and heat capacity. Surprisingly, in the case of the cap analogues of moderate affinity for eIF4E positive value of the heat capacity change was

observed, which was subsequently confirmed by direct isothermal calorimetry (ITC). The results were analysed in terms of conformational changes of the proteins upon the complexes formation. Nontrivial enthalpy-entropy compensation pointed to significant fluctuations of the *apo*-eIF4E and indicated that the cap-binding microstate lies *ca.* 10 kJ/mol below the mean energy of all available conformational states.

To better understand how phosphorylation of eIF4E regulates translation, a unique protein engineering technique, intein-mediated protein ligation, was applied to obtain eIF4E selectively phosphorylated at Ser209. Using synthetic cap analogues, the cap affinity for phosphorylated *versus* unphosphorylated eIF4E was measured by a fluorimetric titration method. It was shown that phosphorylation of eIF4E attenuated its interaction with mRNA 5' cap by electrostatic repulsion, which has biological implications on protein translation. Moreover, studies performed with eIF4E specifically mutated at positions 209 and 159 proved the significant role of Lys159 in the binding of capped mRNA but ruled out the so called "clamping model".

A highly modified cap-4 structure m⁷Gpppm₃^{6,6,2}Apm²Apm²Cpm₂^{3,2}U at mRNAs of trypanosomatids, including dangerous parasites *Leishmanias*, was chemically obtained for the first time. Cap-4, together with other synthetic cap structures, allowed to characterize the cap-specificity of recently cloned eIF4E from *Leishmania* using fluorescence titration. The investigations of protein translation mechanisms in organisms possessing cap-4 should facilitate a search for drugs that selectively inhibit protein synthesis in those parasites (in cooperation with prof. Michal Shapira, Ben Gurion University, Israel).

Ten new "anti-reverse" dinucleotide cap analogues (ARCAs) modified at positions C2' and C3' of m⁷Guo were designed and synthesized. Their conformations were determined in solution, as well as their binding affinities for eIF4E, inhibition of *in vitro* translation, degrees of reverse capping during *in vitro* transcription, capping efficiencies, and the ability to stimulate cap-dependent translation when incorporated into mRNA. The results indicated that *e. g.* modifications at C2', like those at C3', prevent reverse incorporation. Some of the newly synthesized ARCAs already appeared as significant tools in protein biotechnology, since their mRNA transcripts translate 2-3 times more efficiently than the mRNAs containing conventional cap.

Synthetic cap analogues were employed to characterize the decapping enzymes (denoted DcpS) from human and nematodes. It was shown that the substrate specificities of DcpS from both species differ significantly. This indicates that the metabolic processes undergo different pathways. It was also shown that translational mechanisms regulated by cap structure are dissimilar in human and nematodes. These observations open a new field for drug design directed against diseases caused by some parasitic nematodes (*Ascaris lumbricoidis*).

2. The crystal structure of the binary complex of trimeric purine nucleoside phosphorylase (PNP) from calf spleen with the acyclic nucleoside phosphonate inhibitor 2,6-diamino-(S)-9-[2-(phosphonomethoxy)propyl]purine ((S)-PMPDAP) was determined at 2.3 Å resolution in the space group $P2_12_12_1$ which, in contrast to the previously described cubic space group $P2_13$, has two independent enzyme trimers in the asymmetric unit. Hence possible differences between monomers forming the biologically active trimer could be detected, if present. These results provide new data for clarifying the mechanism of catalysis and giving reasons for the non-Michaelis kinetics of trimeric PNPs. The studies were performed in cooperation with Institute für Chemie-Kristallographie, Freie Universität Berlin, Germany and Institute of Organic Chemistry and Biochemistry, Academy of Sciences of the Czech Republic.
3. Methods of purification of green fluorescent protein (GFP) and its mutants were developed. For S65T/G67A-GFP mutant, which does not form the chromophore, folding pathway and competition between folding and aggregation were studied by spectroscopic

methods. These studies revealed intermediate - molten globule state in folding and, in lower concentration of denaturant, another intermediate state, which is most prone to aggregation (in cooperation with prof. Patricia Clark, Notre Dame University, USA)

4. The role of key titratable residues, as sources of electrostatic interactions, in complex formation between eIF4E protein and analogues of 5'-end of mRNA, during initiation of protein translation, was explained. This analysis was based on stopped-flow spectrofluorimetric measurements at several pH values, and computer simulation of protonation equilibria in protein-ligand association. A method for performing constant-pH molecular dynamics (MD) simulations, with an implicit solvent and explicit treatment of protonation/deprotonation phenomena, was worked out. Usefulness of this approach was checked using a short peptide derived from ovomucoid third domain (OMTKY3), acetyl-Ser-Asp-Asn-Lys-Thr-Tyr-Gly-amide (residues 26-32 of OMTKY3), and several dicarboxylic acids (succinic acid, glutaric acid, adipic acid and cork acid). A qualitative agreement between predicted and experimental acidic dissociation constants, obtained by this algorithm, indicates that it accurately samples protonation and conformation states of investigated systems.
5. New methods for modelling and interpretation of decays of electronic excited states (singlet and triplet) in biological systems were developed. Biomolecules, particularly proteins and their complexes with ligands, were treated as a complex system existing in a large variety of energetic states corresponding to the interaction of chromophores with the environment, charge transfer and conformational heterogeneity of biomolecules or their dynamical nature. We showed that the underlying reasons for non-exponential intensity decays of emission (fluorescence, phosphorescence) are distribution of characteristic lifetimes of chromophore or time-dependent energy migration processes. It has been shown that, for a given mean value, and assuming only positive values of lifetimes, the gamma lifetime distribution is the most probable one. This led to a power-like decay function (Tsallis q-exponential function), and allows statistical treatment of fluorescence or phosphorescence decays characterized by mean value of lifetime distribution, and a parameter of heterogeneity (q) directly derived from the relative variance of distribution. In the absence of heterogeneity ($q \rightarrow 1$) lifetime distribution becomes a delta distribution and the decay function converges from a power-like form to a single-exponential form. We have also shown that non-exponential fluorescence decay may result from time-dependent energy transport. The latter may be accounted for by electron transport from the excited fluorophore to neighboring residues or the peptide bond carbonyl. We have introduced the time-dependent hopping rate, which, in turn, led to the luminescence decay function with power-like tail, yet another manifestation of the Tsallis nonextensive statistics. Moreover, the power-like tail implies the time hierarchy in energy migration process due to the hierarchical energy-level structure.

Studies on the mechanism of action of human deoxyribonucleoside kinases demonstrated for the first time that inorganic tripolyphosphate (PPP_i) and adenosine-2'(3')-deoxy-3'(2')-triphosphates may act as a phosphate donor, with a donor specificity dependent on acceptor. In striking contrast to ATP, the phosphorylation reaction with PPP_i follows strict Michaelis-Menten kinetics. Pyrophosphate (PP_i , the product) was inactive as phosphate donor, but was a competitive inhibitor vs ATP or PPP_i . Overall results are consistent with PPP_i being the primitive phosphate donor, from which ATP and other NTPs appeared as phosphate donors during evolution.

The acid/base properties of xanthine (Xan, $pK_a=7.5$), its nucleosides and nucleotides, their N-alkyl derivatives and other analogues differ from the corresponding 6-oxopurines guanine (Gua) and hypoxanthine (Hx) in that, at physiological pH, it consists of a $\approx 1:1$ equilibrium mixture of the neutral and monoanionic forms, the latter due to ionisation of N(3)-H, in striking contrast to dissociation of the N(1)-H in both Gua and Hx at higher

pH. In xanthosine (Xao, $pK_a=5.7$) and its nucleotides the xanthine ring is predominantly, or exclusively, a similar monoanion at physiological pH. The foregoing, somewhat surprisingly, been widely overlooked in studies on the properties of these compounds in various enzyme systems and metabolic pathways, enable for the first time to explain the molecular mechanism of substrate activities of both neutral and monoanionic forms of Xan and Xao with purine nucleoside phosphorylases.

Studies on the structure and conformation of the promutagenic N⁴-methoxycytosine in argon or nitrogen low-temperature matrixes led to observation of syn→anti ($\lambda>295$ nm) or anti→syn ($\lambda>335$ nm) photoisomerisation of N⁴-methoxy group relative to the ring nitrogen N(3). Although this reaction concerns rotation of the large methoxy group, it reaches photostationary state, and steric hindrance of the matrix cage do not preclude it.

6. Research carried out by the molecular modelling and bioinformatics research group was focused on development and applications of fast quantum generators of the potential energy function, in particular an Approximate Valence Bond Method, and its application in classical and quantum-classical molecular dynamics simulations of selected enzymatic processes. In parallel, bioinformatics methods have been applied in homology analysis and structure prediction of enzymes involved in phosphorylation processes. Phosphoryl transfer processes are of particular interest, and they are ongoing subject of advanced molecular modelling.

Equipment:

Time-resolved spectrofluorimeters: Fluorolog-3Tau Spex, and System 5000 IBH Consultants Ltd, stopped-flow spectrometer SX.18MV Applied Photophysics Ltd., 4 spectrofluorimeters: LS50B Perkin Elmer, LS55 Perkin Elmer, FluoroMax Spex, and Shimadzu RS5001, ITC calorimeter OMEGA MicroCal Inc., centrifuge Avanti J-20I Beckman-Coulter, 6 UV VIS and 2 IR spectrophotometers, two HPLC chromatography systems Waters, FPLC chromatography system Amersham-Pharmacia, CV-37 Voltammograph Bioanalytical Systems, thermocycler PCR MJ Research Inc., Silicon Graphics workstations and PC computers; open access to: NMR spectrometers, Varian UNITY plus 500 MHz and Varian UNITYplus 400 MHz, CD spectrometer Avis, MS spectrometer Q-Tof2 Micromass, and supercomputer CRAY.

B.Sc. (licentiate) thesis (2003 - 2004)

1. Rafał Dygan, Zastosowanie biocujników w badaniach środowiska (Application of biosensors in environmental studies), 2004, supervisor: dr Elżbieta Bojarska

M.Sc. (magister) theses (2003 - 2004)

1. Piotr Setny, Badanie różnic i podobieństw w oddziaływaniach kinazy CK2 z cząsteczkami ATP i GTP metodami dynamiki molekularnej (Molecular dynamics study of differences and similarities in interactions of ATP and GTP with CK2 kinase), 2003, supervisor: dr hab. Maciej Geller
2. Patrycja Tanaś, Wpływ równowag protonacyjno-dysocjacyjnych enzymu PNP-II z *Escherichia coli* i jego substratów na reakcję fosforolizy nukleozydów purynowych i reakcję odwrotną-syntezy (Effect of association and dissociation of protons in *E. coli* PNP-II and its substrates on phosphorolysis of purine nucleosides and reverse synthetic reaction), 2003, supervisor: dr hab. Borys Kierdaszuk
3. Maciej Dobrzyński, Modelling biochemical networks, 2003, supervisors: dr Peter Rein ten Wolde (Vrije University Amsterdam, The Netherlands), dr Witold Rudnicki (Interdisciplinary Centre for Modelling Warsaw University)

4. Aleksandra Witkiewicz, Studies of kinesin and its mutants with optical trapping methods, 2003, supervisors: prof. Christoph Schmidt (Vrije University Amsterdam, The Netherlands), dr hab. Agnieszka Bzowska
5. Joanna Kwiecińska, Correlated fluctuations in viscoelastic biopolymer solutions: theory and experiments for two-bead microrheology, 2003, supervisors: prof. Christoph Schmidt (Vrije University Amsterdam, The Netherlands), prof. Marek Cieplak (Institute of Physics PAN, Warszawa)
6. Katarzyna Stępnik, Oddziaływanie trimerycznej fosforylasy nukleozydów purynowych (ze śledziona cielęcej) z guaniną - badania metodami spektroskopii emisyjnej i absorpcyjnej UV (Interactions of trimeric purine nucleoside phosphorylase from calf spleen with guanine - studies by means of emission and absorption UV spectroscopy), 2003, supervisor: dr Beata Wielgus - Kutrowska
7. Remigiusz Worch, Badanie mechanizmu oddziaływania kompleksu białkowego CBC z końcem 5' mRNA metodami spektroskopii emisyjnej (Studies of interaction mechanism of the CBC protein complex and mRNA 5' terminus using molecular spectroscopy), 2003, supervisors: prof. Ryszard Stolarski, prof. Edward Darzynkiewicz
8. Joanna Łomnicka-Szczegielniak, Badanie mechanizmów redox chloropochodnych zasad purynowych pod wpływem promieniowania UVC (Study of redox mechanisms of chloro derivatives due to UVC irradiation), 2003, supervisor: dr Elżbieta Bojarska
9. Anna Słowik, Kinetyczne i spektroskopowe badania oddziaływań 8-azapuryn z oksydazą ksantynową (Kinetic and spectroscopic studies of interactions between 8-azapurines and xanthine oxidase), 2004, supervisor: dr Elżbieta Bojarska
10. Łukasz Kniżewski, Annotacje białek w bazie ACLAME (Annotation of proteins in ACLAME basis), 2004, supervisors dr Krzysztof Ginalski (Interdisciplinary Centre for Modelling, Warsaw University), prof. Ryszard Stolarski
11. Renata Rudnicka, Badanie właściwości inhibitorowych 2,6-modyfikowanych zasad purynowych w obecności oksydazy ksantynowej (Investigation of inhibitory properties of purine bases modified at positions 2 and 6 toward xanthine oxidase), 2004, supervisor dr Elżbieta Bojarska
12. Kinga Banach, Odstępstwa od modelu Michaelisa-Menten w reakcji katalizowanej przez oksydazę ksantynową – badania w funkcji pH (Deviations from Michaelis-Menten catalytic model of xanthine oxidase – pH dependence), 2004, supervisor: dr hab. Agnieszka Bzowska
13. Michał Nowakowski, Badania strukturalne NMR w roztworze peptydów opiatowych i fragmentu D101-K137 białka XPA (Structural NMR investigations in solution of opiate peptides and a D101-K137 fragment of XPA protein), 2004, supervisors: dr Jacek Wójcik (Institute of Biochemistry and Biophysics PAN, Warszawa), prof. Ryszard Stolarski

Ph. D. (doctor) theses (2003 - 2004)

1. Anna Niedźwiecka, Thermodynamic analysis of interaction of eIF4E protein with mRNA 5' cap structure and 4E-BP1 and eIF4G protein fragments, 2003, supervisor: dr hab. Ryszard Stolarski

D. Sc. (dr hab., habilitation) theses (2003 - 2004)

1. Agnieszka Bzowska, Struktura trójwymiarowa i molekularny mechanizm katalizy białek z rodziny fosforylaz nukleozydów purynowych (PNP) (3D structure and mechanism of enzymatic catalysis of proteins from purine nucleoside phosphorylase (PNP) family), 2003

PUBLICATIONS (2003 - 2004)

1. A. Jabłonowska et al., Alzheimer's disease Abeta peptide fragment 10-30 forms a spectrum of metastable oligomers with marked preference for N to N and C to C monomer terminiproximity, *JOURNAL OF MOLECULAR BIOLOGY* 344 (2004) 1037, coauthors: M. Dadlez
2. T. Grycuk et al., A model for furcate septal increase in a triassic scleractiniamorph, *ACTA PALEONTOLOGICA POLONICA* 49 (2004) 529, coauthors: J. Stolarski, E. Roniewicz
3. J. Żuberek et al., Binding studies of eukaryotic initiation factor eIF4E with novel mRNA dinucleotide cap analogues, *NUCLEOSIDES NUCLEOTIDES & NUCLEIC ACIDS* 22 (2003) 1703, coauthors: J. Jemielity, J. Stępiński, M. Lewdorowicz, A. Niedźwiecka, D. Haber, R. Stolarski, E. Darzynkiewicz,
4. M. Luic et al., Calf spleen purine nucleoside phosphorylase: crystal structure of the binary complex with a potent multisubstrate analogue inhibitor, *ACTA CRYSTALLOGRAPHICA SECTION D - BIOLOGICAL CRYSTALLOGRAPHY D* 60 (2004) 1417, coauthors: M. Bzowska
5. Y. Yoffe et al., Cap-binding activity of an eIF4E homolog from *Leishmania*, *RNA* 10 (2004) 1764, coauthors: J. Żuberek, M. Lewdorowicz, M. Jankowska-Anyszka, J. Stępiński, E. Darzynkiewicz
6. Ł. Walewski et al., Fast QM/MM method and its application to molecular systems, *CHEMICAL PHYSICS LETTERS* 397 (2004) 451, coauthors: B. Lesyng
7. J. Kalinowski et al., Class IV charge model for the self-consistent charge density – functional tight – binding model, *JOURNAL OF PHYSICAL CHEMISTRY* 108 (2004) 2545, coauthors: B. Lesyng
8. M. Lewdorowicz et al., Chemical synthesis and binding activity of the trypanosomatid cap-4 structure, *RNA* 10 (2004) 1469, coauthors: J. Żuberek, J. Jemielity, J. Stępiński, R. Stolarski, M. Shapira, E. Darzynkiewicz
9. M. Garstka et al., Chloroplast structure, chlorophyll-protein complexes and polypeptide composition in plants with different susceptibility to dark-chilling stress, *CELLULAR & MOLECULAR BIOLOGY LETTERS* 9 (2004) 70, coauthor: B. Kierdaszuk
10. M. Długosz, J. Antosiewicz, Constant-pH molecular dynamics simulations: a test case of succinic acid, *CHEMICAL PHYSICS* 302 (2004) 161
11. M. Długosz et al., Constant-pH molecular dynamics study of protonation-structure relationship in a heptapeptide derived from ovomucoid third domain, *PHYSICAL REVIEW* 69 (2004) 1, coauthors: J. Antosiewicz
12. S. Lall et al., Contribution of trans-splicing, 5(prim)-Leader Lehigh, Cap-Poly(A) synergism, and initiation factors to nematode translation in an *Ascaris suum* embryo Cell-free system, *JOURNAL OF BIOLOGICAL CHEMISTRY* 279 (2004) 45573, coauthors: M. Jankowska-Anyszka, J. Stępiński, E. Darzynkiewicz
13. N. Davezac et al., Global proteomic approach unmasks involvement of keratins 8 and 18 in the delivery of cystic fibrosis transmembrane conductance regulator (CFTR)/DELTA508 CFTR to the plasma membrane, *PROTEOMICS* 4 (2004) 3833, coauthors: M. Dadlez
14. J. Włodarczyk et al., Identification of the tautomeric form of formycin A in its complex with *Escherichia coli* purine nucleoside phosphorylase based on the effect of enzyme–ligand binding on fluorescence and phosphorescence, *EUROPEAN BIOPHYSICS JOURNAL WITH BIOPHYSICS LETTERS* 33 (2004) 377, coauthors: G. Galitonov, B. Kierdaszuk

15. J. Żuberek et al., Influence of electric charge variation at residues 209 and 159 on the interaction of eIF4E with the mRNA 5'(prim) terminus, *BIOCHEMISTRY* 43 (2004) 5370, coauthors: J. Jemielity, J. Stępiński, M. Dadlez, R. Stolarski, E. Darżynkiewicz
16. J. Wierzchowski et al., Interactions of calf spleen purine nucleoside phosphorylase with 8 azaguanine, and a bisubstrate analogue inhibitor: implications for the reaction mechanism, *ZEITSCHRIFT FÜR NATURFORSCHUNG C* 59c (2004) 713, coauthors: M. Bzowska, K. Stępiński, D. Shugar
17. J. Włodarczyk, B. Kierdaszuk, Kinetics of triplet excitation transport in disordered organic solids, *CHEMICAL PHYSICS* 297 (2004) 139
18. L. Cohen et al., Nematode m7GpppG and m(3)2,2,7GpppG decapping: Activities in *Ascaris* embryos and characterization of *C. elegans* scavenger DcpS, *RNA* 10 (2004) 1609, coauthors: M. Jankowska-Anyszka, J. Stępiński, E. Darżynkiewicz
19. E. Grudzień et al., Novel cap analogs for in vitro synthesis of mRNAs with high translational efficiency, *RNA* 10 (2004) 1479, coauthors: J. Stępiński, M. Jankowska-Anyszka, R. Stolarski, E. Darżynkiewicz.
20. J. Włodarczyk, B. Kierdaszuk, Origin of non-exponential fluorescence decays in enzyme ligand complex, in: *PROGRESS IN BIOMEDICAL OPTICS AND IMAGING (VOL. 5) COMPLEX DYNAMICS, FLUCTUATIONS, CHAOS AND FRACTALS IN BIOMEDICAL PHOTONICS* (V.V. Tuchin Ed.) Proceedings of SPIE, 5330, (2004) 92.
21. L. Lapinski et al., Photochemical syn-anti isomerization reactions in N4-methoxycytosines. A matrix isolation study *JOURNAL OF PHOTOCHEMISTRY AND PHOTOBIOLOGY A CHEMISTRY* 163 (2004) 489, coauthor: B. Kierdaszuk
22. M. Długosz, J. Antosiewicz, pK_as in dicarboxylic acids by constant-pH molecular dynamics simulations, *ZEITSCHRIFT FÜR NATURFORSCHUNG SECTION A* 59a (2004) 873
23. E. Romanowska et al., The biochemical and functional properties of thylakoid protein complexes from mesophyll and bundle sheath chloroplasts of three types of C4 plants *CELLULAR & MOLECULAR BIOLOGY LETTERS* 9 (2004) 45, coauthors: B. Kierdaszuk
24. A. Niedźwiecka et al., Thermodynamics of mRNA 5 cap binding by eukaryotic translation initiation factor eIF4E, *BIOCHEMISTRY* 43 (2004) 13305, coauthors: E. Darżynkiewicz, R. Stolarski
25. David Shugar, Preface of 3rd International Conference on Inhibitors of protein Kinases, *BIOCHIMICA ET BIOPHYSICA ACTA - PROTEINS and PROTEOMICS* 1697 (2004) 1
26. D. Laurents et al., Charge-charge interactions are key determinants of the pK values of ionizable groups in ribonuclease Sa (pI=3.5) and a basic variant (pI=10.2), *JOURNAL OF MOLECULAR BIOLOGY* 325 (2003) 1077, coauthors: J. Antosiewicz
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29. G. Koellner et al., Crystal structure of calf spleen purine nucleoside phosphorylase in a complex with multisubstrate analogue inhibitor with 2,6-diaminopurine aglycone, *NUCLEOSIDES NUCLEOTIDES & NUCLEIC ACIDS* 22 (2003) 1699, coauthors G. Raszewski, M. Bzowska

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42. B. Huyghues-Despointes et al., pK values of histidine residue in ribonuclease Sa: Effect of salt and set charge, *JOURNAL OF MOLECULAR BIOLOGY* 325 (2003) 1093 coauthors: J. Antosiewicz
43. M. Wojciechowski et al., Prediction of secondary ionization of the phosphate group in phosphotyrosine peptides, *BIOPHYSICAL JOURNAL* 84 (2003) 750, coauthors: T. Grycuk, J. Antosiewicz, B. Lesyng,
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48. R. Stolarski, Thermodynamics of specific protein-RNA interactions, *ACTA BIOCHIMICA POLONICA* 50 (2003) 297
49. E. Kulikowska, *ACTA BIOCHIMICA POLONICA* 51 (2004) 493, coauthors: B. Kierdaszuk, D. Shugar

INVITED TALKS (2003 - 2004)

1. M. Dadlez, Analysis of differentially displayed proteins in HeLa cells expressing CFTR and delta 508 CFTR, HUPO World Congress, Montreal, Canada, October 2003
2. B. Kierdaszuk, Interpretation of fluorescence decays: from a sum of discrete exponentials to continuous lifetime distributions, 10th European Conference on Spectroscopy of Biological Molecules, Szeged, Hungary, August-September 2003
2. E. Darzynkiewicz, Role of mRNA 5' cap structure in regulation of gene expression in eukaryots, Workshop on Structure and Function of Biomolecules, Będlewo/Poznań, Poland, May 2004
3. J. Antosiewicz, Impact of protonation equilibria on protein structure and function, Workshop on Structure and Function of Biomolecules, Będlewo/Poznań, Poland, May 2004
4. B. Lesyng, CM3/SCC-DFTB charges, generalized Born and hydrophobic models in description of hydration free energies, Protein Structure Prediction and Protein Folding: Past, Present, and Perspectives, Gdansk, Poland, September 2004
5. B. Lesyng, Selected microscopic and mesoscopic modelling tools and models - an Overview, Modelling and Design of Molecular Materials, Wrocław, Poland, September 2004
6. B. Lesyng, Modelling and understanding complex biomolecular systems and processes: Applications in Nanosciences, Biotechnology and Biomedicine, Converging Sciences, Trento, Italy, December 2004
7. B. Kierdaszuk, Protein (enzyme) - ligand (substrate, inhibitor) recognition and binding, Workshop on Structure and Function of Biomolecules Będlewo/Poznań, Poland, May 2004
8. B. Kierdaszuk, Origin of non-exponential fluorescence decays in enzyme-ligand complex, SPIE International Biomedical Optics Symposium, Photonics West 2004, San Jose, California, USA, January 2004
9. M. Dadlez, Analysis of differentially displayed proteins in HeLa cells expressing CFTR and delta 508 CFTR, HUPO World Congress, Montreal, Canada, October 2003

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Scientific Staff - 13 persons

ETA (Engineers, Technicians, Administration) : 5 persons

Number of grants in 2003-2004: 4

SCIENTIFIC ACTIVITY

Areas of scientific activity:

Mechanisms of nucleus-nucleus collisions at 10 MeV/nucleon - 2 GeV/nucleon.

Structure of transitional and superdeformed nuclei.

Statistical and nonstatistical gamma emissions in heavy-ion collisions and bremsstrahlung studies.

Properties of short lived nuclei produced in the WIGISOL separator.

Application of nuclear physics in medicine.

Main achievements:

1. A complete systematics of excitation functions and system size dependencies of global stopping and side flow for heavy ion reactions in the energy range between 0.09A and 1.93A GeV was studied. Our data show that the degree of stopping remain significantly below the expectations of a full stopping scenario and is highly correlated to the amount of side flow.
2. Systematic studies of cluster production in central collisions for symmetric systems ranging from $A = 40$ to $A = 197$ at 0.4A GeV incident beam energy. It was found that the multiplicity of clusters with charge $Z \geq 3$ grows quadratically with the system total charge and is associated with the midrapidity source with increasing transverse velocity fluctuations. The results, as well as simulations using quantum molecular dynamics, suggest a collision process where droplets, i.e. nucleon clusters, are created in an expanding, gradually cooling, nucleon gas.
3. Analysis of the Ta+Au reaction at 40A MeV provided a clear separation of two components of hard photons: direct and quasi-thermal. The slopes of the spectra change slightly with the impact parameter. HBT analysis of bremsstrahlung photon pairs lead to the observation of the interferometry signal only for central collisions. This observation might be understood, if the time span between direct and quasi-thermal emission of photons is about 170 fm/c.
4. Angular distributions of subthreshold neutral pions produced in 60A MeV and 90A MeV Ar-induced reactions were obtained and well described within a simple model of pion

reabsorption in nuclear matter. The value of $A_2 = 0.32$ parameter has been determined for the angular distribution of primordial pions $1+A_2 P_2(\cos \theta)$.

5. A method of estimating cross sections for the synthesis of super-heavy nuclei by fusion reactions was developed. This method was tested on 12 experimentally measured one-neutron-out fusion excitation functions resulting in production of elements with $Z=102,103\dots,112$. Predictions and experimental data are in a very good agreement.
6. Twenty-eight E2 matrix elements have been determined in ^{104}Ru from the multiple Coulomb excitation. The data were compared with results of calculations done in the framework of the microscopic quadrupole plus pairing collective model formulated by the Lublin - Warsaw theoretical groups collaboration. Excellent agreement of the experimental data with theoretical calculations without any free parameters was obtained.
7. The lifetime of levels in ^{132}La (the first lifetimes measurement in nuclei for which the presence of chiral bands is suggested) and ^{128}Cs have been measured in beam of the Warsaw University Cyclotron using the Doppler Shift Attenuation method. The absolute M1 and E2 transition probabilities have been deduced. Conclusions: the ^{132}La nucleus is not a good example of the chiral symmetry breaking. In ^{128}Cs the electromagnetic properties and level scheme are much closer to the chiral interpretation than the case of ^{132}La . The level scheme alone can not be used as an indicator of chirality.
8. Identification of octupole excitations in neutron - rich Xe and Cs nuclei, pseudo-spin band and signature inversion in the semidecoupled band in odd-odd nucleus ^{172}Lu and the 9/2 [404] neutron-hole excitations in neutron-rich nuclei in the mass $A \sim 100$ region.
9. Investigations of lifetimes in dipole bands of ^{141}Eu and ^{142}Gd . It was shown that they can be interpreted as magnetic rotational bands.
10. Experimental studies of the Giant Dipole Resonance (GDR) in highly excited $^{36}\text{Ar}^*$ nuclei by $^{12}\text{C} + ^{24}\text{Mg}$ reaction at about 4 MeV/u allowed to extract an isospin mixing coefficient for ^{36}Ar compound nuclei at excitation energy of 49 MeV, $\alpha_s^2 = 0.12 \pm 0.05$. Our result compared with values obtained earlier for lighter nuclei (^{28}Si , ^{32}S) at the same excitation energy suggests that isospin mixing increases with increasing mass and charge of the nucleus.
11. After test experiments at the IGISOL (ION Guide & Isotope Separator On Line) device a series of improvements have been introduced. A new diagnostic system for the ion beams is used and a new gas cell was constructed with special care for conservation of laminar helium flow. The efficiency of the system is investigated by using the α -decay recoil products of ^{223}Ra and compared with the simulation results calculated by using a program FLUENT. In on-line experiments the heavy-ion reaction $^{14}\text{N} + ^{209}\text{Bi}$ was studied. The search for isomers in nuclei beyond lead is performed.
12. The radiobiological effects caused by charged ^{12}C heavy ions in living cells were studied at the Warsaw Cyclotron. Thin samples were irradiated by horizontal beam of 120 MeV ions with uniform dose distribution at the irradiated target. Determination of the optimal doses and exposure times that yield enough mitotic cells for scoring of chromosomal aberrations is the goal of the project.

B. Sc. (licentiate) thesis (2003 - 2004)

1. Ewa Hryń, Nowe układy planetarne (New planetary systems), 2003, supervisor: dr hab. Mirosław Kozłowski
2. Jacek Kowalczyk, Historia równania $E = mc^2$ (The history of $E = mc^2$ equation), 2003, supervisor: dr hab. Mirosław Kozłowski

3. Dorota Mitura, Zastosowanie szczególnej teorii względności w reakcjach ciężkojonowych (The application of special theory of relativity in heavy-ion reactions), 2003, supervisor: dr hab. Mirosław Kozłowski
4. Marcin Sadowski, Przygotowanie i wdrożenie oprogramowania do analizy rozkładów kątowych promieniowania γ rejestrowanego za pomocą układu wielodetektorowego EUROBALL (Creation and practical implementation of the software to analyse angular distributions of γ -radiation registered with the help of the EUROBALL multidetector setup), 2003, supervisor: prof. dr hab. Teresa Rząca-Urban
5. Jacek Barwiski, Strona internetowa Dydaktycznej Pracowni Promieniotwórczości (Web page of the NPD Educational Laboratory of Radioactivity), 2004, supervisor: dr Piotr Jaracz
6. Katarzyna Krupska, Detekcja fotonów anihilacyjnych w detektorze PET - symulacja Monte Carlo (Detection of annihilation γ -rays in PET detector - Monte Carlo simulation), 2004, supervisor: dr hab. Zygmunt Szepliński

M. Sc. (magister) thesis (2003 - 2004)

1. Ewelina Gruszczyńska, Produkcja izotopów dla diagnostyki medycznej w cyklotronie o wysokim prądzie wiązki (Isotope production for medical diagnostics conducted in high-current-beam cyclotron), 2003, supervisor: dr hab. Zygmunt Szepliński
2. Izabela Skwira, Fuzja ciężkich układów jądrowych - prawdopodobieństwo przetrwania (The fusion of heavy nuclear systems - survival probability), 2003, supervisor: prof. dr hab. Krystyna Siwek-Wilczyńska
3. Iwona Zalewska, Badanie stanów wzbudzonych ^{130}La (Investigation of excited states ^{130}La), 2003, supervisor: dr hab. Tomasz Morek
4. Robert Moruś, Badanie emisji wysokoenergetycznych kwantów γ z reakcji $^{20}\text{Ne} + ^{12}\text{C}$ przy energii pocisku 9.5 MeV/u (The investigation of high-energy γ -quanta from the $^{20}\text{Ne} + ^{12}\text{C}$ reaction at 9.5 MeV/u projectile energy), 2003, supervisor: prof. dr hab. Marta Kicińska-Habior
5. Maciej Mazanka, Kanałowanie jonów w monokryształach UO_2 i GaN (The channelling of ions in UO_2 and GaN monocrystals), 2004, supervisor: prof. dr hab. Krystyna Siwek-Wilczyńska, dr Lech Nowicki (Institute for Nuclear Studies)
6. Magdalena Maria Zasiewska, Poszukiwanie nowych stanów wzbudzonych w neutronowo-nadmiarowych jądrach z obszaru $A \approx 100$ (Search for new excited states in neutron-rich nuclei from $A \approx 100$ mass region), 2004, supervisor: dr hab. Teresa Rząca-Urban

Ph. D (doctor) thesis (2003 - 2004)

1. Marcin Smolarkiewicz, Poszukiwanie i badanie intermitencji w reakcji $\text{Au} + \text{Au}$ w zakresie energii pocisków 150-800 AMeV (The search for and investigation of intermittency in $\text{Au} + \text{Au}$ reaction in the 150 - 800 AMeV), 2003, supervisor: prof. dr hab. Krystyna Siwek-Wilczyńska

PUBLICATIONS (2003 - 2004)

1. A. Andronic et al., Directed flow in $\text{Au}+\text{Au}$, $\text{Xe}+\text{CsI}$, and $\text{Ni}+\text{Ni}$ collisions and the nuclear equation of state, *PHYS. REV. C* 67 (2003) 034907, coauthors: M. Kirejczyk, B. Sikora, K. Siwek-Wilczyńska, Z. Tymiński, K. Wiśniewski

2. H. Clement et al., Two-pion production in nucleon-nucleon collisions. Meson 2002: 7th International Workshop on Production. Properties and Interaction of Mesons: Cracow, Poland 24-28 May 2002. WORLD SCIENTIFIC (2003) 281, coauthors: A. Turowiecki, Z. Wilhelmi
3. E. Doroshkevich et al., Study of baryon and search for dibaryon resonances by the $pp \rightarrow pp\pi^+\pi^-$ reaction, EUR. PHYS. J. A 18 (2003) 171, coauthors: A. Turowiecki, Z. Wilhelmi
4. E. Grodner et al., Behaviour of B (E2) for the $h_{11/2}$ band transitions in ^{131}La , ACTA PHYS. POL. B 34 (2003) 2447, coauthors: Ch. Droste, T. Morek, J. Srebrny
5. J. Iwanicki et al., Electromagnetic properties of ^{165}Ho inferred from Coulomb excitation, JOURNAL OF PHYSICS G: NUCLEAR AND PARTICLE PHYSICS 29 (2003) 743, coauthor: J. Srebrny
6. M. Jacewicz et al., Report in the charged decay products identification possibilities in WASA, PHYS. SCRIPTA T 104 (2003) 98, coauthors: A. Turowiecki, Z. Wilhelmi
7. I. Koch et al., First results of the CELSIUS/WASA experiment, PHYS. SCRIPTA T 104 (2003) 29, coauthors: A. Turowiecki, Z. Wilhelmi
8. C. Lau et al., Recent studies to improve release properties from thick isotope separator on-line fission targets, NUCL. INSTR. AND METH. IN PHYS. RES. B 204 (2003) 246, coauthor: A. Wojtasiewicz
9. M. Loewe et al., Collective vibrations built on the $K^\pi = 9^-$ high-spin isomer in ^{180}Ta , PHYS. LETT. B 551 (2003) 71, coauthor: J. Srebrny
10. A. Mangiarotti et al., Sub-threshold ϕ -meson yield in central $^{58}\text{Ni} + ^{58}\text{Ni}$ collisions, NUCL. PHYS. A 714 (2003) 89, coauthors: M. Kirejczyk, B. Sikora, K. Siwek-Wilczyńska, K. Wiśniewski
11. J. Marciak-Kozłowska, M. Kozłowski, Thermal conduction in one dimensional structures heated by ultra-short laser pulses, LASERS IN ENGINEERING 13 (2003) 101
12. J. Marciak-Kozłowska, M. Kozłowski, Thermal transport induced by ultra-short laser pulses in molecular nanomaterials, LASERS IN ENGINEERING 13 (2003) 107
13. Z. Marcinkowska et al., Magnetic rotation in the nucleus ^{141}Eu , ACTA PHYS. POL. B 34 (2003) 2319, coauthors: T. Rząca-Urban, Ch. Droste, T. Morek, B. Czajkowska, R. Marcinkowski
14. J. Pätzold et al., The $pp \rightarrow pp\pi^+\pi^-$ reaction studied in the low-energy tail of the Roper resonance, PHYS. REV. C 67 (2003) 052202, coauthors: A. Turowiecki, Z. Wilhelmi
15. K. Siwek-Wilczyńska, I. Skwira, J. Wilczyński, Barrier distributions and systematics of fusion - and capture cross sections, ACTA PHYS. POL. B 34 (2003) 1867
16. W. J. Świątecki, K. Siwek-Wilczyńska, J. Wilczyński, Fusion by diffusion, ACTA PHYS. POL. B 34 (2003) 2049
17. W. Urban et al., First observation of the $\nu 9/2[404]$ orbital in the $A \sim 100$ mass region, EUR. PHYS. J. A 16 (2003) 11, coauthors: T. Rząca-Urban, A. Złomaniec
18. W. Urban et al., The strength of octupole correlations in neutron-rich Xe isotopes, EUR. PHYS. J. A 16 (2003) 303, coauthor: T. Rząca-Urban
19. Ts. Venkova et al., Delayed crossing in the $\pi h_{9/2} 1/2^- [541]$ band of ^{173}Lu , EUR. PHYS. J. A 18 (2003) 577, coauthor: T. Rząca-Urban
20. Ts. Venkova et al., Pseudo-spin band in the odd-odd nucleus ^{172}Lu , EUR. PHYS. J. A 18 (2003) 1, coauthor: T. Rząca-Urban
21. M. Wolińska-Cichocka et al., In-beam spectroscopy of nuclei produced in the $^{98}\text{Mo} (^{16}\text{O}, xn)$ reaction, ACTA PHYS. POL. B 34 (2003) 2305, coauthors: Ch. Droste, M. Kowalczyk, T. Morek, J. Srebrny

22. E. Wójcik et al., High-energy γ -ray emission studies with Janosik set-up in $^{20}\text{Ne}+^{12}\text{C}$ at 5.2 MeV/u, ACTA PHYS. POL. B 34 (2003) 2399, coauthors: M. Kicińska-Habior, O. Kijewska, M. Kowalczyk
23. M. Würkner et al., Coulomb excitation and structure of the rotational bands in ^{231}Pa , NUCL. PHYS. A 725 (2003) 3, coauthor: J. Srebrny
24. K. Zając et al., Collective quadrupole excitations of transactinide nuclei, ACTA PHYS. POL. B 34 (2003) 1789, coauthor: J. Srebrny
25. J. Złomańczuk et al., Kinematically complete measurement of the $\text{pd} \rightarrow \text{pd}\eta$ reaction, PHYSICA SCRIPTA T 104 (2003) 84, coauthors: A. Turowiecki, Z. Wilhelmi
26. N. Bastid et al., Shape parameters, of the participant source in Ru + Ru collisions at 400 A MeV, NUCL. PHYS. A 742 (2004) 29, coauthors: M. Kirejczyk, B. Sikora, K. Siwek-Wilczyńska, M. M. Smolarkiewicz, I. J. Soliwoda, Z. Tymiński, K. Wiśniewski
27. R. Bilger et al., Measurement of the $\text{pd} \rightarrow \text{pd} \eta$ cross section in complete kinematics, PHYS. REV. C 69 (2004) 014003, coauthors: A. Turowiecki, Z. Wilhelmi
28. Ch. Droste et al., Description of ^{111}Ru within the Core-Quasiparticle Coupling model, EUR. PHYS. J. A 22 (2004) 179, coauthors: J. Srebrny, T. Morek
29. E. De Filippo et al., Dynamical aspects of fragment productions in the reactions $^{124}\text{Sn}+^{64}\text{Ni}$ and $^{112}\text{Sn}+^{58}\text{Ni}$ at 35 A MeV. Proceedings of the IWM2003 "International Workshop on Multifragmentation and Related Topics". TIPOLITOGRAFIA DEI F.LLI BONANNO VALVERDE (2004) 121, coauthors: K. Siwek-Wilczyńska, I. Skwira
30. E. Grodner et al., DSAM lifetime measurements in the yrast band of ^{131}La and the chiral bands in ^{132}La , INTERNATIONAL JOURNAL OF MODERN PHYSICS E 13 (2004) 243, coauthors: J. Srebrny, Ch. Droste, T. Morek
31. N. Herrmann, K. Wiśniewski, Hadronic matter properties from the reaction studies at SIS, ACTA PHYS. POL. B 35 (2004) 1091
32. M. Kicińska-Habior et al., Giant dipole radiation and isospin purity in highly excited ^{32}S nuclei, NUCL. PHYS. A 731 (2004) 138, coauthors: E. Wójcik, O. Kijewska, M. Kowalczyk
33. M. Kirejczyk, On the invariance of scaled factorial moments when original distribution is folded with the binomial, ACTA PHYS. POL. B 35 (2004) 2425
34. M. Kmiecik et al., Probing nuclear shapes close to the fission limit with the giant dipole resonance in ^{216}Rn , PHYS. REV. C 70 (2004) 064317, coauthor: M. Kicińska-Habior
35. A. J. Kordyasz et al., Monolithic silicon E – ΔE telescope produced by the quasi-selective epitaxy, NUCL. INSTR. AND METH. IN PHYS. RES. A 528 (2004) 721, coauthor: M. Kowalczyk
36. A. J. Kordyasz et al., Response to heavy ions and fission fragments of the monolithic silicon E- ΔE telescopes produced by the Quasi-Selective Epitaxy, NUCL. INSTR. AND METH. IN PHYS. RES. A 530 (2004) 87, coauthor: M. Kowalczyk
37. R. M. Lieder et al., Investigations of the level scheme of ^{144}Gd and lifetimes in the quadrupole bands, EUR. PHYS. J. A 21 (2004) 37, coauthor: T. Rząca-Urban
38. A. Maj et al., Evidence for the Jacobi shape transition in hot ^{46}Ti , NUCL. PHYS. A 731 (2004) 319, coauthor: M. Kicińska-Habior
39. A. Maj et al., A study of the Jacobi shape transition in light, fast rotating nuclei with the EUROBALL IV, HECTOR and EUCLIDES arrays, AIP CONFERENCE PROCEEDINGS 701 (2004) 104, coauthor: M. Kicińska-Habior
40. A. Maj et al., Search for the Jacobi shape transition in light nuclei, EUR. PHYS. J A 20 (2004) 165, coauthor: M. Kicińska-Habior
41. T. Materna et al., Tracking dissipation in capture reactions, INTERNATIONAL JOURNAL OF MODERN PHYSICS E 13 (2004) 285, coauthor: K. Siwek - Wilczyńska

42. A. Pagano et al., Fragmentation studies with the CHIMERA detector at LNS in Catania: recent progress, NUCL. PHYS. A 734 (2004) 504, coauthors: K. Siwek-Wilczyńska, I. Skwira
43. E. O. Podsvirova et al., Investigation of lifetimes in dipole bands of ^{141}Eu , EUR. PHYS. J. A 21 (2004) 1, coauthors: Ch. Droste, T. Morek, T. Rząca-Urban
44. G. Politi et al., Present status of the CHIMERA-ISOSPIN experiment. Proceedings of the IWM2003 "International Workshop on Multifragmentation and Related Topics". TIPOLITOGRAFIA DEI F.LLI BONANNO VALVERDE (2004) 95, coauthors: K. Siwek-Wilczyńska, I. Skwira
45. W. Reisdorf et al., Nuclear stopping from 0.09A to 1.93A GeV and its correlation to flow, PHYS. REV. LETT. 92 (2004) 232301, coauthors: M. Kirejczyk, Z. Tymiński, B. Sikora, K. Siwek-Wilczyńska, K. Wiśniewski
46. W. Reisdorf et al., Droplet formation in expanding nuclear matter: a system-size dependent study, PHYS. LETT. B 595 (2004) 118, coauthors: M. Kirejczyk, B. Sikora, K. Siwek-Wilczyńska, Z. Tymiński, K. Wiśniewski
47. K. Siwek-Wilczyńska, J. Wilczyński, Empirical nucleus-nucleus potential deduced from fusion excitation functions, PHYS. REV. C 69 (2004) 024611
48. M. M. Smolarkiewicz, M. Kirejczyk, B. Sikora, K. Siwek-Wilczyńska, I. J. Soliwoda - Poddany, Intermittency in Au + Au collisions below 1A GeV. Can it be reproduced by IQMD simulations?, ACTA PHYS. POL. B 35 (2004) 1151
49. G. Stoicea et al., Azimuthal dependence of collective expansion for symmetric heavy-ion collisions, PHYS. REV. LETT. 92 (2004) 072303, coauthors: M. Kirejczyk, B. Sikora, K. Siwek-Wilczyńska, K. Wiśniewski
50. W. J. Świątecki, K. Siwek-Wilczyńska, J. Wilczyński, Calculations of cross sections for the synthesis of super-heavy nuclei in cold fusion reactions, INTERNATIONAL JOURNAL OF MODERN PHYSICS E 13 (2004) 261
51. L. Świdorski et al., How many fusion barriers?, INTERNATIONAL JOURNAL OF MODERN PHYSICS E 13 (2004) 315, coauthors: M. Kowalczyk, K. Piasecki
52. W. Urban et al., The $\nu_{9/2}$ [404] orbital and the deformation in the $A \sim 100$ region, EUR. PHYS. J. A 22 (2004) 241, coauthors: T. Rząca-Urban, A. Złomaniec
53. W. Urban et al., New bands and spin-parity assignments in ^{111}Ru , EUR. PHYS. J. A 22 (2004) 231, coauthors: T. Rząca-Urban, Ch. Droste
54. W. Urban et al., First observation of excited states in the ^{110}Mo nucleus, EUR. PHYS. J. A 20 (2004) 381, coauthor: T. Rząca-Urban
55. W. Urban et al., Observation of octupole excitations in ^{141}Cs and ^{143}Cs nuclei, PHYS. REV. C 69 (2004) 017305, coauthor: T. Rząca-Urban
56. W. Urban et al., Near-yrast, medium-spin structure of the ^{107}Tc nucleus, PHYS. REV. C 70 (2004) 057308, coauthor: T. Rząca-Urban
57. W. Urban et al., New spins for ground states and isomers in ^{115}Pd and ^{117}Pd , EUR. PHYS. J. A 22 (2004) 157, coauthors: A. Złomaniec, T. Rząca-Urban
58. A. Wojtasiewicz et al., Investigation of a gas catcher/ion guide system at the Warsaw cyclotron, NUCL. PHYS. A 746 (2004) 663c, coauthor: S. Sidor
59. Ts. Venkova et al., Signature inversion in the semidecoupled $\pi h_{9/2} \otimes \nu i_{13/2}$ band of the odd-odd nucleus ^{172}Lu , EUR. PHYS. J. A 20 (2004) 375, coauthor: T. Rząca-Urban

BOOKS (2003 - 2004)

1. T. Matulewicz, E. Skrzypczak, Kinematyka relatywistyczna w zadaniach (Problems in relativistic kinematics), ZAKŁAD GRAFICZNY UW 2003

INVITED TALKS (2003 - 2004)

1. Marta Kicińska-Habior, Giant dipole radiation and isospin purity in highly excited ^{32}S nuclei, International Conference in Collective Motion in Nuclei Under Extreme Conditions (COMEX 1), Paris, France, June 2003
2. Tomasz Matulewicz, Particle production in proton-nucleus and nucleus-nucleus collisions at beam energy around 200A MeV, Colloquium of the Polish Physical Society, Jagiellonian University, Cracow, Poland, May 2003
3. Tomasz Matulewicz, Outlook towards future Polish participation in the new accelerator facility at Darmstadt, Polish-German Meeting in the New International Accelerator Facility at Darmstadt, Warsaw, Poland, November 2003
4. Teresa Rząca-Urban, Niezwykłe własności wirujących jąder (Unusual properties of rotating atomic nuclei), Polish Physical Society, Lodz, Poland, March 2003
5. Krystyna Siwek-Wilczyńska, How can we predict fusion/capture cross sections, DEMON Meeting, Strausbourg, France, December 2003
6. Krzysztof Wiśniewski, Particle identification in the CBM detector, Polish - German Meeting on the New International Accelerator Facility at Darmstadt, Warsaw, Poland, November 2003
7. Marta Kicińska-Habior, Isospin Mixing at High Temperatures, XXXIX Zakopane School of Physics, Zakopane, Poland, August-September 2004
8. Julian Srebrny, DSAM lifetime measurements on-beam of the Warsaw Cyclotron as a Test of Chirality, XXXIX Zakopane School of Physics, Zakopane, Poland, August - September 2004
9. Krzysztof Wiśniewski, FOPI - experimental setup and sample results, Mini-workshop on Kaonic Nuclear Clusters, Vienna, Austria, February 2004
10. Krzysztof Wiśniewski, FOPI@GSI - program and perspectives, International Workshop on Future of Nuclear Collisions at High Energies, Kielce, Poland, October 2004

INTERNATIONAL CONFERENCES ORGANIZED BY THE DIVISION (2003 - 2004)

1. XXVIII Mazurian Lakes School of Physics, „Atomic nucleus as a laboratory for fundamental processes”, Krzyże, Poland, August-September, 2003, chairman: Ziemowid Sujkowski, co-organized by the Andrzej Sołtan Institute for Nuclear Studies and the Warsaw University
2. 6th ANKE Collaboration Workshop on „Strangeness Production on nucleons and nuclei”, Krzyże, Poland, September, 2003, co-organized by the Andrzej Sołtan Institute for Nuclear Studies and the Warsaw University

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Scientific staff - 11 persons

ETA (Engineers, Technicians, Administration) - 8 persons (5 on 5-th EU grants)

Number of grants in 2003 - 2004: 7

SCIENTIFIC ACTIVITY

Areas of scientific activity:

Properties of the very exotic, far from stability nuclei, isomerism of exotic nuclei. Properties of $N = Z$ nuclei. Investigation of ways of their decay including:- ground state proton, beta, beta delayed proton and alpha decay, isomeric transitions. Nuclear structure close to the doubly-magic systems: ^{56}Ni , ^{78}Ni , ^{100}Sn , ^{132}Sn and ^{208}Pb . Nuclear structure close to "r" path. Nuclear deformation (e.g. octupole deformed nuclei). Properties of nuclear barriers.

Collaboration links:

Experiments at the nuclear-research centres in Caen (GANIL), Darmstadt (GSI), Geneva (CERN/ISOLDE), Catania (INF), Madrid (IEM CSIC) and Oak Ridge (ORNL) as well as at the university laboratories in Jyväskylä, Louvain-la-Neuve, Strasbourg, Manchester and Uppsala (INF Studsvik). First experiments at the Warsaw cyclotron.

Methods applied:

Investigated nuclei produced via fusion or fragmentation in heavy-ion reactions and via a spontaneous or induced fission. Reaction products selected in isotope-, recoil- or fragment-separators. Advanced nuclear spectroscopy tools, e.g. EUROGAM 2 (array of anti-Compton spectrometers), TAS (The Total Absorption Spectrometer) or a set-up for measurements of subnanosecond life-times.

Main achievements:

In very neutron deficient and $N = Z$ area:

1. In 2003 and 2004 a very fruitful collaboration with Oak Ridge National Laboratory and University of Tennessee continued with two main areas of interest: proton decay studies and beta decay of very neutron rich isotopes from vicinity of ^{78}Ni . Proton decay studies performed at the Holifield radioactive beam facility of ORNL were focused on the light thulium isotopes ^{145}Tm , and ^{144}Tm , latter discovered in November 2003.

2. Beta decay experiment, performed at the National Super Conducting Laboratory of Michigan State University were focused on the ^{76}Ni (8^+) isomer study, followed by the investigation of $^{71-74}\text{Co}$ isotopes. Deexcitation cascade of the 8^+ isomer in ^{76}Ni was identified as well as the first evidence of beta delayed neutron emission in neutron-rich cobalt isotopes were obtained.
3. In September 2004 the test experiment was performed in the NSCL/MSU facility (East Lansing, USA) to investigate the experimental conditions for the studies of the two-proton decay of ^{45}Fe . The results were very promising and a proposal for the detailed studies of the ^{45}Fe decay with use of the OTPC detector was submitted to the NSCL/MSU laboratory.
4. One of the main subjects of our research studies was the investigation of properties of nuclei in the vicinity of doubly-magic ^{100}Sn . Shell model calculations predict in this region the existence of spin-gap isomers formed as a results of enhanced interaction of protons and neutrons occupying the same orbitals. Decay studies of neutron-deficient silver isotopes conducted at the on-line mass separator at GSI Darmstadt resulted in the observation of the long searched $23/2^+$ and $37/2^+$ ^{95}Ag spin-gap isomers decaying by cascade of internal transitions. Decay study of the N=Z nucleus ^{94}Ag unexpectedly revealed the existence of the $T_{1/2}=0.4$ s $I^\pi=21^+$ spin-gap isomer. This state represents a fully aligned configuration of 3 proton and 3 neutron holes in the ^{100}Sn core. The spin and the Q_β energy of the $^{94\text{m}}\text{Ag}(21^+)$ isomer have unprecedented values in the whole chart of nuclei. Various decay modes of the $^{94\text{m}}\text{Ag}(21^+)$ state have been observed: β -delayed γ -ray and proton emission as well as the direct proton decay to the ^{94}Pd high-spin states. New data on the high-spin isomers in the ^{100}Sn region allowed one for a critical test of shell model calculations.
5. Most of the odd-odd N=Z nuclei have the spin and parity 0^+ in the ground state and β - decay to the ground-state of the even-even product by the superallowed $0^+ - 0^+$ Fermi transition. Studies of such decays open a possibility to test the CVC hypothesis of the weak interaction and to test the unitarity of the CKM quark mixing matrix provided that the half-lives, Q-values and the branching ratios are measured with very high accuracy. Our studies of the ^{62}Ga $0^+ - 0^+$ decay performed at the GSI on-line mass separator allowed us to determine the ^{62}Ga half-life as $T_{1/2}= 116.19(4)$. This value is by a factor of 4 more precise than any previous measurement.

In neutron rich area:

1. Investigation of beta decay of very neutron-rich isotopes of thallium, lead and bismuth using the pulsed-release technique and resonant laser ionisation on ISOLDE mass separator in CERN Geneve. Discovery and investigations of new isotopes as ^{215}Pb and ^{218}Bi .
2. The investigation of the ^{149}Ce and ^{149}La nuclei was a part of wider systematic studies of octupole collectivity in the Ba-Nd region, which was undertaken as complementary to our investigation of octupole collective nuclei in the heavy actinide region performed at ISOLDE/CERN. The advanced time-delayed $\beta - \gamma - \gamma$ (t) method was used to measure lifetimes of the low-lying levels in ^{149}Ce . The deduced B(E1) strength implies the presence of substantial octupole correlations in ^{149}Ce , which could be, however, of the octupole vibrational type. The first experimental information on the excited states in the exotic neutron-rich ^{149}La nucleus was obtained. The equilibrium shape in the ground state was found to be quadrupole deformed with a negligible octupole distortion.
3. Nuclear deformation of neutron-rich nuclei in the mass $100 < A < 120$ region.
 - We observed for the first time the $9/2[404]$ neutron hole orbital and explained its role in building up the large deformation in the mass $A=100$ region . The first observation of excited states in the ^{110}Mo nucleus allowed further conclusions about the extend of this region and the transition from the prolate to oblate deformation. Detailed studies of odd-

A nuclei in this region and two-quasiparticle levels in even-even nuclei suggest that excitations in these nuclei correspond to the prolate shape up to $N=68$.

Tests of the shell model in the region of ^{132}Sn .

- Measurements of microsecond isomers in the ^{129}In and ^{129}Sb performed with the Lohengrin separator at ILL, France, provided new information about single-particle configuration in the region of doubly-magic nucleus ^{132}Sn , extending our previous studies in this field.

Octupole correlations in the neutron-rich lanthanides.

- We also continued our long-term studies of octupole correlations in the neutron-rich lanthanides. Such correlations were newfound in the $^{140,142}\text{Xe}$ and the $^{141,143}\text{Cs}$ nuclei.

Magnetic rotation in spherical nuclei around mass $A=140$.

- The continuation of our studies of magnetic rotation in the mass region $A=140$, provided new information on magnetic bands and the deformation in the ^{141}Eu and ^{144}Gd nuclei.

Multiparticle excitations in deformed nuclei around mass $A=170$.

- New information was obtained about the multiparticle configurations involving the $h_{9/2}$ proton and the $i_{13/2}$ neutron levels in deformed nuclei from the mass $A=170$ region, which helped testing of the so called pseudospin quantum number.

The studies listed above were performed in collaboration with Manchester University, ILL, Grenoble and Forschungszentrum Juelich in the frame of collaborations supported by the British Council, IN2P3 of France and the KBN.

Dynamical fission

1. The data analysis of experiment $^{124}\text{Sn} + ^{64}\text{Ni}$ at 35 MeV/u, performed in Catania, was finished. In about 20% of mid-peripheral collisions the projectile-like fragments (PLFs) split in comparable fragments. This class of events is dominated by clearly sequential process: fission after collision. In at least 35 – 90% of cases in relatively short time after collision ($100 < t < 300$ fm/c) the PLFs undergone so called Dynamical Fission (DF) into two aligned fragments; in the rest of cases we observe typical equilibrium fission, slower by about two orders of magnitude. Some properties of DF (in- and out-of-plane, charge and relative fragment velocity distributions) were determined.

Reactions properties and cross sections

1. Participation in an experiment "Penetration of heavy ions through matter in the energy range (40...100) MeV/u" at GSI, Darmstadt (Germany) which results are important for the future upgraded GSI.
2. Participation in an experiment "Production of beams of neutron rich nuclei between Ca and Ni using the ion-guide technique" which was a test of using $^{197}\text{Au}(^{65}\text{Cu}, X)Y$ reaction for producing the mentioned nuclei with the IGISOL facility in Jyväskylä (Finland).

Investigations in Warsaw

1. In collaboration with the Division of Particles and Fundamental Interactions (prof. W. Dominik) we started a new project of designing and constructing a new type of a detector for the detailed studies of the recently discovered two-proton radioactivity. This detector will be based on the principle of the gaseous time projection chamber equipped with an optical readout (Optical Time Projection Chamber – OTPC). The 3-D reconstruction of the decay event will be achieved by the combination of the drift time structure with the 2-D image of the process captured by a CCD camera. After series of development studies, tests of various gas mixtures and different imaging devices, the final design concept has been reached and the first prototype unit is being assembled.
2. At our home lab (Warsaw) we have continued our long term project of studying radiative processes accompanying the electron capture decay in case of forbidden transitions. Recently, we have started measurements of the radiative electron capture

(REC) decay of ^{81}Kr . The sample of ^{81}Kr ($T_{1/2} = 2.3 \cdot 10^5$ y) has been collected by series of irradiations at the ISOLDE mass separator at CERN a few years ago. The activity of contaminants was regularly monitored until it has reached a level low enough for a successful measurement of the very weak REC decay branch in ^{81}Kr .

Investigations on Warsaw Cyclotron:

1. In the frame of the EU „ION CATCHER” project the properties of a gas-catcher/ ion guide system, connected to a mass separator at the Heavy Ion Laboratory of Warsaw University, were investigated. The gas flow simulations were performed using FLUENT code to obtain the best design of a gas cell including gas inlet-exit hole configuration. Two gas cells were constructed with special care for the conservation of laminar helium flow. For the gas cell volumes of 120 and 400 cm³ the extraction times of 2.4 and 5.5 ms, respectively, were obtained using a ^{223}Ra alpha-source. In the on-line experiment the reaction $^{14}\text{N} + ^{209}\text{Bi}$ was studied with target placed inside the helium cell, and extraction efficiency of about 2% was determined for the ^{214}Ra isotope.
2. Using the Warsaw Cyclotron beam we performed experiments on $^{20,22}\text{Ne} + ^{112,116,118}\text{Sn}, ^{\text{nat}}\text{Ni}$ quasi-elastic scattering and determined barrier distributions. In disagreement with theoretical predictions, the barrier distributions in reactions with the Sn target turned out to be structureless, while for the $^{20}\text{Ne} + ^{\text{nat}}\text{Ni}$ system the measured barrier distribution turned out to be structured, in agreement with coupled channels calculations. We look for an explanation of this puzzling findings.

Equipment in Warsaw:

On-line mass-separator at the HI cyclotron with helium guided ion source (in collaboration with Division of Nuclear Physics), He-Jet transport system of radioactive isotopes, several Ge detectors, gamma ray polarimeter, “mini-orange” electron spectrometer, setup for subnanosecond life - time measurements, multi-dimensional acquisition system, DGF acquisition system. Also: 3 DEC - Alpha work stations, 3 SUN - Micro Sparc work stations, ≈ 20 PC (Pentium, NT, 2000,XP, LINUX) + some other.

M.Sc. (magister) theses (2003 - 2004)

1. Paweł Stępczyński, Badanie produktów reakcji $^{16}\text{O} + ^{94}\text{Mo}$ - próba uzyskania nowych informacji o rozpadzie ^{107}Sn (Investigation of the reaction products of $^{16}\text{O} + ^{94}\text{Mo}$ – search of the new information about ^{107}Sn decay), 2004, supervisor: dr Zenon Janas

Ph.D. (doctor) theses (2003 - 2004)

1. Michał Gierlik, Badanie nasilenia przejść Gamowa-Tellera w rozpadzie ^{102}In (Investigation of the Gamow-Teller strength function in ^{102}In decay), 2003, supervisor: dr hab. Andrzej Płochocki
2. Maria Teresa Sawicka, Badanie izotopów niklu, żelaza i kobaltu o znacznym nadmiarze neutronów (Investigation of the neutron-rich Ni, Fe and Co isotopes), 2004, supervisor: dr hab. Marek Pfützner

D.Sc (dr hab., habilitation) theses (2003 - 2003)

1. Marek Pfützner, Badanie nuklidów dalekich od stabilności wytwarzanych metodą fragmentacji jąder – pocisków (Investigation of the nuclei far from stability produced in the fragmentation of the projectile), 2003

PUBLICATIONS (2003 - 2004)

1. M. Karny et al., Fine structure in proton emission from ^{145}Tm discovered with digital signal processing, *PHYS. REV. LETT.* 1 (2003) 012502, coauthors: R. G. Grzywacz, Z. Janas
2. M. Sawicka et al., Isomeric decay of ^{67}Fe – Evidence for deformation, *EUR. PHYS. J. A* 16 (2003) 51, coauthors: R. Grzywacz, Z. Janas, M. Pfützner, J. Żylicz
3. W. Urban et al., First observation of the ν $9/2$ [404] orbital in the $A \approx 100$ mass region, *EUR. PHYS. J. A* 16 (2003) 11
4. R. Schmidt et al., Nucleon density in the nuclear periphery determined with antiprotonic x rays: Cadmium and tin isotopes, *PHYS. REV. C* 67 (2003) 044308, coauthor: W. Kurcewicz
5. M. Pfützner et al., Discovery of the two-proton decay of ^{45}Fe , *ACTA PHYS. POL. B* 34 (2003) 2363, coauthors: R. Grzywacz, Z. Janas, J. Kurcewicz
6. W. Urban et al., The strength of octupole correlations in neutron-rich Xe isotopes, *EUR. PHYS. J. A* 16 (2003) 303
7. L. Batist et al., Isomerism in ^{96}Ag and non-yrast levels in ^{96}Pd and ^{95}Rh , studied in β decay, *NUCL. PHYS. A* 720 (2003) 245, coauthors: M. Gierlik, Z. Janas, M. Karny, A. Płochocki
8. M. Gierlik et al., Gamow-Teller strength distribution near ^{100}Sn , The beta decay of ^{102}In , *NUCL. PHYS. A* 724 (2003) 313, coauthors: A. Płochocki, M. Karny, W. Urban, Z. Janas
9. C. Plettner et al., Beta decay of exotic nuclei close to ^{100}Sn : ^{94}Ag and ^{100}In , *ACTA PHYS. Pol. B* 34 (2003) 2439, coauthors: Z. Janas, M. Karny
10. J. L. Durell et al., Two-quasiparticle bands in $A = 100$ region of neutron-rich nuclei, *ACTA PHYS. Pol. B* 34 (2003) 2277, coauthor: W. Urban
11. W. Królas et al., First observation of excited states in ^{140}Dy , *ACTA PHYS. Pol. B* 34 (2003) 2315, coauthor: R. Grzywacz
12. Z. Marcinkowska et al., Magnetic rotation in the nucleus ^{141}Eu , *ACTA PHYS. Pol. B* 34 (2003) 2319, coauthor: W. Urban
13. M. Moszyński et al., Study of pure NaI at room and liquid nitrogen temperatures, *IEE TRANSTACTION ON NUCLEAR SCIENCE*, vol 50, no 4 (2003) 767, coauthor: A. Syntfeld
14. A. Syntfeld et al., Search for quenching of the electric dipole moment D_0 in ^{149}Ce , *PHYS. REV. C* 68 (2003) 024304-1, coauthor: W. Kurcewicz
15. R. Grzywacz, Applications of digital pulse processing in nuclear spectroscopy, *NUCL. INSTR. METH. B* 204 (2003) 649
16. B. Blank et al., First observation of two-proton radioactivity from an atomic nucleus, *C. R. PHYSIQUE* 4 (2003) 521, coauthor: M. Pfützner
17. C. Mazzocchi et al., Beta decay of ^{50}Ni , *EUR. PHYS. J. A* 17 (2003) 519, coauthors: R. Grzywacz, Z. Janas, J. Kurcewicz, M. Pfützner
18. A. Algora et al., Fine structure of the Gamow-Teller resonance revealed in the decay of ^{150}Ho 2' isomer, *PHYS. REV. C* 68 (2003) 034301, coauthors: M. Gierlik, M. Karny, Z. Janas, A. Płochocki
19. M. Sawicka et al., Low energy levels in ^{72}Ni , *PHYS. REV. C* 68 (2003) 044304-1, coauthors: R. Grzywacz, M. Pfützner, Z. Janas, J. Żylicz
20. J. Kurpeta et al., Isomeric and ground-state decay of ^{215}Bi , *EUR. PHYS. J. A* 18 (2003) 31, coauthors: A. Płochocki, Z. Janas, M. Karny, W. Kurcewicz

21. T. N. Ginter et al., Neutron single-particle states populated via proton emission from ^{146}Tm and ^{150}Lu , *PHYS. REV. C* 68 (2003) 034330, coauthors: R. Grzywacz, Z. Janas, M. Karny
22. J. Kurcewicz et al., Radiative electron capture in the first forbidden unique decay of ^{204}Tl , *NUCL. PHYS. A* 728 (2003) 3, coauthors: M. Pfützner, B. Szweryn
23. Ts. Venkova et al., Pseudo-spin band in the odd-odd nucleus ^{172}Lu , *EUR. PHYS. J. A* 18 (2003) 1, coauthor: W. Urban
24. Ts. Venkova et al., Delayed crossing in the $\pi h_{9/2}^{-1/2}$ [541] band of ^{173}Lu , *EUR. PHYS. J. A* 18 (2003) 577, coauthor: W. Urban
25. J. Kurpeta et al., The decay of the new neutron-rich isotope ^{217}Bi , *EUR. PHYS. J. A* 18 (2003) 5, coauthors: A. Płochocki, Z. Janas, M. Karny, W. Kurcewicz
26. J. Genevey et al., High-spin microsecond isomers in ^{129}In and ^{129}Sb , *PHYS. REV. C* 67 (2003) 054312-1, coauthor: W. Urban
27. A. J. Kordyasz et al., Monolithic silicon E- Δ E telescope produced by the Quasi-selective Epitaxy, *NUKLEONIKA* 48 (2003) 31, coauthor: E. Piasecki
28. K. A. Gladnishki et al., Isomer spectroscopy in the neutron-deficient lead region following projectile fragmentation, *ACTA PHYS. POL. B* 34 (2003) 2395, coauthor: A. Korgul
29. J. Döring et al., Identification of isomers in the $N=Z+1$ nucleus ^{95}Ag , *PHYS. REV. C* 68 (2003) 034306, coauthor: Z. Janas
30. J. Giovinazzo et al., Two-proton decay of ^{45}Fe : a new type of radioactivity, *NUCL. PHYS. A* 722 (2003) 434c, coauthors: R. Grzywacz, M. Pfützner
31. A. Heinz et al., Electromagnetic-induced fission of ^{238}U projectile fragments, a test case for the production of spherical super-heavy nuclei, *NUCL. PHYS. A* 713 (2003) 3, coauthor: M. Pfützner
32. H. Mach et al., Coupling of valence particles/holes to $^{68,70}\text{Ni}$ studied via measurements of the B(E2) strength in $^{67,69,70}\text{Ni}$ and ^{71}Cu , *NUCL. PHYS. A* 719 (2003) 213c, coauthors: R. Grzywacz, M. Pfützner, M. Sawicka
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34. K. P. Rykaczewski et al., Fine structure in one-proton emission studied at Oak Ridge, Proton-emitting nuclei, Second Intern. Symposium, PROCON 2003, Legnaro, Włochy, February 2003, *AIP CONF PROCEEDINGS*, 681 (2003) 11, coauthors: R. Grzywacz, Z. Janas, M. Karny
35. M. Pfützner et al., Evidence for the 2p decay of ^{45}Fe from GSI, Proton-emitting nuclei, Second Intern. Symposium, PROCON 2003, Legnaro, Włochy, February 2003, *AIP CONF. PROCEEDINGS*, 681 (2003) 105, coauthors: R. Grzywacz, Z. Janas, J. Kurcewicz
36. J. Giovinazzo et al., Two-proton radioactivity: the case of ^{45}Fe , Proton-emitting nuclei, Second Intern. Symposium, PROCON 2003, Legnaro, Włochy, February 2003, *AIP CONF. PROCEEDINGS* 681 (2003) 111, coauthors: R. Grzywacz, M. Pfützner
37. C. Mazzocchi et al., Decay of ^{114}Ba , Proton-emitting nuclei, Second Intern. Symposium, PROCON 2003, Legnaro, Włochy, February 2003, *AIP CONF. PROCEEDINGS* 681 (2003) 139, coauthors: Z. Janas, M. Gierlik, J. Żylicz
38. C.-H. Yu et al., Gamma-Ray Spectroscopy Beyond the Proton-Drip Line, Proton-emitting nuclei, Second Intern. Symposium, PROCON 2003, Legnaro, Włochy, February 2003, *AIP CONF PROCEEDINGS*. 681 (2003) 172, coauthor: R. Grzywacz
39. R. Grzywacz et al., Digital Spectroscopy for Proton Emitters, Proton-emitting nuclei, Second Intern. Symposium, PROCON 2003, Legnaro, Włochy, February 2003, *AIP CONF. PROCEEDINGS*, 681 (2003) 259

40. W. Królas et al., First Observation of Excited States in ^{40}Dy , Proton-emitting nuclei, Second Intern. Symposium, PROCON 2003, Legnaro, Włochy, February 2003, AIP CONF. PROCEEDINGS 681 (2003) 183, coauthor: R. Grzywacz
41. I. Mukha et al., Beta-delayed proton decay of a high-spin isomer of ^{94}Ag , Proton-emitting nuclei, Second Intern. Symposium, PROCON 2003, Legnaro, Włochy, February 2003, AIP CONF. PROCEEDINGS 681 (2003) 209, coauthor: Z. Janas
42. L. Świdorski et al., How many fusion barriers, INT. JOURN. of MODERN PHYS. E 13 (2004) 315, coauthor: E. Piasecki
43. H. De Witte et al., First observation of the β decay of neutron-rich ^{218}Bi by the pulsed-release technique and resonant laser ionization, PHYS. REV. C 69 (2004) 044305-1, coauthors: Z. Janas, W. Kurcewicz, J. Kurpeta, A. Płochocki
44. B. Blank et al., High-precision measurement of the half-life of ^{62}Ga , PHYS. REV. C 69 (2004) 015502, coauthors: Z. Janas, J. Żylicz
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46. J. L. Durell et al., Two-quasiparticle bands in neutron-rich nuclei, EUR. PHYS. J. A 20 (2004) 97, coauthor: W. Urban
47. M. Sawicka et al., Evidence for an isomer in ^{76}Ni , EUR. PHYS. J. A 20 (2004) 109, coauthors: M. Pfützner, R. Grzywacz
48. B. Kłos et al., Strong interaction end E2 effect in even-A antiprotonic Te atoms, PHYS. REV. C 69 (2004) 044311, coauthors: K. Gulda, W. Kurcewicz
49. A. Wojtasiewicz et al., Investigation of a gas catcher/ion guide system at the Warsaw cyclotron, NUCL. PHYS. A 746 (2004) 663c, coauthors: M. Gierlik, Z. Janas, W. Kurcewicz, J. Kurpeta, S. Lewandowski, A. Płochocki, S. Sidor, A. Syntfeld
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53. W. Urban et al., Observation of octupole excitation in ^{141}Cs and ^{143}Cs nuclei, PHYS. REV. C 69 (2004) 017305-1
54. M. Karny et al., Excitation energy of the T=0 β -decaying 9^+ isomer in ^{70}Br , PHYS. REV. C 70 (2004) 014310, coauthors: A. Korgul, J. Żylicz
55. M. Pfützner, Two proton radioactivity: the status and perspectives, NUCL. PHYS. A 738 (2004) 101
56. A. Pagano et al., Fragmentation studies with the CHIMERA detector at LNS in Catania: recent progress, NUCL. PHYS. A 734 (2004) 504, coauthors: E. Piasecki, L. Świdorski
57. A. J. Kordyasz et al., Monolithic silicon E- Δ E telescopes produced by the quasi-selective epitaxy, NUCL. INSTR. METH. A 528 (2004) 721, coauthors: E. Piasecki, L. Świdorski, A. Syntfeld
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60. S. Franchoo et al., Beta-decay measurements of neutron-rich thallium, lead, and bismuth by means of resonant laser ionisation, NUCL. PHYS. A 734 (2004) 449, coauthors: Z. Janas, W. Kurcewicz, J. Kurpeta, A. Płochocki
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63. W. Urban et al., New spins for ground states and isomers in ^{115}Pd and ^{117}Pd , EUR. PHYS. J. A 22 (2004) 157, coauthor: J. Kurpeta
64. W. Urban et al., The $\nu 9/2$ [404] orbital and the deformation in the $A \sim 100$ region, EUR. PHYS. J. A 22 (2004) 241
65. W. Urban et al., Near-yrast, medium-spin structure of the ^{107}Tc nucleus, PHYS. REV. C 70 (2004) 057308-1
66. M. Sawicka et al., Beta-decay of ^{71}Co and ^{73}Co , EUR. PHYS. J. A 22 (2004) 455, coauthors: R. Grzywacz, M. Pfützner, J. Żylicz
67. I. Mukha et al., Studies of β -delayed proton decays of $N \cong Z$ nuclei around ^{100}Sn at the GSI-ISOL facility, NUCL. PHYS. A 746 (2004) 66c, coauthors: Z. Janas, M. Karny, A. Płochocki
68. R. M. Lieder et al., Investigations of the level scheme of ^{144}Gd and lifetimes in the quadrupole bands, EUR. PHYS. J. A 21 (2004) 37, coauthor: W. Urban
69. A. Algora et al., β -decay of ^{148}Dy : Study of the gamow-Teller giant state by means of total absorption spectroscopy, PHYS. REV. C 70 (2004) 064301, coauthors: M. Karny, Z. Janas
70. A. Algora et al., Beta-decay studies using total absorption spectroscopy, Eur. Phys. J. A 20 (2004) 199, coauthor: M. Karny
71. C. Plettner et al., On the β -decaying (21^+) spin gap isomer in ^{94}Ag , NUCL. PHYS. A 733 (2004) 20, coauthor: Z. Janas
72. K. A. Gladnishki et al., Angular momentum population in the projectile fragmentation of ^{238}U at 750 MeV/nucleon, PHYS. REV. C 69 (2004) 024617-1, coauthor: A. Korgul
73. B. Blank et al., Two-proton radioactivity - a curiosity of Nature?, NUCL. PHYS. A 734 (2004) 303, coauthor: M. Pfützner
74. G. Georgiev, R. Grzywacz, M. Pfützner, M. Sawicka, G-factors of isomeric states in the neutron-rich nuclei, EUR. PHYS. J. A 20 (2004) 93
75. W. Kurcewicz, Badania z fizyki jądrowej niskich energii prowadzone na wiązkach systemu ISOLDE, Polska w Europejskiej Organizacji Badań Jądrowych CERN, Kraków 2004, Polska Akademia Umiejętności, Kraków 2004, str. 175

INVITED TALKS (2003 - 2004)

1. M. Pfützner, Evidence for the $2p$ decay of ^{45}Fe from GSI, Symposium on Proton-Emitting Nuclei – PROCON'03, Padwa, February 2003, AIP Conf. Proceedings, eds. Enrico Maglione, Francesca Soramel, Melville, New York 2003, vol. 681, p. 105
2. M. Pfützner, Two-proton radioactivity: the status and perspectives, Gordon Research Conference in Nuclear Chemistry, New London, NH, USA, June 2003
3. M. Pfützner, Na granicach świata nuklidów, XXXVII Zjazd Fizyków Polskich, Gdańsk, September 2003
4. M. Pfützner, Two-proton radioactivity: the status and perspectives, 8th Intern. Conf. on Clustering Aspects on Nuclear Structure and Dynamics, Nara, Japan, November 2003, NUCL. PHYS. A 738 (2004) 101
5. Z. Janas, Recent Results from beta-decay studies in the ^{100}Sn region, V Tours Symposium on Nuclear Physics, Tour, France, August 2003, AIP Conf. Proceedings CP704 (2004) 176
6. M. Pfützner, Two-proton emission, 4th Intern. Conf. on Exotic Nuclei and Atomic Masses (ENAM'04), September 2004, Callaway Gardens, Pine Mountain, Georgia, USA, to be published

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Scientific Staff (total): - 6 persons

ETA (Engineering, Technicians, Administration) : 5 persons

Number of grants in 2003-2004: 8

SCIENTIFIC ACTIVITY

Areas of scientific activity:

Electronic structure of diatomic alkali metal molecules. Electron impact induced transitions between excited atomic states. Hyperfine structure of high lying D states of alkali metal atoms. Laser spectroscopy of radioactive atoms. Electronic structure of van der Waals molecules-long range interatomic interactions.

Nonlinear and quantum optics: entangled photon pairs, correlations in parametric fluorescence, femtosecond pulse shaping and coherent control, broadband parametric amplifiers.

Femtosecond dynamics in condensed media: transient absorption and fluorescence, optical Kerr effect. Nonlinear optics. Bose-Einstein condensation. Spectroscopic studies of fullerenes C₆₀ and their complexes. Trace gas detection by Cavity Ring-Down Spectroscopy. Atmospheric studies by means of various lidar techniques.

Methods:

Doppler - free polarization spectroscopy, polarization labelling spectroscopy technique. Time - dependent photon counting. Langmuir probe methods. Quantum beat spectroscopy. Atomic beam off line technique adapted to radioactive atoms. Investigation of spectral line wing profiles. Quantum calculations of the thermally averaged translational rovibronic spectra. Ultrafast laser techniques. Theoretical and experimental studies of supercontinuum transitions. Time-resolved absorption and fluorescence of laser excited media.

Laser photoelectric measurements in high vacuum. Investigations of weak absorption by Cavity Ring-Down Spectroscopy (CRDS). LIDAR techniques.

Main achievements:

Observation and characterization of numerous highly excited electronic states in K₂, Na₂, Li₂, NaK, NaRb and KLi molecules. Development of numerical methods for analysis of molecular states with double minimum potentials. Elaboration of Cavity Ring-Down Spectroscopy. Application of CRDS for studies of transient processes. Measurements of rate constants for

collisions between electrons and all excited alkali atoms. Observation of the isotope shift between radioactive ^{22}Na and stable ^{23}Na . Determination of interaction potentials for the X, A and B molecular states of Hg – rare gas and Cd – rare gas. First complete analysis of the excitation spectrum of Li^*He . Observation and analysis of the absorption and photoluminescence spectra of C_{60} and their complexes with Hg and Ni. Determination of the work function for $\text{C}_{60}+\text{Ni}$ and $\text{C}_{60}+\text{Pd}$ films. Entangled photon pairs in classical optical communications. Application of a femtosecond optical parametric amplifier to broadband time-resolved fluorescence measurements. Broadband optical parametric amplifiers pumped with long pulses. Adaptive mirrors for pulse shaping. Novel FROG and autocorrelator schemes. Coherent control in three wave mixing. Theory of four wave mixing of matter waves. Direct measurement of the Wigner function for a light mode. New methods of elaboration of lidar signals.

Equipment:

Pulsed Nd: YAG lasers, tunable dye lasers, optical parametric oscillator/amplifier system, Ti: Sapphire femtosecond system consisting of an oscillator (3), 1 kHz fs Ti: Sapphire CPA system (oscillator, regenerative amplifier + NOPA), broadband transient absorption set-up with 100fs resolution, pulse shaping system with high resolution LC modulator, FROG and SPIDER, atomic beam apparatus, high sensitive gated ICCD camera, high-resolution concave grating (R = 6 m) Rowland type spectrometer, fast digital oscilloscopes, photon counters/multiscalers, mobile DIAL systems, multiwavelength lidar system for atmospheric aerosol research.

B.Sc. (licentiate) theses (2003 - 2004)

1. Agnieszka Gruszczyńska, Zimne cząstki (Cold molecules), 2003, supervisor: dr hab. Teresa Grycuk
2. Katarzyna Konarska, Lasery w medycynie (Lasers application in medicine), 2003, supervisor: prof. Aleksandra Leliwa-Kopystyńska
3. Andrzej Lewicki, Wykorzystanie laserów w badaniach naukowych (Lasers application in research), 2003, supervisor: prof. Aleksandra Leliwa-Kopystyńska
4. Dominik Bagiński, Lidar absorpcji różnicowej: budowa, działanie, analiza danych (Differential absorption lidar construction, operation, data analysis), 2004, supervisor: prof. Tadeusz Stacewicz
5. Ewa Ściślewska, Zegary atomowe (Atomic clocks), supervisor: prof. Aleksandra Leliwa-Kopystyńska
6. Aleksandra Kulczyk, Wpływ własności jądra na strukturę poziomów energetycznych atomu (Influence of the nuclear properties on structure of atomic levels), 2004, supervisor: prof. Aleksandra Leliwa-Kopystyńska
7. Przemysław Tempczyk, Fotoasocjacja cząsteczek (Photoassociation of molecules), 2004, supervisor: prof. Paweł Kowalczyk

M.Sc. (magister) theses (2003 - 2004)

1. Jan Chwedeńczuk, Rezonans parametryczny i stabilność kondensatów Bosego – Einsteina (Parametric resonance and stability of Bose Einstein Condensates), 2003, supervisor: dr hab. Marek Trippenbach
2. Katarzyna Komorowska, Generacja drugiej i trzeciej harmonicznej femtosekundowych impulsów laserowych (Second and third harmonic generation with femtosecond laser pulses), 2003, supervisor: prof. Czesław Radzewicz

3. Monika Jałowiecka, Badania doświadczalne i teoretyczne skrzydeł linii rezonansowej cynku ($\lambda = 213.8$ nm) zaburzonej przez krypton (Experimental and theoretical studies of the wings of the resonance line of zinc ($\lambda = 213.8$ nm) perturbed by krypton), 2003, supervisor: dr hab. Teresa Grycuk
4. Renata Dalgiewicz-Nowak, Fluorescencja par kadmu (Fluorescence of the cadmium vapours), 2003, supervisor: dr hab. Teresa Grycuk
5. Piotr Fita, Femtosekundowa dynamika stanów wzbudzonych czasteczek organicznych (Femtosecond dynamics of excited states in organic molecules), 2003, supervisor: prof. Czesław Radzewicz
6. Arkadiusz Nawrocki, Sterowanie i akwizycja danych w lidarze wieloczęstotściowym (Operation and data acquisition in multifrequency lidar), 2004, supervisor: prof. Tadeusz Stacewicz
7. Michał Matuszewski, Badanie propagacji impulsów świetlnych w nieliniowych ośrodkach optycznych, (Pulse propagation in the nonlinear media), 2004, supervisor: dr hab. Marek Trippenbach
8. Łukasz Kornaszewski, Szerokopasmowe przetwarzanie częstości femtosekundowych impulsów laserowych (Broadband frequency conversion with femtosecond laser pulses), 2004, supervisor: prof. Czesław Radzewicz
9. Tomasz Szczęśniak, Badania widma absorpcji par Zn i mieszaniny Zn + Xe w otoczeniu linii rezonansowej cynku 213.8 nm (Absorption spectrum studies around the resonance line of zinc at 213.8 nm for the pure Zn vapour and Zn + Xe mixture), 2004, supervisor: dr hab. Teresa Grycuk

Ph.D (doctor) theses (2003 - 2004)

1. Adam Czyżewski, Badanie absorpcji za pomocą CRDS (Investigation of absorption by Cavity Ring – Down spectroscopy), 2003, supervisor: prof. Tadeusz Stacewicz
2. Kamil Stelmaszczyk, Analiza sygnałów lidarowych (Analysis of lidar signals), 2003, supervisor: prof. Tadeusz Stacewicz
3. Piotr Wasylczyk, Efekty nieliniowe w propagacji krótkich impulsów światła (Nonlinear effects in short pulse propagation), 2003, supervisor: prof. Czesław Radzewicz
4. Agnieszka Wojtaszek, Spektroskopia laserowa izotopów sodu i litu (Laser spectroscopy of lithium and sodium isotopes), 2004, supervisor: prof. Aleksandra Leliwa - Kopystyńska
5. Anna Grochola, Badanie struktury elektronowej dwuatomowych czasteczek metali alkalicznych metodą laserowej spektroskopii polaryzacyjnej (Investigation of electronic structure of alkali metal dimers by polarisation labelling spectroscopy technique), 2004, supervisor: prof. Paweł Kowalczyk

PUBLICATIONS (2003-2004)

1. E. Infeld, M. Trippenbach, Enhancement of four wave mixing in Bose-Einstein condensates by introducing mismatch, *PHYSICAL REVIEW A* 68 (2003) 1
2. P. Kowalczyk, A. Grochola et al., Experimental study of the $6^1\Pi$ and $7^1\Pi$ states of NaK by polarization labeling spectroscopy technique, *JOURNAL OF MOLECULAR SPECTROSCOPY* 221 (2003) 279, coauthors: W. Jastrzębski, P. Kortyka
3. T. Kutner, T. Grycuk et al., Fluorescence of Cd vapour following strong resonance excitation, *PROCEEDINGS OF INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING* 5258 (2003) 126, coauthors: R. Nowak, A. Szulc

4. T. Kutner, T. Grycuk et al. , Fluorescence spectra of Cd₂ dimer: transitions involving 0_u+ and 1_u Rydberg states and the lowest excited degerade states, CHEMICAL PHYSICS LETTERS 384 (2003) 171, coauthors : R. Dalgiewicz-Nowak, A. Szulc
5. J. Chwedeńczuk, P. Ziń, M. Trippenbach et al., Harmonically trapped classical gas under critical rotation, ACTA PHYSICA POLONICA A 104 (2003) 399, coauthors: B. Dąbrowska, M. Gajda, K. Rzażewski
6. A. Pietruczuk, T. Stacewicz., Investigation of collision between Li(2P) atoms and electrons: excitation of 4¹ levels, ACTA PHYSICA POLONICA A 103 (2003) 323
7. A. Pietruczuk, P. Kruk, T. Stacewicz, Investigation of electron impact induced transitions between excited lithium potassium levels, RADIATION PHYSICS AND CHEMISTRY 68 (2003) 245
8. K. Ernst, S. Chudzyński, G. Karasiński, A. Pietruczuk et al., Multiwavenlenth lidar for determination of the atmospheric aerosol size distribution, PROCEEDINGS OF INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING 5229 (2003) 45, coauthor: T. Stacewicz
9. P. Wasylczyk, W. Wasilewski, M. Matuszewski, M. Trippenbach et al., Nonlinear propagation of femtosecond laser pulses in dielectric, PROCEEDINGS OF SPIE 5258 (2003) 20, coauthor: C. Radzewicz
10. D. Vouagner, E. Czerwosz, B. Champagnon et al., Photoelectric properties of nanostructural carbonaceous films containing Ni nanocrystals investigated by picosecond laser-induced phtohoelectric charge emission, JOURNAL OF VACUUM SCIENCE & TECHNOLOGY B 21 4 (2003) 1556, coauthors: H. Wronka, J. Girardeau -Montaut
11. E. Czerwosz et al., Photoelectric work function determination for the nanostructural carbonaceous film, VACUUM 72 (2003) 237
12. E. Czerwosz, P. Dłużewski, M. Kozłowski et al., Photoelectric work function of carbonaceous films containing Ni nanocrystals, THIN SOLID FILMS 423 (2003) 161, coauthors: R. Nowakowski, T. Stacewicz
13. E. Czerwosz P. Dłużewski, M. Kozłowski et al., Phototelectric work function determination for the nanostructural carbocenaous films, VACUUM 70 2-3 (2003) 237, coauthors: R. Nowakowski , T. Stacewicz
14. P. Kowalczyk, W. Jastrzębski, R. Nadyak., Potential curve of the 4¹Σ state of NaK by polarisation labelling spectroscopy, CHEMICAL PHYSICS LETTERS 374 (2003) 297
15. T. Stacewicz, S. Chudzyński, A. Czyżewski, K. Ernst et al., Studies of physical processes in the eart, RADIATION PHYSICS AND CHEMISTRY 68 1-2 (2003) 57, coauthors: G. Karasiński, A. Pietruczuk, W. Skubiszak, K. Stelmaszczyk
16. K. Ernst, G. Karasiński, A. Pietruczuk, T. Stacewicz, Teriving the atmospheric aerosol size distribution by means of multiwavelenght lidar, PROCEEDINGS OF INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING 5258 (2003) 156
17. P. Kowalczyk, N. Sadeghi, D. Setser, The Cu(²D_{5/2} and ²D_{3/2}) chemiluminescent reactions with ClF, PHYSICAL CHEMISTRY CHEMICAL PHYSICS 5 (2003) 3443
18. P. Kowalczyk, S. Kasahara, Md. Kabir, H. Kato, The E4¹Π state in K₂ and its perturbations, JOURNAL OF MOLECULAR SPECTROSCOPY 220 (2003) 162
19. P. Kowalczyk, A. Grochola, W. Jastrzębski et al., The molecular constants and potential energy curve of the D¹Π state in KLi, CHEMICAL PHYSICS LETTERS 372 (2003) 173, coauthors: A. Ross, P. Crozet
20. E. Infeld, M. Trippenbach, Useful models of four wave mixing in Bose-Einstein condensates, JOURNAL OF PHYSICS B-ATOMIC MOLECULAR AND OPTICAL PHYSICS 36 (2003) 4327

21. M. Matuszewski, W. Wasilewski, M. Trippenbach, Y. Band, Vectorial nonlinear optical pulse propagation equation on anisotropic medium, *OPTICS COMMUNICATIONS* 221 (2003) 337
22. Grochola, P. Kowalczyk et al., A regularized inverted perturbation approach method: potential energy curve of the $4^1\Sigma^+u$ state in Na₂, *JOURNAL OF CHEMICAL PHYSICS* 121 (2004) 5754, coauthors: W. Jastrzębski, A. Pashov
23. P. Wasylczyk, W. Wasilewski, C. Radzewicz, A single-shot autocorrelator based on a Babinet compensator, *REVIEW OF SCIENTIFIC INSTRUMENTS*, 75 (2004) 2482
24. P. Płochocka, P. Kosacki, W. Maślana, J. Cibert et al., Dynamics of neutral and charged exciton line intensities, *SEMICONDUCTOR SCIENCE AND TECHNOLOGY* 19 (2004) 296, coauthors: A. Golnik, C. Radzewicz, J. Gaj
25. J. Chwedeńczuk, M. Trippenbach, K. Rzażewski, Elastic scattering losses in the four-wave mixing of Bose-Einstein condensates, *JOURNAL OF PHYSICS B-ATOMIC MOLECULAR AND OPTICAL PHYSICS* 37 (2004) 391
26. M. Trippenbach, M. Matuszewski, E. Infeld et al., Enhancement of third harmonic generation by wave vector mismatch to counter phase-modulation, *OPTICS COMMUNICATIONS*, 229 (2004) 391, coauthors: Cao Long Van, R. Tasgal, Y. Band
27. P. Kowalczyk, A. Grochola et al., Experimental and theoretical investigation of the $6^1\Sigma^+_u$ and $7^1\Pi_u$ states of K₂, *JOURNAL OF MOLECULAR SPECTROSCOPY* 224 (2004) 151
28. K. Banaszek, A. Dragan, W. Wasilewski, C. Radzewicz, Experimental demonstration of entanglement-enhanced classical communication over a quantum channel with correlated noise, *PHYSICAL REVIEW LETTERS* 92 (2004) 257901
29. W. Wasilewski, P. Wasylczyk, C. Radzewicz, Femtosecond laser pulses measured with a photodiode - FROG revisited, *APPLIED PHYSICS B-LASERS AND OPTICS* 78 (2004) 589
30. P. Płochocka, P. Kosacki, W. Maślana et al., Femtosecond study of the interplay between excitons, trions and carriers in (Cd, Mn) Te quantum wells, *PHYSICAL REVIEW LETTERS* 92 17 (2004) 177402, coauthors: J. Cibert, S. Tatarenko, C. Radzewicz, J. Gaj
31. J. Burke, P. Julienne, C. Williams, Y. Band, M. Trippenbach, Four-wave mixing in Bose-Einstein condensate systems with multiple spin states, *PHYSICAL REVIEW A* 70 (2004) 33606
32. R. Tasgal, M. Trippenbach, M. Matuszewski, Y. Band, Highly nonlinear dynamics of third harmonic generation by focused beams, *PHYSICAL REVIEW A* 69 (2004) 013809
33. N. Gorbounov, A. Grochola, P. Kruk, A. Pietruczuk, T. Stacewicz, Investigation of electron-excited atom collisions, *PHYSICAL AND CHEMICAL NEWS* 17 (2004) 1
34. J. Chwedeńczuk, K. Góral, M. Trippenbach, T. Koehler, P. Julienne, Molecular production in two component atomic fermi gases, *PHYSICAL REVIEW LETTERS* 93 (2004) 26040
35. J. Gaj, P. Kosacki, P. Płochocka, W. Maślana, J. Cibert, S. Tatarenko, C. Radzewicz, Neutral and charged excitons in a CdTe-based quantum well, *LOW TEMPERATURE PHYSICS* 30 11 (2004) 1133
36. C. Long, P. Goldstein, M. Trippenbach, On existence of solitons for the 3rd harmonic of a light beam in planar waveguides, *ACTA PHYSICA POLONICA A* 105 (2004) 437
37. P. Kowalczyk, A. Grochola, W. Jastrzebski et al., On the $C^1\Sigma^+$ state of NaK, *JOURNAL OF MOLECULAR SPECTROSCOPY*, 226 (2004) 95 coauthors: P. Kortyka, A. Ross, P. Crozet, I. Russier-Antoine
38. M. Wojtkowski, T. Bajraszewski, I. Gorczyńska et al., Ophthalmic imaging by spectral optical coherence tomography, *AMERICAN JOURNAL OF OPHTHALMOLOGY* 138 (2004) 412 coauthors: P. Targowski, W. Wasilewski, A. Kowalczyk, C. Radzewicz

39. Grochola, W. Jastrzębski, P. Kortyka, P. Kowalczyk, Polarization labelling spectroscopy of the $4^1\Pi$ state in the KLi molecule, *MOLECULAR PHYSICS* 102 (2004) 1739
40. S. Chudzyński, G. Karasiński, W. Skubiszak, T. Stacewicz, Simple polichromator for multiwavelength lidar, *PROCEEDINGS OF SPIE* 5566 (2004) 1
41. A. Grochola, W. Jastrzębski, P. Kowalczyk, The $3^1\Pi_u$ state in Na_2 , *CHEMICAL PHYSICS LETTERS* 394 (2004) 383
42. M. Matuszewski, M. Trippenbach, B. Malomed, E. Infeld, A. Skorupski, Two-dimensional dispersion managed light bullets in Kerr media, *PHYSICAL REVIEW B* 70 (2004) 01660
43. M. Matuszewski, M. Trippenbach, B. Malomed, E. Infeld, A. Skorupski, Two-dimensional dispersion managed light bullets in Kerr media, *PHYSICAL REVIEW E* 70 (2004) 01663
44. P. Ziń, M. Trippenbach, M. Gajda, Pair-correlation function of a metastable helium Bose-Einstein condensate, *PHYSICAL REVIEW A* 70 (2004) 023614
45. C. Radzewicz, P. Wasylczyk, W. Wasilewski, J. Krasinski, Piezo-driven deformable mirror for femtosecond pulse shaping, *OPTICS LETTERS* 29 (2004) 177
46. M. K. Kubkowska, T. M. Szcześniak, T. Grycuk, Long-range interactions and the oscillator strength for the $^11_u, ^10^+_u \leftarrow X ^10^+_g$ transitions in Zn_2 , *ACTA PHYSICA POLONICA A* 105 4 (2004) 317

INVITED TALKS (2003 - 2004)

1. T. Stacewicz, Investigation of electron impact induced transitions between excited atomic levels, Czwarte Seminarium Francusko-Polskie: Plazma termiczna w w przestrzeni kosmicznej i w laboratorium, FRAPOL, Bourges, France, June 2003
2. T. Stacewicz., Laser spectroscopy methods for investigation of atmospheric impurities, XX Sympozjum Jubileuszowe: Fizika Atmosfery i Okieana, Tomsk, Rosja, July 2003
3. T. Stacewicz. Lidars for investigation of atmospheric impurities and aerosols, International Conference on Systems of Optical Security, Warsaw, Poland, December 2003
4. C. Radzewicz, Short pulse generation, USF Ultra School, Toruń, Poland, August 2003
5. T. Stacewicz, Collisions of electrons with excited atoms, V Warsztaty Fizyki Atomowej i Molekularnej, Jurata, Poland, September 2004
6. C. Radzewicz, Optyka nieliniowa i optyka ultrakrótkich impulsów (Nonlinear and ultrafast optics), Ogólnopolskie Warsztaty: Optyka i Informatyka Kwantowa, Toruń, Poland, September 2004

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Scientific Staff (total) - 25 persons

ETA (Engineers, Technicians, Administration) - 11 persons

Number of grants in 2003-2004 - 18

SCIENTIFIC ACTIVITY

Main scientific activities are centered around experiments in European Organization for Nuclear Research CERN in Geneva and Deutsches Elektronen Synchrotron DESY in Hamburg.

We participate in following experiments (the experiments' names are given in brackets):

1. Muon and hadron scattering experiments at CERN Super Proton Synchrotron (COMPASS),
2. Fixed target heavy ion experiments at CERN SPS (NA49),
3. Electron- proton scattering at HERA at DESY (ZEUS)
4. Cosmic ray physics with ZEUS detector
5. Preparation of the proton-proton experiment at the forthcoming CERN Large Hadron Collider (CMS),
6. Neutrinos and search for proton decay (Super Kamiokande, K2K, ICARUS)
7. Development of radiation detectors for high energy physics experiments and other fields. Physics of radiation detection.
8. Preparation for experiments at future Linear Collider and Photon Collider (TESLA).
9. Two proton decay of ^{45}Fe – preparation of experimental setup
10. π of the sky experiment – search for visible light effects accompanying gamma bursts (GRB)
11. Electron-positron annihilation at LEP at CERN (DELPHI).

In most of these activities we work in close collaboration with the experimental high energy group from the Sołtan Institute for Nuclear Studies in Świerk near Warsaw.

We are also engaged in a phenomenological analysis of all deep inelastic scattering results (in collaboration with the Niewodniczański Institute of Nuclear Physics in Cracow).

The scientific scope of our activities covers precision tests of the standard model (including CP violation), neutrino oscillations, baryon number violation, two photon physics, deep inelastic scattering and photoproduction (QCD, nuclear effects in structure functions, low x physics, photon structure functions, spin structure functions) and relativistic heavy ion physics.

The group is involved in data analysis and simulation, as well as software development and detector studies, with the particular emphasis on the gaseous detectors and fast trigger electronics. We have well equipped detector and electronics laboratory with experienced and well qualified technical staff, and a computer cluster of more than ten modern workstations. Cluster is partially used as a part of the world wide GRID project. In the past, we have contributed significantly to the experimental hardware in DELPHI (construction of the large part of the electromagnetic calorimeter HPC) and ZEUS (design and construction of the BAC calorimeter and its electronics). Currently our main responsibility is the first level muon trigger in the CMS experiment at the CERN LHC.

Most important results in the last two years include:

- test production preparation for the first level muon trigger electronics in the CMS experiment
- final results from searches for deviations from the Standard model predictions based on the ZEUS data collected from 1994 to 2000
- first results on Neutral Current and Charged Current deep inelastic scattering with longitudinally polarised electron and positron beams
- jet asymmetry in azimuthal angle
- observation of neutrino oscillations in K2K
- limits on Dark Matter weakly interacting particles using Super-Kamiokande data

Presently we have nine graduate students.

M.Sc. (magister) theses (2003 - 2004)

1. Alicja Muszyńska, Analiza głęboko-wirtualnego rozpraszania Comptona w oddziaływaniach ep (eksperyment ZEUS), Analysis of the deep virtual Compton scattering in ep interactions at ZEUS experiment, 2003, supervisor: prof. dr hab. J. Ciborowski
2. Grzegorz Brona, Search for pentaquark states in the COMPASS experiment, 2004, supervisor: prof. dr hab. B. Badelek
3. Beata Olszewska, Detekcja mionów kosmicznych w kalorymetrze uzupełniającym BAC (eksperyment ZEUS), Cosmic muon detection in backup calorimeter BAC of the ZEUS experiment, 2004, supervisor: prof. dr hab. J. Ciborowski

Ph.D. (doctor) theses (2003 - 2004)

1. Mikołaj Cwiok, New Resistive Plate Chambers with high counting rate capability for the CMS experiment, 2003, supervisor: dr hab. W. Dominik
2. Robert Ciesielski, Exclusive J/ψ Production in Deep Inelastic ep Scattering in the ZEUS Experiment at HERA, 2004, supervisor: prof. dr hab. J. Ciborowski
3. Małgorzata Kazana, Signatures of GMSB SUSY particles in the CMS detector at the LHC, 2004, supervisor: prof. dr hab. J. Królikowski

PUBLICATIONS (2003 - 2004)

1. M. Ćwiok, W. Dominik, M. Górski, J. Królikowski, Effect of temperature variation and gas composition on the stability of the RPC operation, NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATOR SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT 508(1-2) (2003) 38
2. S. Chekanov et al., Measurement of the open-charm contribution to the diffractive proton structure function, ZEUS Collaboration, NUCLEAR PHYSICS B 672 (2003) 3, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R.J. Nowak, J.M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A.F. Żarnecki
3. S. Chekanov et al., Measurement of high- Q^2 charged current cross sections in e^+p deep inelastic scattering at HERA, ZEUS Collaboration, EUROPEAN PHYSICAL JOURNAL C 32 (2003)1, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R.J. Nowak, J.M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A.F. Żarnecki
4. S. Chekanov et al., Measurement of deeply virtual Compton scattering at HERA, ZEUS Collaboration, PHYSICS LETTERS B 573 (2003) 46, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
5. S. Chekanov et al., Jet production in charged current deep inelastic $e+p$ scattering at HERA, ZEUS Collaboration, EUROPEAN PHYSICAL JOURNAL C 31 (2003) 149, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
6. S. Chekanov et al., A search for resonance decays to lepton+jet at HERA and limits on leptoquarks, ZEUS Collaboration, PHYSICAL REVIEW D 68 (2003) 052004, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
7. S. Chekanov et al., Dijet angular distributions in photoproduction of charm at HERA, ZEUS Collaboration, PHYSICS LETTERS B 565 (2003) 87, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A.F. Żarnecki
8. S. Chekanov et al., Search for single-top production in ep collisions at HERA, ZEUS Collaboration, PHYSICS LETTERS B 559 (2003) 153, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
9. S. Chekanov et al., Scaling violations and determination of α_s from jet production in γp interactions at HERA, ZEUS Collaboration, PHYSICS LETTERS B 560 (2003) 7, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
10. S. Chekanov et al., Measurement of subjet multiplicities in neutral current deep inelastic scattering at HERA and determination of α_s , ZEUS Collaboration, PHYSICS LETTERS B 558 (2003) 41, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
11. S. Chekanov et al., Measurement of event shapes in deep inelastic scattering at HERA, ZEUS Collaboration, EUROPEAN PHYSICAL JOURNAL C 27 (2003) 531, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
12. S. Chekanov et al., Observation of the strange sea in the proton via inclusive ϕ -meson production in neutral current deep inelastic scattering at HERA, ZEUS Collaboration, PHYSICS LETTERS B 553 (2003) 141, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
13. S. Chekanov et al., Study of the azimuthal asymmetry of jets in neutral current deep inelastic scattering at HERA, ZEUS Collaboration, PHYSICS LETTERS B 551 (2003)

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14. S. Chekanov et al., Measurements of inelastic J/ψ and ψ' photoproduction at HERA, ZEUS Collaboration, EUROPEAN PHYSICAL JOURNAL C 27 (2003) 173, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R.J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
 15. S. Chekanov et al., Leading proton production in e^+p collisions at HERA, ZEUS Collaboration, NUCLEAR PHYSICS B 658 (2003) 3, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
 16. S. Chekanov et al., Measurement of high- Q^2 e^-p neutral current cross sections at HERA and the extraction of $x F_3$ (revised), ZEUS Collaboration, EUROPEAN PHYSICAL JOURNAL C 28 (2003) 175, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
 17. S. Chekanov et al., A ZEUS next-to-leading-order QCD analysis of data on deep inelastic scattering, ZEUS Collaboration, PHYSICAL REVIEW D 67 (2003) 012007, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
 18. S. Chekanov et al., Measurement of proton-dissociative diffractive photoproduction of vector mesons at large momentum transfer at HERA, ZEUS Collaboration, EUROPEAN PHYSICAL JOURNAL C 26 (2003) 389, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R.J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
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 20. P. Nieżurawski, A. F. Żarnecki, M. Krawczyk, The SM Higgs boson production $\gamma\gamma \rightarrow h \rightarrow b \bar{b}$ at the photon collider at TESLA, ACTA PHYSICA POLONICA B 34 (2003) 177
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 22. M. A. Ahn et al., Indications of Neutrino Oscillation in a 250 km Long-baseline Experiment, PHYSICAL REVIEW LETTERS 90 (2003) 41801, coauthors: D. Kielczewska
 23. Y. Gando et al., Search for electron antineutrinos from the Sun at Super-Kamiokande, PHYSICAL REVIEW LETTERS 90 (2003) 171302, coauthors: D. Kielczewska
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 25. J. Yoo et al., A search for periodic modulations of the solar neutrino flux in Super-Kamiokande-I, PHYSICAL REVIEW D 68 (2003) 092002, coauthors: D. Kielczewska
 26. J. Abdallah et al., Search for $B(s)0$ anti- $B(s)0$ oscillations and measurement of $B(d)0$ anti- $B(d)0$ oscillations using events with an inclusively reconstructed vertex, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 28 (2003) 155, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 27. J. Abdallah et al., Search for an LSP gluino at LEP with the DELPHI detector, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 26 (2003) 505, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 28. J. Abdallah et al., Search for double charged Higgs bosons at LEP 2, DELPHI Collaboration, PHYSICS LETTERS B 552 (2003) 12, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk

29. J. Abdallah et al., Search for supersymmetric particles in light gravitino scenarios and sleptons NLSP, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 27 (2003) 15, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
30. J. Abdallah et al., Inclusive b decays to wrong sign charmed mesons, DELPHI Collaboration, PHYSICS LETTERS B 561 (2003) 26, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
31. J. Abdallah et al., Search for resonant sneutrino production at $s^{*1/2} = 183$ GeV to 208 GeV, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C Tom 28 r. 2003, str. 15-26, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
32. R. Barate et al., Search for standard model Higgs boson at LEP, DELPHI Collaboration, PHYSICS LETTERS B 565 (2003) 61, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
33. J. Abdallah et al., A study of the energy evolution of event shape distributions and their means with DELPHI detector at LEP, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 29 (2003) 285, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
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35. J. Abdallah et al., ZZ production in $e+e-$ interactions at $s^{*1/2} = 183$ GeV to 209 GeV, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 30 (2003) 447, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
36. J. Abdallah et al., Measurement of inclusive $f(1)(1285)$ and $f(2)(1420)$ production in Z decays with DELPHI detector, DELPHI Collaboration, PHYSICS LETTERS B 569 (2003) 129, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
37. J. Abdallah et al., The $\eta(c)(2980)$ formation in two photon collisions at LEP energies, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 31 (2003) 481, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
38. J. Abdallah et al., Measurement of the $e+e-$ anomalous quartic gauge coupling with DELPHI, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 31 (2003) 139, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
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40. B. Badełek, Spin dependent structure function $g_1(x, Q^2)$ at low x and low Q^2 , ACTA PHYSICA POLONICA B 34 (2003) 2943
41. F. Arneodo et al., Observation of long ionizing tracks with the ICARUS T600 first half-module, NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT 508 (2003) 287; erratum ibid. A 516 (2004) 610, coauthors: B. Badełek, D. Kielczewska, J. Łagoda
42. G. Unel et al., Measuring the linear polarization of gammas in 20 GeV to 170 GeV range, NUCLEAR PHYSICS A 721 (2003) 1071, coauthors: B. Badełek
43. V. Afanasiev et al., Bose-Einstein correlations of charge kaons in central Pb-Pb collisions at $E_{beam} = 158$ GeV per nucleon, PHYSICS LETTERS B 557 (2003) 157, coauthors: K. Grebieszko, W. Retyk, E. Skrzypczak
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45. Wetzler et al., Directed and elliptic flow in Pb-Pb collisions at 40 AGeV and 158 AGeV, NUCLEAR PHYSICS A 715 (2003) 583, coauthors: K. Grebieszko, W. Retyk, E. Skrzypczak

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53. S. Amoruso et al., Analysis of the liquid Argon purity in the ICARUS T600 TPC, NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT 516 (2004) 68, coauthors: D. Kielczewska, J. Łagoda
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 78. S. Chekanov et al., Isolated tau leptons in events with large missing transverse momentum at HERA, ZEUS Collaboration, PHYSICS LETTERS B 583 (2004) 41, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
 79. S. Chekanov et al., Bose-Einstein correlations in one and two dimensions in deep inelastic scattering, ZEUS Collaboration, PHYSICS LETTERS B 583 (2004) 231, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki
 80. S. Chekanov et al., Measurement of $D^{*\pm}$ production in deep inelastic e^+p scattering at HERA, ZEUS Collaboration, PHYSICAL REVIEW D 69 (2004) 012004, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki.
 81. S. Chekanov et al., Observation of $K_s^0 K_s^0$ resonances in deep inelastic scattering at HERA, ZEUS Collaboration, PHYSICS LETTERS B 578 (2004) 33, coauthors: J. Ciborowski, R. Ciesielski, G. Grzelak, R. J. Nowak, J. M. Pawlak, T. Tymieniecka, A. Ukleja, J. Ukleja, A. F. Żarnecki.
 82. J. Abdallah et al., Final results from DELPHI on the searches for SM and MSSM neutral Higgs bosons, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 32 (2004) 145, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 83. J. Abdallah et al., b tagging in DELPHI at LEP, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 32 (2004) 185, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 84. J. Abdallah et al., Searches for supersymmetric particles in $e+e-$ collisions up to 208 GeV and interpretation of the results within MSSM, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 31 (2004) 421, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 85. J. Abdallah et al., Measurement of the W pair production cross section and W branching ratios in $e+e-$ collisions at $\sqrt{s} = 161$ GeV to 209 GeV, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 34 (2004) 127, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 86. J. Abdallah et al., Searches for invisibly decaying Higgs bosons with the DELPHI detector at LEP, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 32 (2004) 475, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 87. J. Abdallah et al., Measurement of $|V(cb)|$ using the semileptonic decay $\text{anti-B}0(d) \rightarrow D^{*+} l \text{ anti } \nu(l)$, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 33 (2004) 213, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 88. J. Abdallah et al., A Precise measurement of the B^+ , B^0 and mean b hadron lifetime with the DELPHI detector at LEP1, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 33 (2004) 307, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 89. J. Abdallah et al., Measurement of the $\Lambda_0(b)$ decay form-factor, DELPHI Collaboration, PHYSICS LETTERS B 585 (2004) 63, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
 90. J. Abdallah et al., Measurement of the forward-backward asymmetries of $e+e- \rightarrow Z \rightarrow b \text{ anti-b}$ and $e+e- \rightarrow Z \rightarrow c \text{ anti-c}$ using prompt leptons, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 34 (2004) 109, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk

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92. J. Abdallah et al., Search for charged Higgs bosons at LEP in general two Higgs doubled models, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 34 (2004) 399, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
93. J. Abdallah et al., Search for $B_0(s)$ anti- $B_0(s)$ oscillations in DELPHI using high-p(t) leptons, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 35 (2004) 35, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
94. J. Abdallah et al., Search for single top production via FCNC at LEP at $s^{1/2}=189$ GeV to 208 GeV, DELPHI Collaboration, PHYSICS LETTERS B 590 (2004) 21, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
95. K. Doroba, Precision tests of electroweak interactions: what we have learned from LEP and SLC?, ACTA PHYSICA POLONICA B 35 (2004) 1173
96. J. Abdallah et al., Search for supersymmetric particles assuming R-parity nonconservation in e^+e^- collisions at $s^{1/2}=192$ GeV to 208 GeV, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 36 (2004) 1, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
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98. J. Abdallah et al., The measurement of the $\alpha(s)$ from event shape with the DELPHI detector at the highest LEP energies, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 37 (2004) 1, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
99. J. Abdallah et al., Search for fermiophobic Higgs bosons in final states with photons at LEP 2, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 35 (2004) 313, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
100. J. Abdallah et al., A precise measurement of the tau lifetime, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 36 (2004) 283, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
101. J. Abdallah et al., Determination of the $e^+e^- \rightarrow \gamma\gamma$ cross section at LEP 2, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 37 (2004) 405, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
102. J. Abdallah et al., Searches for neutral higgs bosons in extended models, DELPHI Collaboration, EUROPEAN PHYSICAL JOURNAL C 38 (2004) 1, coauthors: K. Doroba, K. Grzelak, M. Trochimczuk
103. K. Kadija et al., Exotic baryon resonances In pp interactions In NA49 detector, JOURNAL OF PHYSICS G – NUCLEAR AND PARTICLE PHYSICS 30 (2004) 1359, coauthors: K. Grebieszko, E. Skrzypczak
104. C. Meurer et al., Hyperon Production in Pb-Pb collisions at the CERN SPS, JOURNAL OF PHYSICS G – NUCLEAR AND PARTICLE PHYSICS 30 (2004) 1325, coauthors: K. Grebieszko, E. Skrzypczak
105. C. Alt et al., Electric charge fluctuations in central Pb-Pb collisions at 20 AGeV, 30 AGeV, 40 AGeV, 80 AGeV and 158 AGeV, PHYSICAL REVIEW C 70 (2004) 0064903, coauthors: K. Grebieszko, E. Skrzypczak
106. O. Chvala et al., On the importance of isospin effects for the interpretation of nuclear collisions, EUROPEAN PHYSICAL JOURNAL C 33 (2004) 615, coauthors: K. Grebieszko, E. Skrzypczak
107. C. Roland et al., Event-by-event fluctuations of particle ratios in central Pb-Pb collisions at 20 AGeV to 158 AGeV, JOURNAL OF PHYSICS G – NUCLEAR AND PARTICLE PHYSICS 30 (2004) 1381, coauthors: K. Grebieszko, E. Skrzypczak

108. S. Kniege et al., Rapidity and transverse momentum dependence of pi-pi Bose-Einstein correlations measured at 20 AGeV, 30 AGeV, 40 AGeV, 80 AGeV and 158 AGeV beam energy, JOURNAL OF PHYSICS G – NUCLEAR AND PARTICLE PHYSICS 30 (2004) 1073, coauthors: K. Grebieszko, E. Skrzypczak
109. M. Gaździcki et al., Report from NA49, JOURNAL OF PHYSICS G – NUCLEAR AND PARTICLE PHYSICS 30 (2004) 701, coauthors: K. Grebieszko, E. Skrzypczak
110. T. Anticic et al., Lambda and antilambda production in central Pb-Pb collisions at 40 AGeV, 80 AGeV and 158 AGeV, PHYSICS LETTERS B 593 (2004) 022302, coauthors: K. Grebieszko, E. Skrzypczak
111. Mischke et al., Strangeness production in heavy ion collisions at SPS energies, EUROPEAN PHYSICAL JOURNAL C 33 (2004) 621, coauthors: K. Grebieszko, E. Skrzypczak
112. T. Anticic et al., Transverse momentum fluctuations in nuclear collisions at 158 AGeV, PHYSICAL REVIEW C 70 (2004) 034902, coauthors: K. Grebieszko, E. Skrzypczak
113. C. Alt et al., Observation of an exotic $S = -2, Q = -2$ baryon resonance in p-p collisions at the CERN SPS, PHYSICAL REVIEW LETTERS 92 (2004) 042003, coauthors: K. Grebieszko, E. Skrzypczak
114. Kraus et al., System size dependence of strangeness production at 158 AGeV, JOURNAL OF PHYSICS G – NUCLEAR AND PARTICLE PHYSICS 30 (2004) 583, coauthors: K. Grebieszko, E. Skrzypczak
115. M. Mitrovski et al., Omega and anti-omega production in Pb-Pb and p-p collisions at 30 AGeV, 40 AGeV and 158 AGeV, JOURNAL OF PHYSICS G – NUCLEAR AND PARTICLE PHYSICS 30 (2004) 357, coauthors: K. Grebieszko, E. Skrzypczak
116. C. Alt et al., Strangeness from 20 AGeV to 158 AGeV, JOURNAL OF PHYSICS G – NUCLEAR AND PARTICLE PHYSICS 30 (2004) 119, coauthors: K. Grebieszko, E. Skrzypczak

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(professor)

Scientific Staff (total): 7 persons

ETA (Engineers, Technicians, Administration): 3 persons

Number of grants in 2003-2004: 0

SCIENTIFIC ACTIVITY

Main activities:

1. Preparation of textbooks and teaching materials for the reformed school system.
2. Development of new educational aids and demonstrations for lower and upper secondary school, with emphasis on low-cost experiments.
3. Introduction of computer aided experiments into secondary school physics curricula. Preparation of an interactive, multimedia program for teaching physics at secondary school level.
4. Developing methods and techniques for the promotion of physics in society (in public media and through non-formal education)
5. Investigation of pupils' knowledge and understanding of physical phenomena and of the effectiveness of education in the reformed school system.
6. Collaboration with in-service teachers a.o. through developing and setting problems for various types of physics competitions.
7. Elements of e-learning: algorithmization and visualization of physics, i.e. application of computer experiments or numerical modelling for high school, university and advanced levels. Preparation of an educational portal containing teaching materials including movies with audio, animations and simulations.
8. Transport and diffusion in amorphous substances vs. rare events
9. Developing of econophysics: dynamics of assets, extreme value theory, modern theory of risk

B.Sc.(licentiate) theses (2003 – 2004)

18 bachelor theses supervised by dr hab. Ryszard Kutner, dr hab. Andrzej Majhofer, dr Stefania Elbanowska and dr Magdalena Staszel.

M.Sc. (magister) theses (2003 - 2004)

1. Paweł Olasek, Biologia oczami fizyka (Biology in the eyes of a physicist), 2003, supervisor: prof. Andrzej Majhofer

2. Paweł Pęczkowski, Modelowanie procesów fizycznych w nauczaniu (Modelling of physical processes in education), 2003, supervisor: dr Stefania Elbanowska
3. Daniel Gołaszewski, Rola eksperymentu w nauczaniu fizyki w gimnazjum (The role of experiment in physics teaching in lower secondary school), 2003, supervisor: dr Stefania Elbanowska
4. Sławomir Jemielity, Doświadczenia fizyczne w niektórych telewizyjnych programach popularnonaukowych „Kuchnia” i „Od kuchni” (Physics experiments in selected TV popular science programs “Kitchen” and “An inside view”), 2003, supervisor: dr Magdalena Staszal, red. Wiktor Niedzicki
5. Dariusz Żebrowski, Badanie efektu synchronizacji statystycznej w kondensacji Bosego-Einsteina (Study of statistical synchronization in Bose-Einstein condensation), 2004, supervisor: prof. Ryszard Kutner
6. Piotr Mechecki, Analiza dynamiki notowań firmy Elektrim S.A. metodami fizyki statystycznej (Statistical physics analysis of Elektrim company stock market dynamics), 2004, supervisor: prof. Ryszard Kutner
7. Dorota Kurczyńska, Porównanie programów nauczania fizyki i matematyki w szkołach ponadpodstawowych (Comparison of physics and mathematics curricula in secondary schools), 2004, supervisor: prof. Andrzej Majhofer
8. Agnieszka Drzazgowska, Zasady zachowania energii i pędu w nauczaniu fizyki (Laws of energy and momentum conservation in physics education), 2004, supervisor: prof. Andrzej Majhofer
9. Dominika Materek, Fizyk na tropach przestępstw: zastosowanie fizyki w kryminalistyce (Physicist on the trail of crime: application of physics in criminology), 2004, supervisor: prof. Andrzej Majhofer
10. Agnieszka Dobrowolska, Analogie w nauczaniu fizyki na poziomie gimnazjum i liceum (Analogies in physics teaching in lower and upper secondary school), 2004, supervisor: dr Anna Kaczorowska
11. Anna Szkodzińska, Elektromagnetyzm w eksperymencie szkolnym (Electromagnetism in the school experiment), 2004, supervisor: dr Anna Kaczorowska
12. Wojciech Wasiek, Optyka fizyczna i geometryczna w eksperymencie szkolnym (Physical and geometrical optics in the school experiment), 2004, supervisor: dr Anna Kaczorowska
13. Urszula Wójcikowska, Wpływ formy przekazu wiedzy na skuteczność nauczania fizyki w różnych przedziałach wiekowych (Influence of the form of knowledge transfer on efficiency of physics teaching in various age ranges), 2004, supervisor: dr Magdalena Staszal
14. Paulina Szczucińska, Metody popularyzacji fizyki w *Scientific American* (Methods of physics popularization in *Scientific American*), 2004, supervisor: dr Magdalena Staszal

PUBLICATIONS (2003 - 2004)

1. M. Kessler et al., Ordering kinetics in an fcc A3B binary alloy model: Monte Carlo studies, *PHYSICAL REVIEW B* 67, 134201 (2003) 1, coauthor: Andrzej Majhofer
2. A. Majhofer, M. Kessler, W. Dieterich, Monte Carlo study of ordering and domain growth in a class of fcc alloy models, *PHYSICA A* 330 (2003) 25
3. A. Galant, R. Kutner, A. Majerowski, Heat transfer, Newton law of cooling and the law of entropy increase simulated...., *LECTURE NOTES IN COMPUTER SCIENCE* 2657 (2003) 45
4. R. Kutner, F. Świtłała, Possible origin of the non-linear long-term autocorrelations within the Gaussian regime, *PHYSICA A* 330 (2003) 177

5. R. Kutner, F. Światała, Stochastic simulations of time series by using the spatial-temporal Weierstrass function, *LECTURE NOTES IN COMPUTER SCIENCE* 2657 (2003) 407
6. R. Kutner, F. Światała, Stochastic simulations of time series within Weierstrass-Mandelbrot walks, *QUANTITATIVE FINANCE* 3 (2003) 201
7. R. Kutner, F. Światała, Study of non-linear autocorrelations within the Gaussian regime, *EUROPEAN PHYSICAL JOURNAL B* 33 (2003) 495
8. M. Gall, R. Kutner, A. Majerowski, D. Żebrowski, Bose-Einstein condensation studied by the real-time Monte Carlo simulation in the frame of java applet, *LECTURE NOTES IN COMPUTER SCIENCE* 3039 (2004) 672
9. R. Kutner, F. Światała, Remarks on the possible universal mechanism of the non-linear long-term autocorrelations in financial time-series, *PHYSICS A* 344 (2004) 244
10. M. Gall, R. Kutner, W. Wesela, The proof and illustration of the central limit theorem by brownian numerical experiments in real time within java applet, *LECTURE NOTES IN COMPUTER SCIENCE* 3037 (2004) 467
11. R. Kutner, A. Majerowski, Entropia niejedno ma imię (1). Entropia termodynamiczna gazu doskonałego (Many faces of entropy. 1. Thermodynamic entropy of ideal gas), *FIZYKA W SZKOLE* 270 (XLIX), no.5 (2003) 23
12. R. Kutner, A. Majerowski, Entropia niejedno ma imię (2) Meandry entropii – na ratunek klasycznej termodynamice (Many faces of entropy. 2. Meanders of entropy – for sake of classical thermodynamics), *FIZYKA W SZKOLE* 271 (L) 1 (2004) 15
13. R. Kutner, M. Gall, A. Majerowski, Entropia niejedno ma imię.(3). Nareszcie bliżej rzeczywistości (Many faces of entropy. 3. At last closer to reality), *FIZYKA W SZKOLE* 272 (L) 2 (2004) 22
14. R. Kutner, M. Gall, M. Maciejczyk, Entropia niejedno ma imię (4). Prozaiczne oblicze entropii (Many faces of entropy.4. Prosaic face of entropy), *FIZYKA W SZKOLE* 275 (L) 5 (2004) 17
15. R. Kutner, Rare and extreme events as basis of generalized Levy Walks, in: *From quanta to societies. Proc. 2nd European Interdisciplinary School on Nonlinear Dynamics for System and Signal Analysis*, Pabst Science Publishers (2003) 319
16. S. Elbanowska, Vytvareni zajmu deti a zaku a fyziku, *Proc.Vlachovice Seminar* (2003) 22
17. P. Pęczkowski, Kwantowe efekty grawitacji (Quantum effects of gravity), *DELTA* 11 (2004) 6

Curricula, textbooks and other teaching materials for primary and secondary school

1. S. Elbanowska et al., Program do nauczania przyrody w zreformowanej szkole (Elementary science curriculum for the reformed school), Wydawnictwo MAC Edukacja, 2003
2. A. Kaczorowska, Fizyka i astronomia. Część 2. Zakres podstawowy. Podręcznik dla uczniów liceum i technikum (Physics and astronomy for upper secondary school, basic version, part 2) WYD. EDUKACYJNE ŻAK, 2003
3. A. Kaczorowska, Fizyka i astronomia. Część 3. Wersja rozszerzona. (Physics and astronomy for upper secondary school, extended version, part 3), WYD. EDUKACYJNE ŻAK, 2003
4. A. Kaczorowska et al., Zbiór zadań. Fizyka i astronomia. Wersja podstawowa (Problems in physics and astronomy. Basic version) WYD. EDUKACYJNE ŻAK, 2003
5. S. Elbanowska, Doświadczenia na lekcjach przyrody (Experiments on lessons in elementary science), Nowa Era 2004

INVITED TALKS (2003 - 2004)

1. R. Kutner, Possible origin of the non-linear long-term autocorrelations within the Gaussian regime, Int. Workshop on Randomness and Complexity, Eilat, Israel, 2003
2. R. Kutner, Heat transfer, Newton's Law of cooling and the Law of Entropy Increase simulated by the real-time computer experiment in Java, Int. Conference on Computational Science, Melbourne/St. Petersburg, 2003
3. R. Kutner, Stochastic simulation of time series by using the spatial-temporal Weierstrass function, Int. Conf. On Computational Science, Melbourne/St. Petersburg, 2003
4. R. Kutner, Termodynamika statystyczna w doświadczeniach numerycznych, XXXVII Zjazd Fizyków Polskich, Gdańsk, Polska, 2003
5. R. Kutner, Remarks on the possible universal mechanism of the non-linear long-term autocorrelations in financial time-series, EPS Conference, University of Technology, Warsaw, Poland, 2003
6. R. Kutner, O nowych możliwościach nauczania i uczenia się fizyki: termodynamika statystyczna w doświadczeniach numerycznych w Javie, VII Ogólnopolska Konferencja Naukowa „Informatyczne Przygotowanie Nauczycieli”, Kraków, 2003
7. R. Kutner, Bose-Einstein condensation studied by the real-time Monte-Carlo simulation in the frame of Java Applet, 4th Int. Conference on Computational Science – ICCS 2004, Kraków, Poland, 2004
8. R. Kutner, “Domino Effect” produced by discretization of the continuous-Time Random Walk as a possible origin of the non-linear long-time autocorrelations occurring in financial time-series, The 3rd Nikkei Econophysics Research Workshop and Symposium on Practical Fruits of Econophysics: Business Models in the 21st Century. Risk management and Expectations for Econophysics, Tokyo, Japan, 2004
9. R. Kutner, Laboratorium numeryczne w nauczaniu Fizyki. Termodynamika statystyczna w Javie, XX Konferencja „Informatyka w Szkole”, Wrocław, Poland, 2004

CONFERENCES ORGANIZED BY THE DIVISION (2003 - 2004)

1. First Polish Symposium on Econo- and Sociophysics, November 2004, Warsaw; main organizer: R. Kutner.

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Scientific Staff – 22 persons + 12 Ph.D. students

ETA (Engineers, Technicians, Administration) – 7 persons, 2 of them are physicists

Number of grants in 2003-2004: - 16

SCIENTIFIC ACTIVITY

Areas of scientific activity:

- Growth and characterization of III-V semiconductor materials (mainly nitrides) and their heterostructures.
- Properties of quasi-two-dimensional electron gas in semiconductor heterostructures under external fields (e.g. magnetic field, electric field, hydrostatic pressure, uniaxial stress).
- Optical properties of single quantum dots.
- Interaction between spins of charge carriers (electrons and holes) and magnetic moments of paramagnetic ions in diluted magnetic semiconductors (bulk materials and semiconductor heterostructures). Spin engineering.
- Magnetic properties of diluted magnetic semiconductors and their heterostructures. Search for room-temperature ferromagnetic semiconductors.
- Impurities and defects in semiconductors and their heterostructures.
- Emission and detection of THz radiation basing on nanometer-size field effect transistors.
- Low energy excitations (in particular – within shallow donors).
- Electronic transport in semiconductor heterostructures, including resonant tunnelling.
- Electronic noise measurements.

Methods:

- MOCVD, AMMONO and Czochralski crystal growth techniques.
- Standard characterization techniques: Hall effect, DLTS, electrochemical CV profiling, atomic force microscope (AFM), Kelvin probe microscopy.
- Infrared, visible and UV optical and magneto-optical spectroscopy (in some cases including ultra-fast time-resolved measurements): absorption, reflectance, electro-reflectance, photo-reflectance, photoconductivity, photoluminescence, photoluminescence excitation.
- Magnetization measurements.

- Far infrared spectroscopy – absorption, reflectance and photoconductivity.
- Magnetotransport measurements: conductivity tensor at magnetic fields, I-V and C-V (differential capacitance – voltage) in lateral and vertical transport experiments.
- External fields: magnetic fields up to 12 T (higher magnetic fields available in cooperation with e.g. High Magnetic Field Laboratory in Grenoble), low temperatures down to 1.3 K, uniaxial and hydrostatic pressures (up to 1.5 GPa).

Main achievements:

- Investigations of femtosecond dynamics of excitons, trions and free carriers have been completed in doped CdMnTe quantum wells. This is the first work devoted to ultrafast processes in semiconductors which was entirely performed in Solid State Physics Division.
- Shell structure of excited exciton states in self-organized quantum dots in InGaAs/GaAs, as well as localization of excitons in the wetting layer have been observed and investigated.
- New MOCVD growth technique, leading to dramatic decrease of dislocation densities in heteroepitaxial (Al₂O₃) nitride layers has been developed. The method bases on stopped growth with an exposition of the surface of the grown crystal to silane (SiH₄).
- Novel method of growth of sparse GaN/AlGaIn self-organized quantum dot systems has been developed. The densities of quantum dots are so small that it is possible to observe luminescence from individual dots without preparation of special masks or mesa structures. This system is unique worldwide.
- Neutral Mn in GaP, GaAs and InP has been found to have electronic Mn²⁺(d⁵) + *hole* configuration which is not typical for deep transition metal impurities.
- The role of an in-plane electric field on the optical anisotropy of quantum dots has been demonstrated in the measurements of an anisotropic exchange splitting of excitons in individual quantum dots.
- Tunnelling through individual impurities has been observed in nanometer-size mesa structures which, in a sense, resemble big quantum dots with real zero-dimension (impurities) states. Very sharp and highly magnetic-field-sensitive structures, observed in I-V characteristic have been explained to be related to spatial quantization of electronic states in the mesa itself.
- Photo- and electro-luminescence performed on coupled double quantum wells embedded in p-i-n have proved the existence of resonant tunnelling between the wells.
- Intradonor magneto-optical transitions in homogeneously iodine-doped II-VI heterostructures have enabled to detect the excitations inside the potential fluctuations localizing electrons in the quantum well. The observed transitions depend on the applied electric field but, completely unexpectedly, not on the photon energy - they appear at a definite value of a magnetic field, no matter what photon energy is.
- Sharp emission structures related to mesoscopic islands in type II GaAs/AlAs quantum wells have been observed for the first time. For small excitation power the spectrum of a single isolated island is dominated by the emission of an excitonic type. For higher excitation, however, binding of biexcitons and multiexcitonic complexes is observed, i.e. one deals with exciton droplets in naturally formed GaAlAs islands.
- So-called „optical Shubnikov de Haas effect” has been observed in GaN/AlGaIn heterostructures and used to demonstrate the existence of the two dimensional electronic gas at the interface.

- Free-carrier-controlled ferromagnetism has been investigated in III-V and II-VI semiconducting systems (e.g. InMnSb and CdMnTe),
- Spin injection and spin tunnelling, as well as manipulation of spin orientation (i.e. so-called spin engineering) in free-carrier-induced ferromagnetism has been observed and investigated in CdMnTe quantum wells.

Equipment:

- MOCVD system for growing III-V layers and nanostructures – especially nitrides,
- High pressure system for crystal growth using the Czochralski method,
- AMONO thermal method for nitride growth,
- Various optical and magneto-optical (up to 12T) systems for spectroscopic investigations in the UV, visible, near-infrared and far-infrared spectral ranges – luminescence, absorption, photo- and electro-reflectance, photoconductivity etc. ,
- Femtosecond pump-probe laser setup for measurements of extremely fast dynamics of carriers, excitons and charged excitons,
- SQUID magnetometer,
- Helium liquefier,
- Atomic Force Microscopy, Kelvin probe surface potential microscopy,
- Fourier Transform Spectrometer,
- Equipment for TEM preparation.

B.Sc. (licentiate) theses (2003 - 2004)

1. Emil Wierzbński, Badanie rozkładu potencjału na powierzchni warstw z azotku galu (Investigation of surface-potential distribution of GaN layers), 2003, supervisor: prof. dr hab. Jacek Baranowski
2. Maria Grzegorzka, Metody światłowodowe w badaniach optycznych GaN (Optical fiber-based methods in GaN optical investigations), 2003, supervisor: dr Andrzej Wyszomółka
3. Katarzyna Kowalewska, Spektroskopia w dalekiej podczerwieni (Far-infrared spectroscopy), 2004, supervisor: dr hab. Andrzej Witowski
4. Tomasz Toczyński, Oprogramowanie monochromatora (Realization of a monochromator computer control), 2004, supervisor: dr Piotr Kossacki
5. Monika Wilińska, Własności półprzewodników w podczerwieni (Infrared optical properties of semiconductors), 2004, supervisor: dr hab. Andrzej Witowski

M.Sc. (magister) theses (2003 - 2004)

1. Barbara Chwalisz, Wpływ lokalizacji na rekombinację promienistą w strukturach półprzewodnikowych o obniżonej wymiarowości (Influence of localization on radiative recombination in semiconductor structures of reduced dimensionality), 2003, supervisor: dr Andrzej Wyszomółka
2. Wojciech Pacuski, Magnetospektroskopia domieszkowanych studni kwantowych (Magnetospectroscopy of doped quantum wells), 2003, supervisor: dr Piotr Kossacki
4. Jacek Kasprzak, Efekty polaritonowe w mikrownękach półprzewodnikowych II-VI (Polariton effects in microcavities made of II-VI semiconductors), 2003, supervisor: prof. dr hab. Jan Gaj
5. Jerzy Plesiewicz, Własności optyczne GaN w dalekiej podczerwieni (Far-infrared optical properties of GaN), 2003, supervisor: dr hab. Dariusz Wasik
6. Przemysław Witczak, Elektroluminescencja w strukturach metal/GaAs/InGaAs/AlGaAs (Electroluminescence in metal/GaAs/InGaAs/AlGaAs structures), 2003, supervisors: dr Adam Babiński, prof. dr hab. Andrzej Twardowski
7. (Electroluminescence in metal/GaAs/InGaAs/AlGaAs structures), 2003, supervisors: dr Adam Babiński, prof. dr hab. Andrzej Twardowski

1. Stanisław Lipiński, Nauczanie mechaniki i elementów termodynamiki na poziomie elementarnym (Teaching of elementary mechanics and thermodynamics), 2003, supervisor: prof. dr hab. Jan Gaj
2. Piotr Caban, Komputerowe modelowanie procesu wzrostu azotków (Computer modelling of GaN growth process), 2004, supervisor: prof. dr hab. Jacek Baranowski
3. Jolanta Lewandowska, Prezentacja zjawisk fizycznych dla uczniów na przykładzie wykładów Polskiego Towarzystwa Fizycznego (Presentation of physical phenomena for students, basing on the lectures organized by Polish Physical Society) 2004, supervisor: dr hab. Krzysztof Korona
4. Katarzyna Surowiecka, Wpływ pola elektrycznego na luminescencję z układu dwóch studni kwantowych GaAs/GaAlAs (Influence of electric field on luminescence from the system of two GaAs/GaAlAs quantum wells), 2004, supervisor: dr Andrzej Wyszomółek
5. Maciej Sakowicz, Luminescencja z rozdzielczością czasową z heterostruktury GaAs/AlGaAs (Time-resolved luminescence in GaAs/AlGaAs heterostructures), 2004, supervisor: dr Jerzy Łusakowski
6. Jacek Błoniarczyk, Badania transportowe InP:Mn. Projekt i realizacja układu doświadczalnego do pomiarów efektu Halla w konfiguracji *Hall Bar i Van der Pauw'a* (Transport investigations in InP:Mn. Design and realization of an experimental setup for Hall effect measurements), 2004, supervisor: prof. dr hab. Andrzej Twardowski
7. Piotr Beliczyński, Badanie przewodnictwa elektrycznego studni kwantowych CdTe/CdMgTe (Investigations of electrical conductivity of CdTe/CdMgTe quantum wells), 2004, supervisor: dr Krzysztof Karpierz
8. Wojciech Zaleszczyk, Badania magnetospektroskopowe w dalekiej podczerwieni studni kwantowych CdTe/CdMgTe (Far-infrared magnetospectroscopy of CdTe/CdMgTe quantum wells), 2004, supervisor: dr Krzysztof Karpierz
9. Małgorzata Jaworek, Badania optyczne domieszkowanych mikrokryształów GaN, otrzymanych metodą AMMONO-termalną (Optical investigations of doped GaN microcrystals grown in ammono-thermal process), 2004, supervisor: dr Andrzej Wyszomółek
10. Artur Trajnerowicz, Badanie efektu izotopowego w widmie fononów w $\text{YBa}_2\text{Cu}_4\text{O}_8$ (Investigations of isotopic effect in phonon spectrum of $\text{YBa}_2\text{Cu}_4\text{O}_8$), 2004, supervisor: dr hab. Andrzej Golnik

Physics Teachers College

1. Mariusz Pawłowski, Badania nanokryształów GaN techniką transmisyjnej mikroskopii elektronowej (Investigations of GaN nanocrystals by means of transmission electron microscopy), 2003, supervisors: prof. dr hab. Maria Kamińska, dr P. Dłużewski
2. Adam Kwiatkowski, Podstawowe własności optyczne półprzewodników samoistnych (Basic optical properties of intrinsic semiconductors), 2004, supervisor: dr hab. Dariusz Wasik
3. Dominik Kozaczka, Odbicie i fotoodbicie od półprzewodników (Reflectance and photo-reflectance of semiconductors), 2004, supervisor: prof. dr hab. Jacek Baranowski
4. Michał Praski, Wyznaczenie stałej Plancka na podstawie pomiarów zjawiska fotoelektrycznego (Determination of the Planck constant from the photoelectric effect), 2004, supervisor: dr Jacek Przybytek

PhD. (doctor) theses (2003 - 2004)

1. Aneta Drabińska, Fotoodbicie i elektroodbicie w niskowymiarowych strukturach azotkowych (Photo- and electro-reflectance in low-dimension nitride structures), 2004, supervisor: prof. dr hab. Jacek Baranowski

2. Arkadiusz Kudelski, In-plane optical anisotropy of semiconductor heterostructures (Anizotropia optyczna w płaszczyźnie warstw heterostruktur półprzewodnikowych), 2004, supervisor: prof. dr hab. Jan Gaj
3. Marta Gryglas, Resonant tunneling via single impurities in GaAs/AlAs/GaAs heterostructure (Tunelowanie rezonansowe poprzez pojedyncze domieszki w heterostrukturze GaAs/AlAs/GaAs), 2004, supervisor: prof. dr hab. Michał Baj.
4. Paulina Płochocka, Spektroskopia ultraszybkich procesów w studniach kwantowych (Spectroscopy of ultra-fast processes in quantum wells), 2004, supervisor: prof. dr hab Jan Gaj
5. Agnieszka Wołoś, Properties of Mn in the selected group III-V semiconductors (Własności manganu w wybranych półprzewodnikach grupy III-V), 2004, supervisor: prof. dr hab. Maria Kamińska

PUBLICATIONS (2003 - 2004)

1. M. Gryglas et al., 2DEG spectroscopy with resonant tunneling through single impurity state, INTERNATIONAL JOURNAL OF NANOSCIENCE 2 (2003) 585, coauthor: M. Baj
2. T. Słupiński, H. Munekata, A. Oiwa, Alloying (In,Mn)As and (Ga,Mn)As: ferromagnetic (In,Ga,Mn)As lattice-matched to InP, JOURNAL OF SUPERCONDUCTIVITY 16 (2003), 45
3. K. Kowalik et al., Characterization of self-assembled CdTe/ZnTe quantum dots, ACTA PHYSICA POLONICA A 103 (2003) 539, coauthors: A. Kudelski, A. Golnik, J. Gaj
4. S. Tatarenko et al., Control of ferromagnetism in Cd(1-x)Mn(x)Te quantum wells, ACTA PHYSICA POLONICA A 11 (2003) 133, coauthors: W. Maślana, P. Kossacki, J. Gaj
5. H. Boukari et al., Control of magnetic properties in (Cd,Mn)Te quantum wells inserted in pin diodes, JOURNAL OF SUPERCONDUCTIVITY 16 (2003) 163, coauthors P. Kossacki, J. Gaj
6. G. A. Khodaparast et al., Cyclotron resonance of electrons and holes in paramagnetic and ferromagnetic InMnAs-based films and heterostructures, JOURNAL OF SUPERCONDUCTIVITY 16 (2003) 107, coauthor: T. Słupiński
7. K. Korona et al., Dynamics of trapping on donors and relaxation of the B-exciton in GaN, PHYSICA STATUS SOLIDI B-BASIC RESEARCH, 235 (2003) 31, coauthors: A. Wyszomolek, R. Stępniewski, J. Baranowski
8. A. Kudelski et al., Excitonic luminescence from nonsymmetric heterovalent AlAs/GaAs/ZnSe quantum wells, APPLIED PHYSICS LETTERS 82 (2003) 1854
9. R. Stępniewski et al., Fine structure of effective mass acceptors in gallium nitride, PHYSICAL REVIEW LETTERS 91 (2003) 226404, coauthors: A. Wyszomolek, K. Pakuła, J. Baranowski
10. M. Szot et al., FIR photon energy independent intra-impurity transitions in uniformly iodine-doped CdTeCd(1-x)Mg(x)Te quantum well, PHYSICA STATUS SOLIDI C-CONFERENCE 2 (2003) 609, coauthors: K. Karpierz, M. Grynberg
11. B. Macieja et al., Formation of Mn-Related Defect Band in InP, ACTA PHYSICA POLONICA A 103 (2003) 637, coauthors: K. Korona, A. Witowski, D. Wasik, A. Wyszomolek, M. Kamińska, A. Twardowski
12. Ł. Kłopotowski et al., Hanle effect of charged and neutral excitons in quantum wells, JOURNAL OF SUPERCONDUCTIVITY 16 (2003) 435, coauthors: J. Suffczyński, M. Nawrocki
13. F. Teppe et al., Imaging electron spin vector in semiconductors, SOLID STATE COMMUNICATIONS, 128 (2003) 403, coauthor: M. Nawrocki

14. K. Kowalik et al., In-plane optical anisotropy of parabolic and half-parabolic Cd_{1-x}Mn_xTe quantum wells, SOLID STATE COMMUNICATIONS 126 (2003) 467, coauthors: A. Kudelski, J. Gaj
15. G. Kowalski et al., Investigation of the Ga as based layers through the measurement of very weak x-ray reflections, JOURNAL OF PHYSICS D-APPLIED PHYSICS 36 (2003) 162, coauthor: M. Kamińska
16. P. Trautman et al., Light-induced narrowing of excitonic absorption lines in GaN, APPLIED PHYSICS LETTERS 83 (2003) 3510, coauthors: K. Pakuła, R. Bożek, J. Baranowski
17. B. Chwalisz et al., Localization effects in GaN/AlGaIn quantum well - photoluminescence studies, ACTA PHYSICA POLONICA A 103 (2003) 573, coauthors: A. Wyszomółek, R. Bożek, K. Korona, R. Stępniewski, K. Pakuła, J. Baranowski
18. J. Gosk et al., Magnetic Properties of (Ga, Fe)N, JOURNAL OF SUPERCONDUCTIVITY 16 (2003) 79, coauthors: M. Zajac, M. Kamińska, J. Szczytko, A. Twardowski
19. J. Łusakowski et al., Magnetoconductivity of GaAs transistors as detectors of THz radiation, ACTA PHYSICA POLONICA A 103 (2003) 545
20. A. Oiwa et al., Manifestation of local magnetic domain reversal by spin-polarized carrier injection in (Ga,Mn) as thin film, JOURNAL OF SUPERCONDUCTIVITY 16 (2003) 439, coauthor: T. Słupiński
21. J. Łusakowski et al., Mixing of impurity levels by a built-in electric field in a CdMgTeCdZnTe heterostructure, PHYSICA STATUS SOLIDI C-CONFERENCES 2 (2003) 605, coauthor: K. Korona
22. A. Wołoś et al., Mn impurity in GaN studied by electron paramagnetic resonance, ACTA PHYSICA POLONICA A 103 (2003) 595, coauthors: M. Kamińska, A. Twardowski
23. Z. Romanowski et al., MOCVD n-InAs thin layers compared with MBE samples - far infrared magnetophotoconductivity, PHYSICA STATUS SOLIDI C-CONFERENCES 2 (2003) 644, coauthors: M. Szot, K. Karpierz, R. Bożek, R. Stępniewski, M. Grynberg
24. M. Bertolini et al., New structures for carrier-controlled ferromagnetism in Cd_{1-x}Mn_xTe quantum wells, JOURNAL OF CRYSTAL GROWTH 251 (2003) 342, coauthors: W. Maślana, P. Kossacki, J. Gaj
25. J. Gosk et al., Observation of magnetic anisotropy in bulk GaMnN:Mg crystals, ACTA PHYSICA POLONICA A 103 (2003) 665, coauthors: M. Zajac, M. Kamińska, A. Twardowski
26. P. Kossacki, Optical studies of charged excitons in II-VI semiconductor quantum wells, JOURNAL OF PHYSICS-CONDENSED MATTER 15 (2003) 471
27. W. Maślana et al., p-type doping of II-VI heterostructures from surface states: Application to ferromagnetic Cd_(1-x)Mn_(x)Te quantum wells, APPLIED PHYSICS LETTERS 82 (2003) 1875, coauthors: P. Kossacki, J. Gaj
28. M. Wojdak et al., Photoluminescence of GaN layers studied with two-color spectroscopy, SOLID-STATE ELECTRONICS 47 (2003) 579, coauthors: K. Pakuła, J. Baranowski
29. F. Tuomisto et al., Polarity dependent properties of GaN layers grown by hydride vapor phase epitaxy on GaN bulk crystals, PHYSICA STATUS SOLIDI B-BASIC RESEARCH 240 (2003) 289, coauthors: D. Wasik, A. Witowski
30. M. Zajac et al., Possible origin of ferromagnetism in (Ga, Mn)N, JOURNAL OF APPLIED PHYSICS 93 (2003) 4715, coauthors: J. Gosk, M. Kamińska, A. Twardowski
31. K. Korona et al., Properties of zinc acceptor and exciton bound to zinc in ammonothermal GaN, PHYSICA STATUS SOLIDI B-BASIC RESEARCH 235 (2003) 40, coauthor: M. Kamińska

32. G. Neu et al., Residual donors in wurtzite GaN homoepitaxial layers and heterostructures, *PHYSICA STATUS SOLIDI B-BASIC RESEARCH* 235 (2003) 20, coauthor: A. Witowski
33. A. Wyszomłek et al., Resonant interaction of LO phonons with excited donor states in GaN, *PHYSICA STATUS SOLIDI B-BASIC RESEARCH* 235 (2003) 36, coauthors: R. Stępniewski, J. Baranowski
34. M. Gryglas et al., Resonant tunneling through single donor states in GaAs AlAs GaAs devices, *PHYSICA E* 17 (2003) 303, coauthor: M. Baj
35. H. Munekata et al., Rotation of ferromagnetically coupled MnSpins in (Ga,Mn)As by hole spins, *JOURNAL OF SUPERCONDUCTIVITY* 16 (2003) 411, coauthor: T. Słupiński
36. A. Wołoś, S-d exchange interaction in GaN : Mn studied by electron paramagnetic resonance, *APPLIED PHYSICS LETTERS* 83 (2003) 5428, coauthors: M. Kamińska, A. Twardowski
37. A. Wyszomłek, Selective magneto-luminescence spectroscopy of donor-acceptor pairs in n-GaAs, *PHYSICA STATUS SOLIDI B-BASIC RESEARCH* 235 (2003) 48
38. S. Podsiadło et al., Synthesis of bulk Ga(1-x)Mn(x)N: A prospective spintronic material, *CHEMISTRY OF MATERIALS* 15 (2003) 4533, coauthors: J. Gosk, M. Zajac, A. Twardowski
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40. G. Sanders et al., Theoretical and experimental studies of cyclotron resonance in p-type InAs and InMnAs at ultrahigh magnetic fields, *JOURNAL OF APPLIED PHYSICS* 93 (2003) 6897, coauthor: T. Słupiński
41. G. Sanders et al., Theory of cyclotron resonance and magneto-optics in n- and p-type InMnAs in ultra-high magnetic fields, *JOURNAL OF SUPERCONDUCTIVITY* 16 (2003) 452, coauthor: T. Słupiński
42. E. Rohozińska, M. Kowalska, K. Pakuła, Triple axis diffractometric investigations of the microstructure of thin Al_xGa_{1-x}N epitaxial films, *CRYSTAL RESEARCH AND TECHNOLOGY* 38 (2003) 951
43. K. Korona, Tuning of spectral sensitivity of AlGa_N/Ga_N UV detector, *ACTA PHYSICA POLONICA A* 103 (2003) 675, coauthors: A. Drabińska, A. Trajnerowicz, R. Bożek, K. Pakuła, J. Baranowski
44. J. Wang et al., Ultrafast optical manipulation of ferromagnetic order in InMnAs/GaSb, *JOURNAL OF SUPERCONDUCTIVITY* 16 (2003) 373, coauthor: T. Słupiński,
45. M. Gryglas, Acoustic phonon-assisted resonant tunneling via single impurities *PHYSICAL REVIEW B* 69 (2004). 165302, coauthor: M. Baj
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47. J. Janik et al., Carbothermally-assisted aerosol synthesis of semiconducting materials in the system GaN/Mn *JOURNAL OF PHYSICS AND CHEMISTRY OF SOLIDS* 65 (2004) 639, coauthor: M. Kamińska
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49. M. Godlewski et al., Cathodoluminescence and atomic force microscopy study of n-type doped GaN epilayers, *PHYSICA STATUS SOLIDI A-APPLIED RESEARCH* 201 (2004) 212, coauthor: R. Bożek
50. M. Godlewski et al., Compensation mechanisms in magnesium doped GaN, *PHYSICA STATUS SOLIDI A-APPLIED RESEARCH* 201 (2004) 216, coauthor: R. Bożek
51. C. Couteau et al., Correlated photon emission from a single II-VI quantum dot *APPLIED PHYSICS LETTERS* 85 (2004) 6251, coauthor: J. Gaj

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54. A. Antonov et al., Electron transport and terahertz radiation detection in submicrometer sized GaAs/AlGaAs field effect transistors with two-dimensional electron gas, PHYSICS OF THE SOLID STATE 46 (2004) 146, coauthor: J. Łusakowski
55. S. Awirothananon et al., Electronic and structural properties of interdiffused self-assembled quantum dots from magneto-photoluminescence, JAPANESE JOURNAL OF APPLIED PHYSICS PART 1-REGULAR PAPERS SHORT NOTES & REVIEW PAPERS 43 (2004) 2088, coauthor: A. Babiński
56. R. Stepniewski, A. Wyszomółek, M. Potemski, Electronic structure of shallow impurities in GaN studied via bound exciton magneto-optics, PHYSICA STATUS SOLIDI A-APPLIED RESEARCH 201 (2004) 181
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58. A. Suchocki et al., Enhanced Zeeman effect in GGG:Mn(4+), CHEMICAL PHYSICS 298 (2004) 267, coauthor: A. Wyszomółek
59. S. Raymond et al., Excitonic energy shell structure of self-assembled InGaAs/GaAs quantum dots, PHYSICAL REVIEW LETTERS 92 (2004) 187492, coauthor: A. Babiński
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67. J. Gaj et al., Localization of neutral and charged excitons in (Cd,Mn)Te quantum well: a microphotoluminescence study, PHYSICA STATUS SOLIDI C-CONFERENCES 1 (2004) 831, coauthors: A. Golnik, P. Kossacki, K. Kowalik, W. Maślana
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90. D. Scalbert et al., Softening of spin resonance at low temperature in p-doped Cd(1-x)Mn(x)Te quantum wells, *PHYSICAL REVIEW B* 70 (2004) 245304, coauthor: M. Nawrocki
91. B. Chwalisz et al., Spatially resolved micro-luminescence from GaN/AlGaIn quantum dots, *ACTA PHYSICA POLONICA A* 105 (2004) 517, coauthors: A. Wysmołek, R. Bożek, R. Stępniewski, K. Pakuła, P. Kossacki, A. Golnik, J. Baranowski
92. W. Knap et al., Spin and interaction effects in Shubnikov - de Haas oscillations and the quantum Hall effect in GaN/AlGaIn heterostructures, *JOURNAL OF PHYSICS-CONDENSED MATTER* 16 (2004) 3421, coauthor: J. Łusakowski
93. P. Kossacki et al., Spin engineering of carrier-induced magnetic ordering in (Cd, Mn) Te quantum wells, *PHYSICA E* 21 (2004) 943, coauthors: W. Pacuski, W. Maślana, J. Gaj
94. I. Frymark et al., Structure of GaAs:Be crystals studied by X-ray quasi-forbidden reflections, *JOURNAL OF ALLOYS AND COMPOUNDS* 362 (2004) 261, coauthor: M. Kamińska
95. W. Knap et al., Terahertz emission by plasma waves in 60 nanometer gate high electron mobility transistors, *APPLIED PHYSICS LETTERS* 84 (2004) 2331, coauthor: J. Łusakowski
96. A. Mycielski et al., The chemical vapour transport growth of ZnO single crystals, *JOURNAL OF ALLOYS AND COMPOUNDS* 371 (2004) 150, coauthors: B. Chwalisz, A. Wysmołek, R. Stępniewski, J. Baranowski, A. Witowski
97. C. Skierbiszewski et al., The electron effective mass at the bottom of the GaNAs conduction band, *SEMICONDUCTOR SCIENCE AND TECHNOLOGY* 19 (2004) 1189, coauthor: J. Łusakowski
98. Ł. Kłopotowski et al., Tunneling of spin-polarized holes in asymmetric double quantum well structures, *SEMICONDUCTOR SCIENCE AND TECHNOLOGY* 19 (2004) 380, coauthor: M. Nawrocki
99. J. Wang et al., Ultrafast softening in InMnAs, *PHYSICA E* 20 (2004) 412, coauthor: T. Słupiński
100. C. Skierbiszewski, J. Łusakowski, Zeeman splitting in GaInNAs, *JOURNAL OF PHYSICS-CONDENSED MATTER* 16 (2004) 3319
101. A. Mycielski et al., ZnO and ZnO:Mn crystals obtained with the chemical vapour transport method, *PHYSICA STATUS SOLIDI C-CONFERENCES* 1 (2004) 884, coauthors: B. Chwalisz, A. Wysmołek, R. Stępniewski, J. Baranowski, A. Witowski

TEXTBOOKS FOR SECONDARY SCHOOLS

1. Jan Blinowski, Jan Gaj, Andrzej Szymacha, Włodzimierz Zielicz, *FIZYKA I ASTRONOMIA* (Physics and astronomy, textbook for secondary school), podręcznik dla liceum ogólnokształcącego, cz. II Wydawnictwa Szkolne i Pedagogiczne, 2003
2. Jan Blinowski, Jan Gaj, Andrzej Szymacha, Włodzimierz Zielicz, *FIZYKA I ASTRONOMIA. Kształcenie w zakresie rozszerzonym* (Physics and astronomy, Teacher's guide), cz. II, Poradnik dla nauczyciela liceum ogólnokształcącego, Wydawnictwa Szkolne i Pedagogiczne, 2003

3. Jan Gaj, Krzysztof Karpierz, Michał Różyczka, Andrzej Szymacha, Włodzimierz Zielicz, FIZYKA I ASTRONOMIA (Physics and astronomy, textbook for secondary school), podręcznik dla liceum ogólnokształcącego, cz. III, Wydawnictwa Szkolne i Pedagogiczne, 2004
4. Jan Gaj, Krzysztof Karpierz, Danuta Kościelecka, Michał Różyczka, Czesław Wierzchowski, FIZYKA I ASTRONOMIA. Kształcenie w zakresie rozszerzonym (Physics and astronomy, Teacher's guide), cz. III, Poradnik dla nauczyciela liceum ogólnokształcącego, liceum profilowanego i technikum. Przedmiotowy system oceniania, Wydawnictwa Szkolne i Pedagogiczne, 2004

INVITED TALKS (2003 - 2004)

1. A. Drabińska, Photo- and electro-reflectance spectroscopy of low dimensional III-nitride structures XXXII Int. School on the Physics of Semiconducting Compounds, Jaszowiec, May /June 2003
2. M. Nawrocki, Optical spin injection and tunneling in coupled II-VI quantum wells, 11th Int. on II-VI Compounds, Niagara Falls, September 2003
3. R. Stępniewski, A. Wyszomółek and M. Potemski, Electronic structure of shallow impurities in GaN studied via bound exciton magneto-optics, E-MRS Fall Meeting 2003, Warszawa, September 2003
4. A. Wyszomółek, Magneto-spectroscopy of shallow impurities in GaN, XXXIII Int. School on the Physics of Semiconducting Compounds, Jaszowiec, May /June 2004
5. J. Gaj, Carrier-induced ferromagnetic phase in diluted magnetic (Cd,Mn)Te quantum wells, Korea-Polish workshop on Magnetic Semiconductors, Korea, Jeju Island, November 2004
6. J. Gaj, Neutral and charged excitons in a CdTe-based quantum well, Ural International Winter School on the Physics of Semiconductors, Ekaterinburg, February 2004

INTERNATIONAL CONFERENCES ORGANIZED BY THE DIVISION (2003 - 2004)

1. XXXII International School on the Physics of Semiconducting Compounds "Jaszowiec 2003" Ustroń-Jaszowiec, Poland, June 2003, chairman prof. Zbysław Wilamowski
2. XXXIII International School on the Physics of Semiconducting Compounds "Jaszowiec 2004" Ustroń-Jaszowiec, Poland, June 2004 chairman: prof. Roman Stępniewski
3. E-MRS Fall Meeting Symposium C, Center of Excellence: Materials for Optoelectronics and Spintronics (CEMOS), Warsaw, Poland, September 2003, chairman: prof. Jacek Baranowski
4. E-MRS Fall Meeting Symposium C, Center of Excellence: Materials for Optoelectronics and Spintronics (CEMOS), Warsaw, Poland, September 2004, chairman: prof. Jacek Baranowski

DIVISION OF STRUCTURE RESEARCH

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Scientific Staff (total): 7 persons

ETA (Engineers, Technicians, Administration): 3 persons

Number of grants in 2003–2004: 3

SCIENTIFIC ACTIVITY

Areas of scientific activity:

Investigation of defects and deformations of single-crystal lattices and semiconductor thin layers systems (especially AIII–BV compounds and nitrides).

Investigation of magnetic structure and interlayer correlations in semiconductor superlattices (EuTe/PbTe, EuS/PbS, EuS/YbSe, GaMnAs/GaAs).

Methods:

X-ray high-resolution diffractometry. X-ray section, projection, and plane-wave topography. X-ray reflectometry. X-ray powder diffractometry. Simulation techniques for reciprocal space maps and topographs. Elastic and inelastic thermal neutron scattering. Neutron reflectometry and wide-angle neutron diffraction.

Main achievements:

1. Segregation of germanium atoms in Si:Ge single crystals with 1.2% and 3% Ge content has been revealed by x-ray section topography with synchrotron radiation.
2. Dislocation distributions in $\text{GdCa}_4\text{O}(\text{BO}_3)_3$ single crystals grown by Czochralski method have been determined by x-ray diffraction topography.
3. Coherent domains in undoped and Si-doped AlGaN MOCVD layers grown at low pressure have been revealed by high-resolution x-ray diffractometry.
4. The weak (pseudo-forbidden) X-ray reflections have been used to study Be and Mn impurities in GaAs layers using a theoretical model allowing to reveal locations of impurity atoms in the crystal lattice.
5. The change of interlayer coupling from antiferromagnetic in superconductor superlattices on (001)KCl to ferromagnetic in superlattices on (111)BaF₂ has been discovered using nonpolarized neutrons.

Equipment:

X-ray generators (7 pcs), topographic cameras (8 pcs), high-resolution multi-crystal X-ray diffractometers (3 pcs), powder diffractometer (1 pc), triple-axis neutron spectrometer.

B.Sc. (licentiate) theses (2003 - 2004)

1. Aleksandra Czyżak, Czynniki struktury w badaniach rentgenowskich (Structure factor in X-ray studies), 2003, supervisor: dr hab. Grzegorz Kowalski
2. Karolina Danuta Pałowska, Projekt i wykonanie strony internetowej Zakładu Badań Strukturalnych (Design and realisation of the WWW page of Division of Structure Research), 2003, supervisor: dr hab. Jerzy Gronkowski
3. Aneta Oleszkin, Symetria kryształów (Crystal symmetry), 2004, supervisor: dr hab. Maria Lefeld-Sosnowska

M.Sc. (magister) theses (2003 - 2004)

1. Magdalena Rzeszot, Badanie metodami dyfrakcji rentgenowskiej naprężeń podłoża wywołanych nałożeniem warstwy epitaksjalnej w heterostrukturach III/V (An X-ray diffraction study of stresses in the substrate caused by an epitaxial layer in AIII–BV heterostructures), 2003, supervisor: dr hab. Elżbieta Zielińska-Rohozińska
2. Izabella Kulbieda, Reflektometryczne pomiary supersieci materiałów półprzewodnikowych EuTe i PbTe (X-ray reflectometric measurements of superlattices of EuTe and PbTe semiconductor materials), 2003, supervisor: dr Henryk Kępa
3. Karolina Stępkowska, Badanie domieszkowanego arsenku galu wysokorozdzielczymi metodami rentgenowskimi (X-ray high-resolution study of doped gallium arsenide samples), 2003, supervisor: dr hab. Grzegorz Kowalski
4. Rafał Salamonik, Symulacje dynamicznych krzywych dyfrakcyjnych (Simulations of X-ray dynamical diffraction curves), 2004, supervisor: dr Janusz Borowski
5. Tomasz Balcer, Dyfrakcyjne badania wydzieleni tlenków krzemu w monokryształach Si (X-ray diffraction studies of silicon-oxide precipitates in Si single crystals), 2004, supervisor: dr hab. Maria Lefeld-Sosnowska

Ph.D. (doctor) theses (2003 - 2004)

1. Roman Pielaszek, Dyfrakcyjne badania mikrostruktury nanokryształów poddawanych działaniu wysokiego ciśnienia (X-ray diffraction study of microstructure of nanocrystals subjected to high pressure), 2003, supervisor: prof. dr hab. Bogdan Pałosz
2. Ilona Frymark, Rentgenowskie badania dyfrakcyjne domieszkowanych warstw arsenku galu (X-ray diffraction study of doped gallium arsenide layers), 2004, supervisor: dr hab. Grzegorz Kowalski

D.Sc. (dr hab., habilitation) thesis (2003 - 2004)

1. Henryk Kępa, Magnetyczne sprzężenia międzywarstwowe w półprzewodnikowych supersieciach magnetycznych Eu/Te, Eu/S i GaMnAs/GaAs (Magnetic interlayer couplings in semiconductor magnetic superlattices Eu/Te, Eu/S, and GaMnAs/GaAs), 2004

PUBLICATIONS (2003 - 2004)

1. A. Drabińska et al., Investigation of 2D electron gas on AlGaIn/GaN interface by electroreflectance, *PHYS. STAT. SOL. (C)* 1 (2003) 329, coauthor: J. Gronkowski
2. H. Kępa et al., Magnetic interactions in EuTe epitaxial layers and EuTe/PbTe superlattices, *PHYS. REV. B* 68 (2003) 24419

3. H. Kępa et al., Probing hole-induced ferromagnetic exchange in magnetic semiconductors by inelastic neutron scattering, *PHYS. REV. LETT.* 91 (2003) 87205
4. G. Kowalski, I. Frymark, M. Kaminska, Investigations of GaAs based layers through the measurement of very weak x-ray reflections, *J. PHYS. D: APPL. PHYS.* 36 (2003) A 162
5. K. Wieteska et al., Bragg-case section topography of growth defects in Si:Ge crystals, *J. PHYS. D: APPL. PHYS.* 36 (2003) 133, coauthors: M. Lefeld-Sosnowska, M. Regulska
6. E. Zielińska-Rohozińska, M. Kowalska, K. Pakula, Triple axis diffractometric investigations of the microstructure of thin $\text{Al}_x\text{Ga}_{1-x}\text{N}$ epitaxial films, *CRYST. RES. TECHNOL.* 38 (2003) 951
7. H. Kępa et al., Domain structure of EuS/PbS and EuS/YbSe superlattices studied by polarized neutron reflectometry, *PHYSICA B* 345 (2004) 193
8. I. Frymark, G. Kowalski et al., Structure of GaAs:Be crystals studied by X-ray quasi-forbidden reflections, *J. ALLOYS AND COMP.* 362 (2004) 261
9. V. S. Haratyunyan, E. Zielińska-Rohozińska, M. Regulska, High resolution X-ray diffraction study of the Si doping influence on columnar crystal growth of GaN layers, *J. ALLOYS AND COMP.* 362 (2004) 287
10. H. Kępa et al., Determination of hole-induced ferromagnetic Mn–Mn exchange in p-type $\text{Zn}_{1-x}\text{Mn}_x\text{Te}$ by inelastic neutron scattering, *PHYSICA B* 350 (2004) 36
11. H. Kępa et al., Antiferromagnetic interlayer coupling in EuS/YbSe superlattices, *J. MAGN. MAGN. MAT.* 272–276 (2004) 323
12. H. Kępa et al., Determination of hole-induced ferromagnetic exchange between nearest-neighbor Mn spins in p-type $\text{Zn}_{1-x}\text{Mn}_x\text{Te}$, *J. MAGN. MAGN. MAT.* 272–276 (2004) e1545
13. Le Van Khoi et al., Optical determination of phosphorus acceptor binding energy in bulk wide-gap II–VI semimagnetic semiconductors, *PHYS. STAT. SOL. (C)* 1 (2004) 973, coauthor: H. Kępa
14. M. Lefeld-Sosnowska, E. Olszyńska et al., Extended defects in $\text{GdCa}_4\text{O}(\text{BO}_3)_3$ crystals, *J. CRYST. GROWTH* 262 (2004) 388
15. M. Lefeld-Sosnowska, E. Olszyńska et al., Conventional and synchrotron radiation back reflection topography of $\text{GdCa}_4\text{O}(\text{BO}_3)_3$ crystals, *J. ALLOYS AND COMP.* 362 (2004) 153
16. P. Sankowski et al., Interlayer Coupling in EuS-Based Superlattices Deduced from Neutron Scattering Experiments, *ACTA PHYS. POL. A* 105 (2004) 607, coauthor: H. Kępa

INVITED TALKS (2003 - 2004)

1. J. Gronkowski, X-ray diffuse scattering from statistically distributed defects, International Conference on Experimental and Computing Methods in High Resolution Diffraction Applied for Structure Characterization of Modern Materials HREDAMM, Zakopane, June 2004
2. H. Kępa, Neutron diffraction and reflectivity studies of Eu chalcogenides based superlattices, International Conference on Experimental and Computing Methods in High Resolution Diffraction Applied for Structure Characterization of Modern Materials HREDAMM, Zakopane, June 2004

DEPARTMENT OF BIOMEDICAL PHYSICS

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Scientific Staff: 5 persons

ETA (Engineers, Technicians, Administration): 2 persons

Number of grants in 2003-2004: 3

SCIENTIFIC ACTIVITY

Areas of scientific activity:

Localization of sources of neuronal activity generating scalp potentials - solution of the inverse problem. Information extraction from noisy biological time series. Determination of propagation patterns of cortical potentials. Time - frequency analysis of EEG and otoacoustic emissions. Investigation of the oscillatory electrical phenomena in the brain connected with different behavioral states. Analysis and modeling of brain electric activity during performance of actual and imaginary tasks. Mathematical and computational modeling of generation of epileptic discharges - their evolution and bifurcation patterns.

Methods:

- High-resolution time-frequency methods of signal analysis: wavelet transform and its generalization – Matching Pursuit (MP).
- Vector autoregressive parametric model for multichannel time series – determination of propagation of EEG activity and coherence between signals.
- Computational modeling of brain electric activity – extended lumped neural population models.
- Artificial Neural Networks for classification and identification purposes. Independent Component Analysis.

Main achievements:

- The determination of the dynamical pattern of brain electrical activity propagation during real and imaginary task
- The identification of resonant modes and their latencies in otoacoustic emissions.
- Development of compartmental model of beta and gamma rhythms changes during simple movement.
- Confirmation of the hypothesis stating that epileptic seizures initiation is a stochastic process in a bistable system. Results were published in a prestigious journal "Neuroscience".

Apparatus

System for measurement of multichannel EEG time-series, comprising shielding from external fields.

B.Sc. (licentiate) theses (2003 - 2004)

1. Grzegorz Perl, Wykrywanie zamknięcia i otwarcia oczu na podstawie mocy fali alfa w sygnale EEG (Detection of the opening and closure of the eyes based upon the alpha band power in the EEG signal), 2003, supervisor: prof. dr hab. K. Blinowska
2. Piotr Pachocki, Metody rozpowszechniania informacji naukowej za pomocą Internetu przy wykorzystaniu narzędzi niekomercyjnych (Methods of dissemination of the scientific information via Internet using non-commercial tools), 2003, supervisor: dr P. Durka

M.Sc. (magister) theses (2003 - 2004)

1. Monika Walczak, Wpływ treningu na czynności mięśnia przeniesionego w miejsce jego antagonisty w trakcie lokomocji szczura (Influence of the exercise on the action of a muscle moved into the position of its antagonist during rat's locomotion), 2003, supervisor: dr hab. S. Kasicki
2. Dominik Perykasa, Model centralnego generatora wzorców z dodatnim sprzężeniem zwrotnym (A model of the central pattern generator with positive feedback), 2004, supervisor: dr J. Żygierewicz
3. Urszula Malinowska, Powrót do źródeł, czyli bezpośrednia implementacja klasycznych reguł oceny EEG snu w oparciu o fizyczne parametry obecnych w sygnale struktur (Back to the roots, that is a direct implementation of the classical rules of sleep EEG scoring based upon physical parameters of signal's structures), 2004, supervisor: dr P. Durka
4. Marek Barwiński, Przybliżenia adaptacyjne czas - częstość w nieustrukturyzowanych słownikach Gabora (Adaptive time - frequency approximations in unstructured Gabor dictionaries), 2004, supervisor: dr P. Durka
5. Agnieszka Grabska, Model zmian synchronizacyjnych EEG związanych z bodźcem (A model of event related EEG synchronization changes), 2004, supervisor: dr J. Żygierewicz
6. Krzysztof Banasik, Modelowanie rozproszenia fotonów w głowicy akceleratora KD-2 firmy Simens, (Modeling of the photon scattering in the accelerator KD-2, Simens), 2004, supervisor: dr W. Bulski, dr M.Kamiński
7. Marta Polak, Metodyka pomiarów i kontrola jakości danych dla wiązek promieniowania X i e⁻ z medycznych akceleratorów liniowych dla potrzeb komputerowych systemów planowania radioterapii (Methodology of measurements and data quality control for the X and e⁻ radiation beams from medical linear accelerators for computer therapy planning systems), 2004, supervisor: dr W. Bulski, dr P. Durka
8. Michał Jakubiec, Opracowanie metody wykrywania zależności pomiędzy ciągami potencjałów motoneuronów (A method for detection of dependence between trains of motoneurons potentials), 2004, supervisor: dr Bogumiła Mysiek-Laurikainen
9. Paweł Barchwic, Identyfikacja zanieczyszczeń w areozolach atmosferycznych metodą analizy aktywacyjnej (Identification of pollution in atmosphere aerosols using the activation analysis), 2004, supervisor: dr Bogumiła Mysiek-Laurikainen
10. Agnieszka Chojecka, Analiza korelacji między mocą dawki ekspozycyjnej promieniowania gamma w Polsce a zachorowalnością na choroby nowotworowe (Analysis of the correlation between the gamma radiation dose in Poland and cancer diseases), 2004, supervisor: dr Bogumiła Mysiek-Laurikainen

PUBLICATIONS (2003 - 2004)

1. P. J. Durka, H. Klekowicz, K. J. Blinowska, W. Szelenberger, Sz. Niemcewicz, A simple system for detection of EEG artifacts in polysomnographic recordings, *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING* 50 (2003) 526
2. A. Korzeniewska, M. Mańczak, M. Kamiński, K. J. Blinowska, S. Kasicki, Determination of information flow direction among brain structures by a modified Directed Transfer Function method (dDTF), *JOURNAL OF NEUROSCIENCE METHODS*, 125 (2003) 195
3. P. J. Durka, From wavelets to adaptive approximations: time-frequency parametrization of EEG, *BIOMEDICAL ENGINEERING ONLINE* 2 (2003) 1
4. F. H. Lopes da Silva, W. Blanes, S. N. Kalitzin, J. Parra, P. Suffczyński, D. N. Velis, Epilepsies as dynamical diseases of brain systems: basic models of the transition between normal and epileptic activity, *EPILEPSIA* 44 Suppl. 12 (2003) 72
5. F. H. Lopes da Silva, W. Blanes, S. N. Kalitzin, J. Parra, P. Suffczyński, D. N. Velis, Dynamical diseases of brain systems: different routes to epileptic seizures, *IEEE, TBME*, 50 5 (2003) 540
6. B. M. Bouwman, P. Suffczyński, C. M. van Rijn, Vigabatrin changes the properties of spike-and-wave discharges in rat model for absence epilepsy, *EPILEPSIA* 44 Suppl. 12 (2003) 219
7. S. N. Kalitzin, P. Suffczyński, D. N. Velis, J. Parra, F. H. Lopes da Silva, Enhanced gamma-band phase coherency and anticipation of ictal transitions, A realistic neural network model study, *EPILEPSIA* 44 Suppl. 12 (2003) 234
8. S. N. Kalitzin, P. Suffczyński, Comments on "Correlations between brain electrical activities of two spatially separated human subjects"., Wackermann et al., *NEUROSCI. LETT.* 350 (2003) 193
9. P. J. Durka, Wstęp do współczesnej statystyki (Introduction to modern statistic), Wyd. Adamantan (2003)
10. S. N. Kalitzin, D. N. Velis, J. Parra, W. Blanes, F. Van Engelen, P. Suffczyński, F. H Lopes da Silva, Electrophysiological paradigms for assessment the risk of epileptic seizures. Application to photosensitive and temporal lobe epilepsy patients, *PHYSICA MEDICA v XIX N1*(2003) 67
11. K. J. Blinowska, P. J. Durka, J. Żygierewicz, Time-frequency analysis of brain electrical activity - adaptive approximations, *METHODS INF. MED.* 43(2004) 70
12. W. W. Jędrzejczak, K. J. Blinowska, W. Konopka, A. Grzanka, P. J. Durka, Identification of otoacoustic emissions components by means of adaptive approximations, *JOURNAL OF THE ACOUSTIC SOCIETY OF AMERICA* 115 (2004) 2148
13. P. J. Durka, J. Żygierewicz, H. Klekowicz, J. Ginter, K.J. Blinowska, On the statistical significance of event-related EEG desynchronization and synchronization in the time - frequency plane, *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING* 51(2004) 1167
14. R. Kuś, M. Kamiński, K. J. Blinowska, Determination of EEG activity propagation: Pair - Wise Versus multichannel estimate, *IEEE TRANS. ON BME* 51(2004) 1501
15. P. J. Durka, Adaptive time - frequency parametrization of epileptic EEG spikes, *PHYSICAL REVIEW E* 69 051914(2004) 1, Reprinted in *VIRTUAL JOURNAL OF BIOLOGICAL PHYSICS RESEARCH* 7 11 2004
16. G. Blinowski, P. J. Durka, A. Spasiński, Inter - Neuro: From chaos to neuroinformatics knowledge base, *JOURNAL OF MEDICAL INFORMATICS & TECHNOLOGIES* 7 (2004) 33

17. P. J. Durka, D. Ircha, Signal ML: metaformat for description of biomedical time series, *COMPUTER METHODS AND PROGRAMS IN BIOMEDICIN* 76 (2004) 253
18. K. J. Blinowska, R. Kuś, M. Kamiński, Granger causality and information flow in multivariate processes, *PHYSICAL REVIEW E* 70 (2004) 050902
19. P. Suffczyński, S. Kalitzin, F. H. Lopes da Silva, Dynamics of non - convulsive epileptic phenomena modeled by a bistable neuronal network, *NEUROSCIENCE* 126 (2004) 467

INVITED TALKS

1. K. J. Blinowska, Time-frequency and multivariate methods of EEG analysis, Conference on Mathematical Methods of Signal and Image Processing, Etelsten, September 2004
2. M. Kamiński, Determination of transmission patterns in multichannel EEG, 3rd Brain Connectivity Workshop, Havana, Cuba, April 2004

DIVISION OF STRUCTURE AND LATTICE DYNAMICS

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Senior Staff Members: Prof. dr hab. Izabela Sosnowska, dr hab. Radosław Przeniosło
(associate professor)

Scientific Staff (total): 2 persons

ETA (Engineers, Technicians, Administration): 1 person

Number of grants in 1999-2000: 2

SCIENTIFIC ACTIVITY

Areas of scientific activity:

Static and dynamic properties of condensed matter. Crystal and magnetic structure of materials such as: magnetic materials disordered systems, ferroelectrics-antiferromagnets and protonic conductors. Interactions in condensed matter.

Methods:

Scattering of neutrons, X-rays and synchrotron radiation in solids.

Main achievements:

1. It has been shown that the widely accepted Yoshimori model can not be used for a description of the long range ordering of the Mn^{4+} ions in the manganese oxide β - MnO_2 . Neutron diffraction studies [1,3] have shown that the propagation vector of this screw-type modulated structure differs from the value of $7/2c^*$ given by Yoshimori. The length of the propagation vector changes with temperature with a local maximum at about 90 K i.e. near the Néel temperature of 92 K [3]. The c-lattice parameter has a local maximum near 92 K what shows that the importance of the spin-lattice coupling in β - MnO_2 . Our studies have shown that the critical exponent of β - MnO_2 is equal to 0.18 [3].
2. It has been shown that the mixed valence system $CaMn_7O_{12}$ undergoes a charge ordering between 410 K and 440 K. The low temperature, charge ordered phase coexists with the high temperature charge disordered phase from 410 K up to 440 K. The influence of internal strains on this phase separation phenomenon was studied by performing high resolution synchrotron radiation diffraction studies on annealed $CaMn_7O_{12}$ samples. The phase separation phenomenon in $CaMn_7O_{12}$ is not sensitive to internal strains [2].
3. The low temperature crystal structure of $CaMn_7O_{12}$ has been studied by using resolution neutron diffraction and synchrotron radiation diffraction [4]. Our studies have shown an anisotropic thermal lattice expansion of $CaMn_7O_{12}$ with a local maximum and minimum of the c lattice parameter at 50 K and 250 K, respectively [4]. The maximum coincides with a magnetic phase transition in $CaMn_7O_{12}$ while the minimum coincides with the onset of weak diffraction maxima which are interpreted as a sign of a charge ordered state [4].

4. The phase separation phenomenon was also studied in Cu-doped mixed manganese oxides $\text{CaCu}_x\text{Mn}_{7-x}\text{O}_{12}$ with $x=0.4$ and 0.7 . High resolution synchrotron radiation diffraction studies of the ($x=0.4$) compound have shown a coexistence of a high temperature cubic phase with a low temperature trigonal phase in a temperature range from 250 K down to 10 K [5]. At higher Cu doping, i.e. $x=0.7$, the material has a single cubic phase at temperatures down to 10 K [5].
5. The magnetic ordering of the manganese oxide $\alpha - \text{Mn}_2\text{O}_3$ has been studied by using neutron powder diffraction. Our studies have shown that the magnetic ordering model given by Grant et al. is not correct. A new collinear model of the magnetic ordering of $\alpha - \text{Mn}_2\text{O}_3$ at 10 K is presented [6]. The main antiferromagnetic Bragg peaks have different temperature dependence of their intensities, suggesting that the magnetic ordering in $\alpha - \text{Mn}_2\text{O}_3$ cannot be described by a single order parameter [6].

Equipment:

X-ray diffractometer SEIFERT ID-3003. Experiments were performed also at the ISIS neutron spallation source, at Berlin Neutron Scattering Center, at Jülich Research Center, at Institute Laue-Langevin (ILL) and at European Synchrotron Radiation Facility (ESRF), Grenoble, using neutron scattering and synchrotron radiation diffraction.

B.Sc. (licentiate) theses (2003 - 2004)

1. Anna Białogrzywa: Określenie struktury tlenku manganu ($\alpha - \text{Mn}_2\text{O}_3$) w temperaturze pokojowej wykorzystując zjawisko dyfrakcji neutronów (Determination of the crystal structure of manganese oxide ($\alpha - \text{Mn}_2\text{O}_3$) at room temperature by using neutron diffraction), 2004, supervisor: dr hab. Radosław Przeniosło

M.Sc. (magister) theses (2003 - 2004)

1. Wojciech Andrzej Sławiński, Badanie reorientacji momentów magnetycznych w ortoferrycie neodymu metodą dyfrakcji neutronów (Studies of the magnetic moment reorientation in neodymium orthoferrite by using neutron diffraction), 2004, supervisor: dr hab. Radosław Przeniosło
2. Grzegorz Maciej Chojnowski, Wzrost ziaren w nanokrystalicznym chromie badany metodą rozpraszania promieniowania synchrotronowego (Grain growth in nanocrystalline chromium studied by synchrotron radiation scattering), 2004, supervisor: dr hab. Radosław Przeniosło

D.Sc. (dr hab., habilitation) theses (2003 - 2004)

1. Radosław Przeniosło, Uporządkowania ładunków i momentów magnetycznych oraz ich zasięg w układach metali przejściowych, (Charge ordering, magnetic ordering and their coherence lengths in transition metal systems), 2004

PUBLICATIONS (2003-2004)

1. M. Regulski, R. Przeniosło, I. Sosnowska, J.-U. Hoffmann, Incommensurate magnetic structure of $\beta - \text{MnO}_2$, PHYS.REV. B 68 (2003) 172401

2. R. Przeniosło, W. Van Beek, I. Sosnowska, Phase coexistence in annealed $\text{CaMn}_7\text{O}_{12}$, *SOLID STATE COMMUNICATION* 126 (2003) 485
3. M. Regulski, R. Przeniosło, I. Sosnowska, J.-U. Hoffmann, Short and long range magnetic ordering in $\beta\text{-MnO}_2$ - a temperature study, *J. OF THE PHYS. SOC. JAPAN* 73 (2004) 3444
4. R. Przeniosło, et al. Charge ordering and anisotropic thermal expansion of the manganese perovskite $\text{CaMn}_7\text{O}_{12}$, *PHYSICA B* 344 (2004) 358, coauthor: I. Sosnowska
5. R. Przeniosło, I. Sosnowska, W. Van Beek, E. Suard, A. Hewat, Phase separation in $\text{CaCu}_x\text{Mn}_{3-x}\text{Mn}_4\text{O}_{12}$, *J. ALLOYS AND COMPDS.* 362 (2004) 218
6. M. Regulski et al, Neutron diffraction study of the magnetic structure of $\alpha\text{-Mn}_2\text{O}_3$, *J. ALLOYS AND COMPDS.* 362 (2004) 236, coauthors: R. Przeniosło, I. Sosnowska

INVITED TALKS (2003 - 2004)

1. R. Przeniosło, Phase separation and anisotropic thermal expansion in manganite oxide systems, 10th International Seminar "Neutron Scattering Investigations in Condensed Matter" Poznan, May 2003
2. R. Przeniosło, Neutron Scattering in Magnetic Materials, Pre-School of Symposium B European Materials Research Society Fall Meeting, Warsaw, September 2003
3. R. Przeniosło, R. Hempelmann, I. Sosnowska, Magnetic and crystalline microstructure of nanocrystalline metals studied by neutron and synchrotron radiation scattering, Symposium B European Materials Research Society Fall Meeting, Warsaw, September 2003, Speaker: R. Przeniosło.
4. I. Sosnowska, Research training throughout university curricula, *EUA CONFERENCE, Research Training as a Key to a Europe of Knowledge, MAASTRICHT*, October 2004
5. R. Przeniosło, High resolution studies of manganite oxide systems, *Experimental and Computing Methods in High Resolution Diffraction Applied for Structure Characterization of Modern Materials*, Zakopane, June 2004

INTERNATIONAL CONFERENCES ORGANIZED BY LABORATORY (2003 - 2004)

1. I. Sosnowska, member of the scientific committee of the International conference: Development of methods for characterizing the microstructure of novel materials organized as Symposium B in the frame of EMRS Fall Meeting, Warsaw, September 2003
2. I. Sosnowska, member of International Programme and Organizing Committee of the VII International School and Symposium on Synchrotron Radiation in Natural Science, Zakopane, June 2004
3. I. Sosnowska, member of International Advisory Board of the *Experimental and Computing Methods in High Resolution Diffraction Applied for Structure Characterization of Modern Materials*, Zakopane, June 2004
4. R. Przeniosło, member of the scientific committee of the International conference: Applications of Linear and Area Detectors for X-ray and Neutron Diffraction and Spectroscopy (ALADINUS) organized as Symposium D in the frame of EMRS Fall Meeting, Warsaw, September 2004

Scientific Symposium IEP 2004 - a brief summary

It has already become a custom to organise a Symposium of the Institute of Experimental Physics every two years and the present Symposium was the sixth one of a series started in December 1994. The main purpose of the Symposia is to inform members of the Faculty of Physics, as well as students associated with the Faculty, about the present scientific activities of the experimental research groups. In the era of growing diversity of physics, it is important for all of us to know and appreciate achievements of colleagues from neighbouring laboratories. It is even more important for undergraduate students (who have to select a field for their M.Sc. Theses during their sixth semester) to gain insight into activities of various divisions of the Institute and personalities of researchers working in them.

The Organising Committee of the Symposium, consisting of 8 members of the Institute (Krzysztof Doroba, Jan Gaj, Maciej Geller, Paweł Kowalczyk, Tomasz Matulewicz, Marek Pfützner, Izabela Sosnowska, Magdalena Staszal), was appointed in September 2004. Contrary to previous Symposia, the present one has been limited in time to Friday afternoon and Saturday morning (December 3rd and 4th, 2004) for reasons independent from us. The tight time schedule implied shorter lectures (20 minutes for a lecture and 5 minutes for accompanying discussion). However, this constraint generally helped to avoid presentations on highly specialised level, thus making them more comprehensible to the audience. A total of 11 lectures allowed to show major achievements of all divisions of the Institute in the years 2002-2004. Additional information was presented at a poster session organised by Marek Pfützner. A jury (Michał Baj, Marek Pfützner, Teresa Rząca-Urban, Magdalena Staszal) awarded prizes for two posters presented by mgr Artur Kalinowski and Paweł Wnuk (first prize in the history of our Symposia won by an undergraduate student!).

During the Symposium, dr Maciej Witkowski from the Institute of Physics of the Nicolaus Copernicus University in Toruń was awarded the Professor Stefan Pieńkowski prize. The decision was announced by dr Marek Pieńkowski (the creator and benefactor of the prize), on behalf of the jury including prominent members of the Faculties of Physics, Mathematics, Chemistry and Biology of the Warsaw University. The event was followed by a lecture of the prize winner. As a technical novelty, the lecture was transmitted live via Internet, with the lecturer being temporarily at the Massachusetts Institute of Technology in the USA. In addition, the Dean of the Faculty awarded prizes for teaching achievements to prof. Wojciech Dominik, prof. Jan Gaj, mgr Michał Godliński, mgr Paweł Kasprzak, dr Roman Nowak, and dr Paweł Trautman.

Lectures and poster sessions were all well attended by both staff members and students.

On behalf of the Organising Committee
Paweł Kowalczyk

Symposium IFD 2004
3 – 4 grudnia 2004

Piątek 3.XII.2004		
15:15 – 15:20	Otwarcie Symposium Dyrektor IFD : prof. Andrzej Twardowski	
15:20 – 15:30	Wręczenie nagród Wydziału Fizyki	
15:30 – 16:10	Wręczenie nagrody im. Profesora Stefana Pieńkowskiego, wykład laureata dr. Macieja Witkowskiego z Instytutu Fizyki Uniwersytetu Mikołaja Kopernika w Toruniu: Obrazowanie oka za pomocą spektralnej tomografii optycznej z użyciem światła częściowo spójnego	
Przewodniczący: prof. Andrzej Kajetan Wróblewski		
16:10 – 16:35	Krzysztof Wiśniewski	Dziwny stan materii (jądrowej)
16:35 – 17:00	Piotr Kossacki	Ekscyton w morzu dziur
17:00 – 18:00	kawa, herbata, ciastka + sesja plakatowa	
18:00 – 18:25	Wiesław Jędrzejczak	Co może nam powiedzieć ucho, czyli analiza emisji otoakustycznych
18:25 – 18:50	Marcin Regulski	Struktura magnetyczna tlenku manganu, β-MnO₂

Sobota 4.XII.2004		
Przewodniczący: prof. Jan Żylicz		
9:00 – 9:25	Zenon Janas	"Zegar atomowy" do pomiaru czasu życia stanów jądrowych
9:25 – 9:50	Ilona Frymark	Czynnik struktury jako mikrosonda defektów w półprzewodnikach
9:50 – 10:15	Monika Gall	Nierównowagowa termodynamika statystyczna w doświadczeniach numerycznych
10:15 – 10:40	Tomasz Grycuk	Born, Kirkwood, Lord Kelvin, Kepler - spotkanie idei
10:40 – 12:10	kawa, herbata, ciastka + sesja plakatowa	
Przewodniczący: prof. Zdzisław Wilhelmi		
12:10 – 12:35	Piotr Fita	Ultraszybkie przygody cząsteczek
12:35 – 13:00	Adam Babiński	Spektroskopia pojedynczych kropek kwantowych
13:00 – 13:25	Justyna Łagoda	Tajemnice neutrin
13:25 – 13:45	Ogłoszenie wyników konkursu plakatów IFD'2004	
13:45 – 14:00	Podsumowanie sympozjum: prof. Andrzej Twardowski	

- **Skład Jury Konkursu Plakatów: Michał Baj, Marek Pfützner, Teresa Rząca-Urban, Magdalena Staszal**

Komitet Organizacyjny:

Krzysztof Doroba, Jan Gaj, Maciej Geller, Paweł Kowalczyk (przewodniczący),
Tomasz Matulewicz, Marek Pfützner, Izabela Sosnowska, Magdalena Staszal

SYMPOSIUM IEP 2004
3 – 4 December 2004

Friday 3.XII.2004		
15:15 – 15:20	Opening of the Symposium Director of IEP : Prof. Andrzej Twardowski	
15:20 – 15:30	Presentation of teaching awards of the Faculty of Physics	
15:30 – 16:10	Presentation of the Professor Stefan Pieńkowski Prize, lecture of the prize winner, dr Maciej Witkowski from the Institute of Physics of the Nicolaus Copernicus University in Toruń: Ophthalmic imaging by spectral optical coherence tomography	
Chairman: Prof. Andrzej Kajetan Wróblewski		
16:10 – 16:35	Krzysztof Wiśniewski	Strange state of (nuclear) matter
16:35 – 17:00	Piotr Kossacki	Exciton in the sea of carriers
17:00 – 18:00	Tea & coffee break + poster session	
18:00 – 18:25	Wiesław Jędrzejczak	What the ear can tell us - analysis of otoacoustic emissions
18:25 – 18:50	Marcin Regulski	Magnetic structure of β-MnO₂

Saturday 4.XII.2004		
Chairman: Prof. Jan Żylicz		
9:00 – 9:25	Zenon Janas	"Atomic clock" for lifetime measurements of nuclear states
9:25 – 9:50	Ilona Frymark	X-ray structure factor as a microprobe of defects in semiconductors
9:50 – 10:15	Monika Gall	Nonequilibrium statistical thermodynamics in numerical simulations
10:15 – 10:40	Tomasz Grycuk	Born, Kirkwood, Lord Kelvin, Kepler - ideas meeting
10:40 – 12:10	Tea & coffee break + poster session	
Chairman: Prof. Zdzisław Wilhelmi		
12:10 – 12:35	Piotr Fita	Ultrafast adventures of molecules
12:35 – 13:00	Adam Babiński	Single dot spectroscopy
13:00 – 13:25	Justyna Łagoda	Secrets of neutrinos
13:25 – 13:45	Announcement of results of the poster competition	
13:45 – 14:00	Summary of the Symposium: Prof. Andrzej Twardowski	

Organising Committee:

**Krzysztof Doroba, Jan Gaj, Maciej Geller, Paweł Kowalczyk (chairman),
Tomasz Matulewicz, Marek Pfützner, Izabela Sosnowska, Magdalena Staszal**

Symposium IEP'2004 - poster session

Acronyms following the author's list signify a particular Division or Laboratory within the Institute according to the scheme:

BIO	- Division of Biophysics
NP	- Division of Nuclear Physics
NS	- Division of Nuclear Spectroscopy
OP	- Division of Optics
PFI	- Division of Particles and Fundamental Interactions
PE	- Division of Physics Education
SS	- Division of Solid State Physics
SR	- Division of Structure Research
MP	- Laboratory of Medical Physics
SLD	- Laboratory of Structure and Lattice Dynamics
IFT	- Institute of Theoretical Physics

1. R. Kuś, A. Basińska-Starzycka, K. J. Blinowska, M. Kamiński (MP)
Wyznaczanie przepływu informacji w mózgu podczas testu uwagi ciągłej
Determination of the information flow in brain during continuous attention test
2. W. Jędrzejczak, W. Konopka, A. Grzanka, K. J. Blinowska (MP)
Emisje otoakustyczne wywołane krótkimi bodźcami tonalnymi jako składowa TEOAE
Tone burst evoked otoacoustic emissions as a component of TEOAE
3. A. Palewicz, T. Szumiata, R. Przeniosło, I. Sosnowska, W. Van. Beek (SLD)
Badania Synchrotronowe i Mössbauerowskie magneto-elektrycznego tlenku BiFeO₃
Synchrotron Radiation and Mössbauer studies of the magneto-electric oxide BiFeO₃
4. W. Sławiński, R. Przeniosło, I. Sosnowska, E. Suard (SLD)
Badanie magnetycznego, reorientacyjnego przejścia fazowego w NdFeO₃
Investigations of the spin reorientation phase transition in NdFeO₃
5. M. Regulski, R. Przeniosło, I. Sosnowska, J. U. Hoffmann (SLD)
Badanie struktury magnetycznej beta-MnO₂ za pomocą dyfrakcji neutronów
Neutron diffraction study of the magnetic structure of beta-MnO₂
6. R. Worch, A. Niedźwiecka, C. Mazza, J. Stępiński, M. Jankowska-Anyszka, E. E. Darzynkiewicz, S. Cusack, R. Stolarski. (BIO)
Fluorescencja pozwala badać oddziaływania bio-cząsteczek (białko CBC - koniec 5' mRNA)
Fluorescence allows to study biomolecular interactions (CBC protein- mRNA 5' terminus)
7. M. Kowalska, E. Zielińska - Rohozińska, K. Pakuła, R. Bożek (SR)

Badania supersieci rosnących spontanicznie w procesie epitaksji MOCVD warstw AlGaN na szafirze
A study of spontaneous superlattice formation in MOCVD growth of AlGaN layers on sapphire

8. M. Kowalska, E. Zielińska-Rohozińska, K. Pakuła, R. Bożek (SR)
Badanie wpływu wygrzewania w obecności SiH₄ na gęstość dyslokacji heteroepitaksjalnych warstwach GaN
Reduction of dislocation density in heteroepitaxial GaN subjected to annealed SiH₄ treatment
9. I. Frymark, G. Kowalski (SR)
Wyznaczanie pozycji sieciowej domieszki Mn w w strukturach warstwowych kryształów typu blendy cynkowej dla przypadku GaMnAs
Mn impurity lattice location in the ferromagnetic zincblende gallium manganese arsenide layer structure
10. J. Borowski, J. Gronkowski, R. Salamonik (SR)
Symulacje numeryczne rentgenowskich krzywych odbić w układach wielokrystalicznych
Numerical simulations of x-ray rocking curves in multiple-crystal arrangements
11. E. Wierzbicka, M. Lefeld-Sosnowska, A. Pajączkowska, A. Kłos (SR)
Defekty sieci krystalicznej w jednoskośnych monokryształach GdCa₄O(BO₃)₃
Crystal lattice defects in monoclinic GdCa₄O(BO₃)₃ single crystals
12. U. Malinowska, M. Lefeld-Sosnowska, A. Pajączkowska, A. Kłos (SR)
Dyfrakcyjna topografia rentgenowska monokryształów SrLaGaO₄
X-ray topography of SrLaGaO₄ single crystals
13. L. Mankiewicz (PFI), S. Stankiewicz, A. Bard, M. Ćwiok (PFI), H. Czyrkowski (PFI), R. Dąbrowski (PFI), W. Dominik (PFI), M. Grajda, M. Jegier, G. Kasprowicz, K. Kwiecińska, L. Mankiewicz, K. Nawrocki, B. Pilecki, L. W. Piotrowski, G. Pojmański, K. Późniak, R. Romaniuk, R. Salański, M. Sokołowski, D. Szczygieł, D. Szczygieł, G. Wrochna
Pi of the Sky - Automatyczne poszukiwanie błysków optycznych na całym niebie
Pi of the Sky - Automated search for fast optical transients over the whole sky
14. A. Ukleja (PFI)
Asymetria azymutalna w głęboko nieelastycznym rozpraszaniu elektronów na protonach
Azimuthal asymmetry in deep inelastic ep scattering
15. A. Kalinowski (PFI)
Poszukiwanie czastki Higgsa w kanale H -> tau tau -> mu + tau jet + X w detektorze Compact Muon Solenoid (CMS)
Search for Higgs particle in H -> tau tau -> mu + tau jet + X channel in Compact Muon Solenoid (CMS) detector

16. P. Zych(PFI)
Łamanie symetrii elektrosłabej przez sektor silnie oddziałujących bozonów
Electroweak symmetry breaking by sector of strongly interacting bosons
17. P. Niezurawski, A. F. Żarnecki (PFI), M. Krawczyk (IFT)
Pętla w nieznane
A loop for the unknown
18. R. Stolarski (PFI)
Spinowa struktura nukleonu
Spin structure of the nucleon
19. M. Konecki (PFI)
Udział Grupy Warszawskiej w eksperymencie CMS w CERNie
Warsaw Group in the experiment CMS at CERN
20. K. Buńkowski (PFI)
Mionowy trygger RPC detektora CMS - Narzędzia diagnostyczne dla systemu linków optycznych
RPC Muon Trigger of the CMS Detector – Diagnostic Tools for the Optic Links System
21. J. Ukleja (PFI)
Pomiar falowej funkcji fotonu na stożku świetlnym
Measurement of the Light-Cone Wave Function of the Photon
22. R. Kutner, F. Światała (PE)
Nieliniowe korelacje na giełdzie
Nonlinear correlations on a stock market
23. A. Drzazgowska (PE)
Zasady zachowania energii i pędu w nauczaniu fizyki
Energy and momentum conservation laws in physics education
24. P. Pęczkowski (PE)
Doświadczenia ilustrujące dualizm korpuskularno-falowy
Experiments presenting particle-wave duality
25. K. Surowiecka , A. Wysmolek , H. Koenig, M. Potemski, M. Henini (SS)
Rezonasowe tunelowanie w układzie podwójnych studni kwantowych GaAs/AlGaAs
Resonant tunneling in GaAs/AlGaAs double quantum wells
26. M. Sakowicz (SS)
Akceptor Be w polu elektrycznym heterostruktury GaAs/AlGaAs
Be Acceptor in the Electric Field of GaAs/AlGaAs Heterostructure
27. J. Przybytek (SS)
Pomiary szumu elektronicznego jako metoda charakteryzacji procesów fizycznych zachodzących w heterostrukturach półprzewodnikowych

Electronic noise measurements as a tool for characterisation of physical processes in semiconductor heterostructures

28. K. Kowalik, A. Kudelski, A. Golnik, G. Karczewski, J. Kossut, J. A. Gaj (SS)
Ekscyton, bieksyton i trion w tej samej kropce kwantowej CdTe/ZnTe
Multi-carriers complexes in single CdTe/ZnTe quantum dot
29. J. Suffczynski, K. Werner-Malento, A. Golnik, P. Wojnar, G. Karczewski, J. Kossut (SS)
Charakteryzacja mikroluminescencyjna samoorganizujących się kropek kwantowych CdTe/CdZnTe
Microphotoluminescence characterization of self organized CdTe/CdZnTe Quantum Dots
30. M. Zając, J. Gosk, A. Wołoś, M. Kamińska, A. Twardowski, I. Grzegory, M. Boćkowski, S. Porowski (SS)
Anizotropia magnetyczna monokryształów GaMnN:Mn. Rola efektu Jahna Tellera w centrach $Mn^{3+}(d^4)$
Magnetic anisotropy of bulk GaMnN:Mn monocrystals: The role of the Jahn-Teller effect of $Mn^{3+}(d^4)$ center
31. M. Szot, K. Karpierz, J. Kossut, M. Grynberg (SS)
Przejścia wewnątrzdomieszkowe, które nie skalują się energetycznie – fotoprzewodnictwo studni kwantowej CdTe/CdMgTe domieszkowanej jednorodnie jodem
Intra-impurity transitions in uniformly Iodine doped MBE CdTe/CdMgTe quantum well – with no energetic scaling
32. M. Jaworek, A. Wysmołek, M. Zając, J. Gosk, M. Kamińska, A. Twardowski (SS)
Rezonansowe rozpraszanie Ramana GaN domieszkowanego manganem
Resonant Raman scattering on GaN doped with manganese
33. M. Kamińska, A. Wołoś, J. Gosk, M. Zając, A. Stańczyk, K. P. Korona, A. Wysmołek, A. Twardowski, M. Palczewska, M. Piersa, G. Strzelecka, A. Hruban, M. Boćkowski, I. Grzegory, S. Porowski (SS)
Natura domieszki Mn w półprzewodnikach grupy III-V
Nature of manganese impurity in III-V compounds
34. K. Pakuła (SS)
Projekty naukowe realizowane w Zakładzie Fizyki Ciała Stałego IFD UW dzięki modernizacji urządzenia MOVPE
Scientific projects realized in Institute of Experimental Physics owing to modernisation of MOVPE equipment
35. E. Wójcik (NP)
Promieniowanie gamma z rozpadu Gigantycznego Rezonansu Dipolowego a zmieszanie izospinowe w jądrze ^{36}Ar
Giant Dipole Radiation and Isospin Mixing in ^{36}Ar Nuclei
36. K. Piasecki, T. Matulewicz, R. Ostendorf (KVI Groningen) (NP)
Interferometria par fotonów w zderzeniach Ta+Au przy energii 40 MeV/nukleon

Two-photon Interferometry in Ta+Au Collisions at 40 AMeV

37. A. Złomaniec (NP)
Badanie własności jąder $^{173,174}\text{Yb}$ w stanach o dużym momencie pędu
Investigation of high-spin states in $^{173,174}\text{Yb}$ nuclei
38. A. Pietruczuk, T. Stacewicz (OP)
Badanie zderzeń między elektronami i wzbudzonymi atomami
Investigation of collisions between electrons and excited atoms
39. A. Grochola, W. Jastrzębski, P. Kowalczyk, A. Pashov (OP)
Stan $4^1\Sigma_u^+$ cząsteczki Na_2
The $4^1\Sigma_u^+$ state in Na_2
40. P. Wnuk, Cz. Radzewicz (OP)
Deformowalne lustro do kształtowania impulsów femtosekundowych
Deformable mirror for femtosecond pulse shaping
41. M. K. Kubkowska, T. M. Szczesniak, T. Grycuk (OP)
Skrzydła I satelity linii rezonansowej Zn 213.8 nm zaburzonej przez Kr i Xe : badania doświadczalne i teoretyczne
Line wings and satellites of the Zn 213.8 nm resonance line broadened by Kr and Xe : experimental and theoretical studies
42. M. K. Kubkowska, T. M. Szczesniak, T. Kutner, T. Grycuk (OP)
Samorozszerzenie linii rezonansowych Zn 213.8 nm i Cd 228.8 nm. Test potencjałów oddziaływania i siły oscylatora
Self-broadening of the Zn 213.8nm and Cd 228.8nm resonance lines. Test of the interatomic potentials and oscillator strength
43. T. Kutner, M. K. Kubkowska, T. Grycuk (OP)
Pary kadmu w silnym rezonansowym polu laserowym
Cadmium vapor in a strong resonance laser field
43. W. Wasilewski (OP)
Korelacje we fluorescencji parametrycznej w reżimie dużego wzmocnienia
Correlations in high-gain regime of parametric fluorescence
44. M. Matuszewski, M. Trippenbach, E. Infeld (IFT)
Dynamiczna stabilizacja trójwymiarowych solitonów fal materii w potencjałach periodycznych
Dynamical stabilization of three-dimensional matter-wave solitons in periodic potentials
45. A. Korgul, H. Mach, B.A. Brown, A. Covello, B. Fogelberg, R. Schuber, W. Kurcewicz, E. Gręda, R. Orlandi, M. Sawicka (NS)
 ^{135}Sb i „nowy świat” egzotycznych nuklidów
 ^{135}Sb and the „new world” of exotic nuclei
46. J. Kurcewicz (NS)
Przekrój czynny na produkty reakcji fragmentacji $^{238}\text{U}^{92+}$
Cross sections for fragmentation products of $^{238}\text{U}^{92+}$

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Badanie rozpadu beta ^{107}Sb
Beta decay studies of ^{107}Sb
48. M. Ćwiok, W. Dominik, Z. Janas, A. Korgul, K. Miernik, M. Pfützner, M. Sawicka, A. W. Wasilewski (NS)
Optyczna komora projekcji czasowej do obrazowania dwuprotonowego rozpadu ^{45}Fe
Optical time projection chamber for imaging of two-proton decay of ^{45}Fe nucleus