AGH University of Science and Technology

Faculty of Physics and Applied Computer Science

Annual Report 2011

Akademia Górniczo-Hutnicza

im. Stanisława Staszica w Krakowie

Wydział Fizyki i Informatyki Stosowanej

Raport Roczny 2011

AGH

AGH University of Science and Technology

WYDZIAŁ FIZYKI
I INFORMATYKI
STOSOWANEJ

Faculty of Physics and Applied Computer Science

Wydział Fizyki i Informatyki Stosowanej AGH

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DEPUTY DEAN FOR GENERAL AFFAIRS
prof. dr hab. Janusz Wolny

DEPUTY DEAN FOR EDUCATION
dr hab. Andrzej Lenda, prof. AGH

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ADMINISTRATIVE DIRECTOR
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Preface
Wstęp

The Faculty of Physics and Applied Computer Science (FPACS) is one of the fifteen Faculties of the AGH University of Science and Technology in Cracow. The origins of the Faculty are dated back to 1919, when the Academy of Mining was founded, within which the Chair of Physics was erected. It has undergone several organizational transformations until in 1991 the AGH Senate has decided to form the Faculty of Physics and Nuclear Techniques. In 2004 the name was changed to Faculty of Physics and Applied Computer Science, accordingly to the changes in the fields of scientific and educational activity.

Scientific activity of the Faculty comprises both basic and applied research in solid state physics, nuclear and elementary particles physics, medical physics and physics of the environment.

There are six departments within the Faculty:

1. Department of Applied Informatics and Computational Physics
(Katedra Informatyki Stosowanej i Fizyki Komputerowej)
2. Department of Applied Nuclear Physics
(Katedra Zastosowań Fizyki Jądrowej)
3. Department of Medical Physics and Biophysics
(Katedra Fizyki Medycznej i Biofizyki)
4. Department of Solid State Physics
(Katedra Fizyki Ciała Stałego)
5. Department of Particle Interaction and Detection Techniques
(Katedra Oddziaływań i Detekcji Cząstek)
6. Department of Condensed Matter Physics
(Katedra Fizyki Materii Skondensowanej)

All together 177 persons are employed including 118 scientists and 59 technical and administrative staff. There are 46 full professors and 72 assistant professors or post-docs.

Faculty offers several degree programs leading to B.Sc., M.Sc. and Ph.D. degrees.
The undergraduate studies consist of seven-semester bachelor programs in three distinct areas: technical physics, medical physics and applied computer science. They are followed by three-semester graduate programs, leading to the M.Sc. degree in the various specializations.

Area: **Medical Physics**; specializations:
Dosimetry and Electronics in Medicine, Imaging and Biometrics

Area: **Technical Physics**; specializations:
Computer Physics, Solid State Physics, Nuclear Physics, Environmental Physics

Area: **Applied Computer Science**; specialization:
Computer Techniques in Science and Technology.

Faculty members teach both general physics courses and selected branches of physics for students of twelve Faculties of the AGH-UST. The teaching covers both reading lectures as well as organizing tutorials (physics problems classes) and laboratory work. Faculty's teaching assignments for students of other faculties include both undergraduate and graduate levels. Some of lectures are offered in English.
Faculty organizes complementary courses for the 1st year students of the University in physics (parallel to complementary courses in mathematics, organized by the Faculty of Applied Mathematics). The aim of the courses is to fill possible gaps in the high-school education that discourage young candidates from electing technical- and science-oriented areas of study and – for the candidates who undertook such studies – increase the efficiency of the training.

Faculty hosts three four-year programs of Ph.D. Studies in Physics. The first of them are the regular Ph.D. studies in the fields related to the research interests of Faculty members, i.e. technical nuclear physics, condensed matter physics, high energy physics, nuclear electronics, environmental physics.

The second Ph.D. program started on the 1st October 2009 co-organized with Cracow's Institute of Nuclear Physics and Institute of Catalysis and Surface Chemistry (both Institutes are units of the Polish Academy of Science – PAS). The program under the name **"Interdisciplinary Ph.D. Studies (ISD): New Materials for Modern Technologies and Future Energetics"** is financed by the EU Structural Funds (Program: Kapitał Ludzki). The ISD goal is training high-class specialists, with the Ph.D. degree, in fields recognized as strategically important in EU and presented under the general terms: Info, Bio, Nano and Techno. The program of the Ph.D. studies covers a wide variety of physical, chemical and technological topics in materials science and modern energetics.

Finally, the third Ph.D. program run in co-operation with Institute of Catalysis and Surface Chemistry of PAS and selected research institutes of 10 European countries is a common **International PhD program in Nanoscience**. The project is financed by European Union Innovative Economy Program acting via Foundation for Polish Science. It had been selected for financial support as one of three projects in the first call for the International PhD Studies Programs and started in September 2008.
Research is scheduled for 4 or 5 years, of which 6 to 24 months the students will spend abroad, mostly in Western European institutes that belong to the consortium.

Faculty offers also a three semester Post-diploma (part-time) Study for Teachers. The studies are intended for primary and secondary school teachers, who want to gain additional qualifications giving them right to teach: physics, mathematics, chemistry, computer science, natural sciences and technical education.

Physicists – Doctors Honoris Causa of AGH University of Science and Technology

PROF. MARIAN MIĘSOWICZ
1979
PROF. ANDRZEJ OLEŚ
1995
PROF. MICHAŁ HELLER
1996
PROF. ANDRZEJ Z. HRYNKIEWICZ
1999
PROF. MANUEL RICARDO IBARRA
2008
PROF. JURGEN M. HÖNIG
2010

Physicist – Honorary Consul of AGH University of Science and Technology

PROF. ROLF-DIETER HEUER (GENERAL DIRECTOROF CERN)
2009

Physicist – AGH-UST Honorary Professor

PROF. JERZY NIEWODNICZAŃSKI
2009

Long-term visitors

PROF. MAREK MIHALKOVIC – SŁOWACKA AKADEMIA NAUK
20.03.2011 – 01.04.2011, 26.06.2011 – 08.07.2011

Departments, Groups and Leaders, Achievements in 2011
Katedry, Zespoły i ich kierownicy, Najważniejsze osiągnięcia w 2011 r.

Department of Solid State Physics
Katedra Fizyki Ciała Stałego

STAFF

HEAD

prof. dr hab. Kapusta Czesław, full professor

MAGNETIC BULK- AND NANOMATERIALS GROUP
ZESPÓŁ MATERIAŁÓW MAGNETYCZNYCH LITYCH I NANOMATERIAŁÓW

prof. dr hab. Kapusta Czesław, full professor
dr. hab. Przewoźnik Janusz, assistant professor
dr inż. Sikora Marcin, assistant professor
dr Żukrowski Jan, assistant professor
dr inż. Rybicki Damian, teaching assistant
mgr inż. Pilipowicz Aleksander
Syrek Jolanta
mgr inż. Musiał Wacław
inż. Kazała Tadeusz
Bąkowski Mariusz

MAGNETIC, ELECTRICAL AND STRUCTURAL RESEARCH GROUP
ZESPÓŁ BADAŃ MAGNETYCZNYCH, ELEKTRYCZNYCH I STRUKTURALNYCH

dr hab. Paja Antoni, associate professor
dr hab. Gondek Łukasz, assistant professor
dr Joanna Czub, research assistant
dr inż. Niewolski Janusz, teaching assistant

SUPERCONDUCTING AND MAGNETIC MATERIALS GROUP
ZESPÓŁ MATERIAŁÓW NADPRZEWODZĄCYCH I MAGNETYCZNYCH

prof. dr hab. Kołodziejczyk Andrzej, full professor
dr hab. inż. Kozłowski Andrzej, associate professor
dr hab. inż. Tarnawski Zbigniew, associate professor
dr. hab. Woch Wiesław, assistant professor
dr inż. Chmist Janusz, assistant professor
dr inż. Tokarz Waldemar, assistant professor
mgr Zalecki Ryszard

SURFACE NANOSTRUCTURES GROUP
ZESPÓŁ NANOSTRUKTUR POWIERZCHNIOWYCH

prof. dr hab. Korecki Józef, full professor
dr Karaś Wojciech, assistant professor
dr Ślęzak Tomasz, assistant professor
dr inż. Ślęzak Michał
dr Strzelczyk Bartosz
mgr inż. Matlak Krzysztof
prof. dr hab. inż. Przybylski Marek, full professor

PROFILE

Scientific activity of the Department concentrates on the studies of structural, magnetic and electronic properties and phenomena in the nano- and subnanometric thin films and multilayers for magnetic and catalytic applications, in the rare earth-3d element intermetallics and their interstitial solutions of hydrogen, carbon and nitrogen, in superconductors, including the HTc ones, in magnetic oxides, including the colossal - and low field magnetoresistive ones, in nanoparticle magnetic materials for MRI contrast and magnetic hyperthermia as well as in disordered metallic materials.

The experimental facilities of the Department include:

1. MBE set-up for preparation and analysis of thin films and nanostructures, equipped with LEED, AES, MOKE and CEMS with UHV sample transfer possibility.
2. ARUPS-XPS spectrometer.
3. Scanning tunneling microscope, 30-300 K temperature range.
4. VSM, AC susceptometer, ESR spectrometer, set-up for magnetoresistance measurements with closed circle refrigerator and calorimeter for specific heat measurements in 2-300 K range.
5. X-ray diffractometers (2) with temperature controll within 2-450 Kand 300-1450 K range.

Działalność naukowa Katedry koncentruje się na badaniach własności i zjawisk strukturalnych, magnetycznych i elektronowych w nano- i subnanometrowych cien-kich warstwach i wielowarstwach do zastosowań magnetycznych i katalitycznych, w związkach międzymetalicznych ziem rzadkich z pierwiastkami 3d i ich roztworów międzywęzłowych wodoru, węgla i azotu, w nadprzewodnikach, w tym wysokotemperaturowych, w tlenkach magnetycznych, w tym wykazujących kolosalny i niskopolowy magnetoopór oraz w magnetycie, w materiałach nanocząstkowych na środki kontrastowe do MRI i do hipertermii magnetycznej oraz w nieuporządkowanych materiałach metalicznych.

Baza aparaturowa Katedry zawiera:

1. Zestaw MBE do preparatyki i analizy cienkich warstw i nanostruktur, wyposażony w układy LEED, AES, MOKE i CEMS z możliwością transferu próbek w warunkach ultrawysokiej próżni.
2. Spektrometr ARUPS-XPS.
3. Skaningowy mikroskop tunelowy, zakres temperatur 30-300 K.
4. VSM, susceptometr AC, spektrometr ESR, zestaw do pomiarów magnetooporu z chłodziarką, kalorymetr do pomiarów ciepła właściwego w zakresie 2-300 K.
5. Dyfraktometry rentgenowskie (2) z regulacją temperatury 2-450 K i 300-1450 K.

6. Physical Property Measurement System (Quantum Design model, closed circle liquifier) equipped with 9 Tesla magnet, 2-400 K (VSM: 2-1100 K) temperature range, options: DC susceptibility, magnetisation, torque magnetometry, AC susceptibility, resistance /magnetoresistance, thermal expansion & magnetostriction, thermal transport & thermoelectric properties, specific heat.
7. Moessbauer spectrometers (4), transmission & CEMS, for 6 isotopes, 4-1000 K temperature range.
8. NMR spectrometers for proton resonance (15 MHz) and for magnetic materials, 5-1000 MHz, closed circle refrigerator, 2-300 K.
The research staff of the Department extensively uses synchrotron beamlines as well as neutron and muon facilities at the laboratories abroad.

6. Zestaw do pomiarów własności fizycznych - (PPMS-Quantum Design, skraplarka helowa w zamkniętym obiegu), magnes 9 Tesli, zakres temperatur 2-400 K (VSM: 2-1100 K), opcje: podatność DC, namagnesowanie, magnetometr torsyjny, podatność AC, opór/magnetoopór, rozsze-rzalność termiczna & magnetostrykcja, transport cieplny & własności termoele-ktryczne, ciepło właściwe.
7. Spektrometry moessbauerowskie (4), transmisja & CEMS, 6 izotopów, zakres temperatury 4-1000 K.
8. Spektrometry NMR do rezonansu protonowego (15 MHz) i do materiałów magnetycznych, 5-1000 MHz, chłodziarka helowa w zamkniętym obiegu, 2-300 K.
Pracownicy naukowi Katedry są użytkownikami wiązek promieniowania synchro-tronowego oraz laboratoriów neutronowych i mionowych w zagranicznych ośrodkach badawczych.

ACHIEVEMENTS

Method for quantitative kinetics studies in hydrogen-storage systems by neutron imaging was developed.
New method of calculation of the electrical resistivity of liquid and amorphous alloys was developed.
For superconductor Y_4Co_3 on the basis of calculated spin-magnetization distribution and band structure by the FP-KKR method it was proved that superconductivity coexists with quasi-one-dimensional ferromagnetism.
The relation of enhanced tunnel magnetoresistance to different Fe and Co electronic states and local environements in granular Fe-Co-Zr nanocomposite films in Al_2O_3 matrix was explained.

Opracowano metodę analizy kinetyki w zbiornikach na wodór przy pomocy obrazowania neutronowego.
Opracowanonową metodę obliczeń oporności elektrycznej stopów ciekłych i amorficznych.
Dla nadprzewodnika Y_4Co_3 na podstawie obliczonego metodą FP-KKR rozkładu namagnesowania spinowego i struktury pasmowej stwierdzono, że nadprzewodnictwo współistnieje z kwazi- jednowymiarowym ferromagnetyzmem.
Wyjaśniono związek pomiędzy wzmocnionym magnetooporem tunelowym, a stanem elektronowym i lokalnymi otoczeniami Fe i Co w granularnych nanokompozytowych cienkich warstw Fe-Co-Zr w matrycy Al_2O_3.

ACTIVITY

A. PAJA

- President of the General Control Committee of the Polish Physical Society.

- Przewodniczący Głównej Komisji Rewizyjnej Polskiego Towarzystwa Fizycznego.

Ł. GONDEK

- Member of the Scientific Selection Panel of Helmholtz-Zentrum Berlin.

- Członek panelu naukowego Instytutu Helmholtza w Berlinie.

Ł. GONDEK, J. CZUB

- Member of the Małopolska Regional Committee of the Physics Competition.

- Członek Małopolskiego Okręgowego Komitetu Olimpiady Fizycznej.

A. KOŁODZIEJCZYK

- Member of the Interdiscipinary Board of The Prize of The Minister of Science and Higher Education for Outstanding Scientific Achievements.

- Członek Zespołu interdyscyplinarnego d/s oceny wniosków o przyznanie nagrody Ministra Nauki i Szkolnictwa Wyższego w 2011 roku za wybitne osiągnięcia naukowe.

CZ. KAPUSTA

- Member of the Condensed Matter Physics Board of the European Physical Society.
- Board Member of the Polish Synchrotron Radiation Society.

- Członek Komitetu Fizyki Fazy Skondensowanej Europejskiego Towarzystwa Fizycznego.
- Członek Zarządu Polskiego Towarzystwa Promieniowania Synchrotronowego.

Department of Medical Physics and Biophysics
Katedra Fizyki Medycznej i Biofizyki

STAFF

HEAD

prof. dr hab. inż. Lankosz Marek, full professor

BIOMEDICAL AND ENVIRONMENTAL RESEARCH GROUP
ZESPÓŁ BADAŃ BIOMEDYCZNYCH I ŚRODOWISKOWYCH

prof. dr hab. inż. Lankosz Marek, full professor
dr hab. inż. Węgrzynek Dariusz, associate professor
dr hab. inż. Stęgowski Zdzisław, associate professor
dr inż. Dudała Joanna, assistant professor
dr inż. Furman Leszek, assistant professor
dr inż. Samek Lucyna, assistant professor
dr inż. Szczerbowska-Boruchowska Magdalena, assistant professor
dr Ostachowicz Beata, teaching assistant
dr Czyżycki Mateusz, teaching assistant
inż. Wierzbicki Adam
mgr Ostrowski Antoni
Tomasik Ryszard

MOLECULAR BIOPHYSICS AND BIOENERGETICS GROUP
ZESPÓŁ BIOFIZYKI MOLEKULARNEJ I BIOENERGETYKI

dr hab. Burda Kvetoslava, associate professor
dr Fiedor Joanna, assistant professor
dr Orzechowska Aleksandra, assistant professor

BIOMEDICAL IMAGING AND MODELING GROUP
ZESPÓŁ OBRAZOWANIA I MODELOWANIA

prof. dr hab. Figiel Henryk, full professor
dr inż. Chwiej Joanna, assistant professor
dr inż. Jung Aleksandra, assistant professor
dr inż. Matusiak Katarzyna, assistant professor
dr Matuszak Zenon, assistant professor
dr Turek Krzysztof, assistant professor

MOESSBAUER SPECTROSCOPY GROUP
ZESPÓŁ SPEKTROSKOPII MÖSSBAUEROWSKIEJ

prof. dr hab. Dubiel Stanisław, full professor
dr inż. Cieślak Jakub, assistant professor

PROFILE

The Department of Medical Physics and Biophysics consists of four research groups.
The research activities of Biomedical Imaging and Modeling Group cover the development of Magnetic Resonance Imaging technique, optical imaging, modeling of physiological processes and nuclear medicine diagnostic imaging. The research at Biomedical and Environmental Research Group relates mainly to the investigation of the role of biomodulators in the biochemical mechanism of the pathogenesis and progress of cancers and neurodegeneration. Molecular Biophysics and Bioenergetics Group research is focused on: photosynthetic electron transport and oxygen evolution, organization and physical/chemical properties of native and model dye-protein-lipid systems, topography, elasticity and adhesion of normal and pathological cells as well as chemical properties of functionalized carbon nanotubes. The research interest of Mossbauer Spectroscopy Group includes bio-farmaceutico-medical physics. The main object of the research conducted in the Laboratory of Mössbauer Spectroscopy concerns investigation of various physical properties of technologically important alloys and compounds. Additional interest includes use of the Mössbauer Spectroscopy in the investigation of Fe-containing samples of organic or/and pharmaceutical origin or application (like ferritin, anti-anemic medicaments etc).

Katedra Fizyki Medycznej i Biofizyki składa się z czterech zespołów badawczych. Działalność naukowa Zespołu Obrazowania i Modelowania obejmuje rozwój technik magnetycznego rezonansu jądrowego, obrazowania optycznego, modelowania procesów fizjologicznych oraz obrazowanie diagnostyczne w medycynie nuklearnej. Badania naukowe prowadzone w Zespole Badań Biomedycznych i Środowiskowych dotyczą głównie wyjaśnienia roli biomodulatorów w mechanizmach biochemicznych patogenezy nowotworów i chorób neurodegeneracyjnych. Zespół Biofizyki Molekularnej i Bioenergetyki zajmuje się badaniem: fotosyntetycznego transportu elektronów i wydzielania tlenu; organizacji i własności fizyko-chemicznych natywnych i modelowych układów barwnikowo-białkowo-lipidowych; topografii, elastyczności i adhezji zdrowych i patologicznych komórek oraz chemicznych własności funkcjonalizowanych nanorurek węglowych. Zainteresowania naukowe Zespołu Spektroskopii Moessbauerowskiej koncentrują się na fizyce ciała stałego oraz fizyce bio-farmako-medycznej. Główna tematyka naukowa dotyczy badania różnych własności fizycznych stopów i związków technologicznie ważnych. Ponadto zainteresowania naukowe obejmują wykorzystanie spektroskopii moessbauerowskiej w badaniach postaci i własności żelaza, znajdującego się w próbkach organicznych (n.p. ferrytyna), a także w materiałach farmakologicznych (lekach) i innych materiałach o zastosowaniach medycznych.

BIOMEDICAL AND ENVIRONMENTAL RESEARCH GROUP

The research at the Biomedical and Environmental Research Group relates to the development and application of nuclear analytical methods and examination of dynamic systems. The main topics of interest are biomedical research, environmental science, and protection of cultural heritage. Of particular importance is the investigation of the role of biomodulators in the biochemical mechanisms of the pathogenesis and progress of brain gliomas and neurodegeneration. The elemental and molecular chemical micro imaging is performed with the use of the techniques based on synchrotron radiation, i.e. synchrotron radiation X-ray fluorescence (SRXRF), X-ray absorption near edge structure (XANES) spectroscopy, extended X-ray absorption fine structure (EXAFS) spectroscopy and Fourier transform infrared micro spectroscopy (FTIR).

Another research topics of interest are development and applications of methods based on X-ray micro-beams for chemical analysis of elements in heterogeneous samples and utilization of coherent synchrotron beams in studies of living organisms. A research is conducted on utilization of coherent synchrotron beam for investigating of the morphology/physiology of insect-vectors transmitting diseases.

The investigations in environmental science are connected with the influence of air pollution on cultural heritage and on urban and rural environments. Statistical methods are used for identification of possible sources of air pollutants emission.

The scope of research is also application of computational fluid dynamics (CFD) methods for prediction of related physical phenomena and evolution of dynamic system. The CFD results are validated by radiotracer experiments. These methods have been applied to characterize flow in jet mixers and in hydrocyclone classifiers.

Projekty badawcze realizowane w Zespole Badań Biomedycznych I Środowiskowych dotyczą opracowania i zastosowania jądrowych metod pomiarowych oraz badania systemów dynamicznych. Główne kierunki zainteresowań obejmują badania biomedyczne, środowiskowe jak również ochronę dziedzictwa kulturowego. Szczególnie ważne jest wyjaśnienie roli biomodulatorów w procesach biochemicznych wzrostu nowotworów i neurodegeneracji. Do obrazowania rozkładu pierwiastków i biomolekuł w tkankach na poziomie komórkowym stosowane są techniki oparte na promieniowaniu synchrotronowym tzn. synchrotronowa rentgenowska analiza fluorescencyjna (SRXRF), absorpcja promieniowania X w pobliżu progu absorpcji (XANES), spektroskopia wykorzystująca strukturę subtelną blisko progu absorpcji (EXAFS) oraz mikrospektroskopia promieniowania podczerwonego z zastosowaniem transformacji Fouriera (FTIR).

Innym obszarem działalności jest opracowanie i zastosowanie metod opartych na mikro-wiązce promienio-wania X do badania rozkładu pierwia-stków w próbkach silnie niejedno-rodnych i wykorzystanie koherentnego promieniowania synchrotronowego w badaniach żywych organizmów. Prace te dotyczą badań morfologii i fizjologii insektów przenoszących choroby.

Tematyka naukowa w zakresie ochrony środowiska dotyczy badania wpływu zanieczyszczeń powietrza na obiekty muzealne oraz degradację środowiska miejskiego i wiejskiego. Do określania źródeł emisji zanieczyszczeń powietrza stosowane są zaawansowane metody statystyczne.

Zakres badań obejmuje zastosowania metody numerycznej mechaniki płynów (NMP) do wyznaczania fizycznych wielkości opisujących przepływ w zadanym układzie. Wyniki obliczeń NMP weryfikowane są poprzez badania radioznacznikowe. Metoda ta została zastosowana do badania mieszalnika

The laboratory is equipped with state-of-art facilities including X-ray fluorescence and infrared confocal microscopes, multifunctional X-ray fluorescence spectrometer for localized and bulk elemental ultra trace analysis.

strumieniowego oraz hydrocyklonu klasyfikującego.Laboratorium jest wyposażone w wysoko specjalistyczną unikatową aparaturę w tym mikroskopy konfokalne promie-niowania X i promieniowania podczerwonego, wielozadaniowy rentgenowski spektrometr fluorescencyjny do mikro /makro analiz ultra śladowych stężeń pierwiastków.

MOLECULAR BIOPHYSICS AND BIOENERGETICS GROUP

Our research is focused on:

- electron transport in photosystem II and bacterial reaction centers;
- role of non-hem iron on the acceptor side activity of type II photosystems;
- oxygen evolution in photosynthesis;
- structure, organization and physical/chemical properties of native and model dye-protein-lipid systems;
- protective and structural functions of carotenoids in native and model photosynthetic complexes;
- physical properties - topography, elasticity, adhesion forces - of normal and pathological cells and their organelles, and determination of the influence of selected stimuli on these properties in both cell types;
- mechanical properties of biopolymers and their influence on cell vital functions such as migration, proliferation and adhesion;
- influence of ionization radiation and metal ions on membrane stability of human erythrocytes;
- physical and chemical characterization of carbon nanotubes;
- Applied experimental methods: absorption and fluorescence spectroscopy, fluorescence with double modulation, thermoluminescence, fast polarography, atomic force microscopy (AFM), Mössbauer spectroscopy.

Badania zespołu dotyczą:

- transportu elektronów w fotosystemie II i bakteryjnych centrach reakcji;
- wpływu żelaza niehemowego na aktywność strony akceptorowej fotosystemów typu II;
- wydzielania tlenu w procesie fotosyntezy;
- struktury, organizacji i własności fizyko - chemicznych natywnych i modelowych układów barwnikowo-białkowo-lipidowych;
- funkcji strukturalnych i ochronnego działania karotenoidów w natywnych i modelowych kompleksach fotosyntetycznych;
- badania wpływu wybranych czynników na własności fizyczne – topografię, elastyczność i siły adhezji - niezmienionych i patolo-gicznych komórek;
- analizy wpływu własności mechanicznych biopolimerów na funkcje życiowe kmórek, m.in. migrację, poliferację i adhezję;
- wpływu promieniowania jonizującego i jonów metali na stabilność błon erytrocytów;
- charakterystyki fizycznych i chemicznych własności nanorurek węglowych;
- Stosowane metody badawcze: spektroskopia absorpcyjna i fluorescencyjna, fluorescencja o podwójnej modulacji, termoluminescencja, szybka polarografia, mikroskopia sił atomowych (AFM), spektroskopia mössbauerowska.

BIOMEDICAL IMAGING AND MODELING GROUP

The scientific subjects of the group consist of:

- nuclear magnetic resonance imaging,
- optical imaging,
- modeling of physiological processes,
- estimation of radiation doses in clinical diagnostics and therapy.

Research concerning MRI is related to the low field systems based on permanent magnets. The main interest is focused on development of new r.f. coils specially designed for such low field imaging and on investigations concerning programs leading to improvement of the image quality.

The other research interest of the group encompasses problems related to cancer radio- and phototherapy of melanomas and free radical processes in biology.

These include both experimental and theoretical investigation. The group develops mathematical modeling of selected physiological processes. It focused especially on application of compartment modeling for extracorporeal liver support therapy. The scientific activity of the group concerns also nuclear medicine diagnostic imaging and QA (Quality Assurance) procedures and in this field designing of phantoms for static and dynamic studies was successfully developed.

Tematyka badawcza grupy obejmuje następujące zagadnienia:

- Obrazowanie z wykorzystaniem zjawiska rezonansu magnetycznego
- Obrazowanie optyczne
- Modelowanie procesów fizjologicznych
- Szacowanie narażenia radiologicznego w diagnostyce i terapii z wykorzystaniem radiofarmaceutyków

Badania dotyczące Obrazowania Magnetyczno-Rezonansowego dotyczą systemów niskopolowych bazujących na magnesach stałych. Główne zainteresowanie jest zogniskowane na rozwoju nowych cewek w.cz. specjalnie projektowanych dla takiego obrazowania niskopolowego, oraz na badaniach dotyczących programów prowadzących do poprawienia jakości obrazów.

Innym obszarem zainteresowań grupy są problemy związane z radio- i fototerapią nowotworów (melanoma) i procesami wolonorodnikowymi w biologii. Badania obejmują zarówno procedury eksperymentalne i teoretyczne.

Rozwijane są metody matematycznego modelowania wybranych procesów fizjologicznych, w szczególności badania skupiają się na wykorzystaniu modelowania kompartmentowego w ocenie wydajności pozaustrojowej terapii wątroby. Aktywność naukowa grupy obejmuje również zagadnienia związane z obrazowaniem i zapewnieniem jakości w procedurach medycyny nuklearnej jak również z projektowaniem i wdrażaniem fantomów statycznych i dynamicznych.

MOESSBAUERSPECTROSCOPY GROUP

Our research interests include two fields: (1) solid state physics and (2) bio-farmaceutico-medical physics. Our activities in the former were focused on experimental and theoretical investigations of various physical properties of the sigma-phase in Fe-X alloy systems (X=Cr, V, Mo, Re), using different experimental (e. g. Mössbauer Spectroscopy, Nuclear Magnetic Resonance, Neutron Diffraction, Magnetometry, Nuclear Resonance Inelastic X-ray Scattering) and theoretical (e. g. Korringa-Kohn-Rostoker Green's function) methods. Regarding the latter issue, we were interested in forms and properties of iron present in samples of an organic origin (e. g. human liver ferritin) as well as farmaceutical approximants of ferritin like Imferon, Ferrum Lek and Maltofer®.

Program naszych badań obejmuje dwie dziedziny: (1) fizykę ciała stałego oraz (2) fizykę bio-farmaceutyczno-medyczną. W ramach (1) prowadzone były badania różnych własności fizycznych fazy sigma w układach Fe-X (X=Cr, V, Mo, Re) przy pomocy kilku metod eksperymentalnych (spektroskopia mössbauerowska, jądrowy rezonans magnetyczny, rozpraszanie neutronów, magnetometria, jądrowe rezonansowe nieelastyczne rozpraszanie promieniowania rentgenowskiego) oraz metody funkcji Greena. W ramach (2) badane były formy oraz własności żelaza obecnego w próbkach organicznych (m. in. wątrobie ludzkiej) jak i farmaceutyczne modele ferrytyny (Imferon, Ferrum Lek, Maltofer®).

ACHIEVEMENTS

BIOMEDICAL ENVIRONMENTAL RESEARCH GROUP

- Development of the numerical methods for elemental 2D and 3D imaging with the use of X-ray fluorescence microspectroscopy
- Development of measurement control and data acquisition system for scanning micro-beam X-ray fluorescence spectrometer
- Development of the methods of cryo-analysis of oxidation state and chemical environment of selected elements in brain cancers with the use of methods based on synchrotron radiation
- Organization of the International Conference on Development and Application of Nuclear Technologies NUTECH-2011, AGH-University of Science and Technology, Faculty of Physics and Applied Computer Science, Krakow, 11-14 September, 2011

- Opracowanie metod numerycznych dla potrzeb pierwiastkowego obrazowania 2D i 3D w rentgenowskiej mikrospektroskopii fluorescencyjnej.
- Opracowanie programu sterowania i akwizycji danych pomiarowych dla skaningowego rentgenowskiego analizatora fluorescencyjnego
- Opracowanie metody pomiaru w niskich temperaturach stopnia utlenienia i otoczenia chemicznego wybranych pierwiastków w nowotworach mózgu z zastosowaniem metod opartych na promieniowaniu synchrotronowym.
- Zorganizowanie na Wydziale Fizyki i Informatyki Stosowanej AGH Międzynarodowej Konferencji „Development and Application of Nucle-ar Technologies NUTECH-2011", Kraków, 11-14 września 2011, Kraków

- Evaluation of elemental and biomolecular characteristic of dopaminergic neurons in human senile brains.
- Preparation of multi-layer standard reference materials for the evaluation of analytical capabilities of confocal 3D micro X-ray spectrometers and for the validation of mathematical procedures used in 3D μXRF spectroscopy.

- Opracowanie charakterystyki pierwiastkowo-biomolekularnej neuronów dopaminegicznych mózgów starczych u ludzi.
- Przygotowanie wielowarstwowych materiałów referencyjnych do oceny możliwości analitycznych rentgennowskich spektrometrów konfokalnych oraz walidacji procedur matematycznych stosowanych w rentgenowskiej mikroanalizie fluorescencyjnej, w geometrii kofo-kalnej.

MOLECULAR BIOPHYSICS AND BIOENERGETICS GROUP

- We show that changes of the surrounding of the quinone firmly bound on the acceptor side of bacterial reaction centers of type II from non-polar to polar cause an occurrence of a low spin ferrous state of the non-heme iron.
- We found that various ways of grinding of non-functionalized/ functionalized multiwall carbon nanotubes (MWCNT) result in different modification of chemical and physical properties of iron aggregates within MWCNT.
- We show that low doses of γ-, α- and neutron radiation of order of μGy cause damage of the erythrocyte membrane.
- Our studies of the adhesion properties of DPPC multilamellar liposomes show that the adhesive forces are about 5-fold higher at 31 ^{o}C in the presence of 1 mol% β-carotene than in its absence.

- Pokazaliśmy, że zmiana otoczenia chinonu silnie związanego na stronie akceptorowej bakteryjnych centrów reakcji typu II z niepolarnego na polarne powoduje pojawienie się zredukowanego nisko-spinowego stanu żelaza niehemowego.
- Zauważyliśmy, że różne techniki rozdrabniania niefunkcjonalizowanych i funkcjonalizowanych wielościennych nanorurek węglowych (MWCNT) prowadzą do odmiennej modyfikacji chemicznych i fizycznych własności agregatów żelaza związanych w MWCNT.
- Pokazaliśmy, że małe dawki promieniowania γ-, α- i neutronów rzędu μGy powodują uszkodzenie błon erytrocytów.
- Badania nasze, dotyczące własności adhezyjnych liposomów wielowarstwowych DPPC wykazały, że siły adhezji rosną ok. 5-krotnie w temp. 31 ^{o}C w badanych układach w obecności 1ml% β-karotenu.

BIOMEDICAL IMAGING AND MODELING GROUP

- Application of the thermoluminescent dosimetry for radiation dose estimation in radioiodine therapy.

- Zastosowanie dozymetrii termoluminescencyjnej do szacowania dawki terapii z użyciem radiojodu.

- Analysis of an influence of different time schedules on extracorporal liver support therapy efficiency.
- Evaluation of the application of the radiation protection of the personnel in the nuclear medicine hot laboratory.
- Elaboration of the specialized dosimetric phantom and preparation of the patent application
- Construction of surface and low temperature r.f. coils for low field Magnetic Resonance Imaging system.
- Development of numerical programs based on Wavelet and Curvelet Transforms for the noise reduction (improvement of SNR) in Magnetic Resonance Imaging.
- Monte Carlo modeling of the light transport in the pigmented tissues.

- Analiza wpływu różnych schematów czasowych na wydajność pozaustrojowej terapii wątroby.
- Opracowanie aplikacji do szacowania narażenia radiologicznego personelu biorącego udział w przygotowaniu radiofarmaceutyków w zakładzie medycyny nuklearnej.
- Opracowanie specjalistycznego fantomu dozymetrycznego i przygotowanie dotyczącego go zgłoszenia patentowego
- Budowa powierzchniowych i niskotemperaturowych cewek w. cz. do niskopolowego systemu obrazowania magnetyczno-rezonansowego.
- Rozwój programów numerycznych opartych na transformacie falkowej i krzywkowej do redukcji szumów (poprawa SNR) w obrazowaniu magnetyczno-rezonansowym.
- Modelowanie metodą Monte Carlo transportu światła w tkankach upigmentowanych.

MOESSBAUERSPECTROSCOPY GROUP

- Experimental demonstration that the actual distribution of atoms in Fe-Cr alloys significantly depends on the metallurgical state of the alloys.
- Experimental evidence that the spectral parameters viz. the quadrupole splitting and the isomer shift are characteristic features of the human liver ferritin and its farmaceutical approximants (Ferrum Lek, Imferon, Maltofer®). Small differences between these parameters may be related to underlying differences in the size and structure of the ferritin cores in the studied samples.
- Experimental demonstration that both colorimetric co-ordinates a^* and b^* are linearly correlated with the content of goethite and hematite in ochres from Roussillon, hence they are responsible for the colours of the ochres.

- Wykazanie na drodze eksperymentalnej, że rozkład atomów w stopach Fe-Cr w istotny sposób jest zależny od stanu metalurgicznego próbek.
- Wykazanie na drodze eksperymentalnej, że parametry spektralne (rozszczepienie kwadrupolowe oraz przesunięcie izomeryczne) są specyficzne dla ferrytyny pochodzącej z ludzkiej wątroby a także dla jej farmaceutycznych modeli (Ferrum Lek, Imferon, Maltofer®). Niewielkie lecz mierzalne różnice między nimi mogą odzwierciedlać różnice w wielkości i strukturze rdzeni ferrytynowych badanych próbek.
  Wykazanie na drodze eksperymentalnej, że oba kolorymetryczne współrzędne tj. a^* i b^* są liniowo skorelowane z zawartością gethytu i hematytu w próbkach ochry z regionu Roussillon, czyli są odpowiedzialne za ich kolor.

ACTIVITY

M. LANKOSZ

- Member of X-Ray Spectrometry Advisory Board (since 2008)
- Member of Scientific Council of the Institute of Nuclear Chemistry and Technology (since 2002)
- Chairman of the Organizing Committee of the International Conference on Development and Applications of Nuclear Technologies NUTECH 2011 (since 2008)
- Member Committee of Nuclear Technology at the National Atomic Energy Agency (since 2009)
- Member of Editorial Board of „Nukleonika" (since 2010)

- Członek Komitetu Doradczego czasopisma X-Ray Spectrometry (od 2008)
- Członek Rady Naukowej Instytutu Chemii I Techniki Jądrowej (od 2002)
- Przewodniczący Komitetu Organizacyjnego Międzynarodowej Konferencji Rozwój i Zastosowania Technologii Jądrowych - NUTECH 2011 (od 2008)
- Członek Komitetu Technologie Jądrowe przy Państwowej Agencji Atomistyki
- Członek Komitetu Redakcyjnego czasopisma "Nukleonika" (od 2010)
- Członek Zespołu interdyscyplinarnego do spraw Programu wspierania infrastruktury badawczej w ramach Funduszu Nauki i Technologii Polskiej

M. CZYŻYCKI

- Member of the European Microbeam Analysis Society
- Member of the European X-ray Spectrometry Association

- Członek Europejskiego Towarzystwa Analizy Mikrowiązką (EMAS)
- Członek Europejskiego Stowarzyszenia Spektrometrii Promieniowania Rentgenowskiego (EXSA)

Z. STĘGOWSKI

- Member of Editorial Board – Nucleonic Bulletin

- Członek Komitetu Redakcyjnego Biuletynu Nukleonicznego

D. WĘGRZYNEK

- Secretary of the Organizing Committee of the International Conference on Development and Applications of Nuclear Technologies NUTECH 2011 (since 2008)

- Sekretarz Komitetu Organizacyjnego Międzynarodowej Konferencji Development and Applications of Nuclear Technologies NUTECH 2011

K. BURDA

- A member of Scientific Council at Multidisciplinary School of Engineering in Biomedicine, AGH University of Science and Technology (since 2009)
- Head of the BIONAN consortium (since 2008)

- Członek Rady Programowej Międzywydziałowej Szkoły Inżynierii Biomedycznej AGH – Akademii Górniczo-Hutniczej (od 2009)
- Kierownik konsorcjum BIONAN (od 2008)

A. ORZECHOWSKA

- A member of National Qualification Framework for specialization of Medical Physics on Faculty of Physics and Applied Computer Science

- Członek Krajowych Ram Kwalifikacji Kształcenia dla kierunku „Fizyka medyczna" na Wydziale Fizyki I Informatyki Stosowanej

H. FIGIEL

- Member of the Main Board of the Polish Physical Society
- Chairman of the Auditorial Comission of the Polish Society of Neutron Diffraction
- Chairman of the Auditorial Comission of the Polish Fuel Cell and Hydrogen Association
- Chairman of the board of BIOMAR Consortium
- Member of the Programme Board of the Inter-Faculty School of Biomedical Engineering
- Member of International Steering Committee of the International Symposia on Metal Hydrogen Systems
- Secretary of the Krakow Branch of the Societas Humboldtiana Polonorum
- Chairman of the Audit Committee of the Polish Hydrogen and Fuel Cell Association

- Członek Zarządu Głównego Polskiego Towarzystwa Fizycznego
- Przewodniczący Komisji Rewizyjnej Polskiego Towarzystwa Rozpraszania Neutronów
- Przewodniczący Komisji Rewizyjnej Polskiego Stowarzyszenia Wodoru i Ogniw Paliwowych
- Przewodniczący Rady Konsorcjum BIOMAR
- Członek Rady Programowej Międzywydziałowej Szkoły Inżynierii Biomedycznej AGH
- Członek Międzynarodowego Komitetu Koordynacyjnego Międzynarodowych Sympozjów Układów Metal-Wodór
- Członek Komitetu Naukowego II Polskiego Forum Ogniwa Paliwowe i Technologie Wodorowe
- Sekretarz Oddziału Krakowskiego Societas Humboldtiana Polonorum,
- Przewodniczący Komisji Rewizyjnej Polskiego Towarzystwa Wodoru i Ogniw Paliwowych

A. JUNG

- Vice Chairman of the Krakow Branch of the Polish Society of Medical Physics
- Coordinator for Medical Physics field in the project "Now physics. New forms of education closer to employers"

- Zastępca Przewodniczącego Oddziału Krakowskiego Polskiego Towarzystwa Fizyki Medycznej
- Koordynator ds. Kierunku Fizyka Medyczna projektu "Teraz Fizyka. Nowe formy kształcenia bliżej pracodawcy"

Z. MATUSZAK

- President of Cracow Branch of the Polish Biophysical Society

- Prezes Krakowskiego Oddziału Polskiego Towarzystwa Biofizycznego

K. MATUSIAK

- Chairman of the Unit for National Qualification Frame introduction for Medical Physics Course
- Coordinator of 90-th anniversary of Polish Physical Society preparations at the Medical Physics Department

- Przewodnicząca zespołu ds. wdrażania Krajowych Ram Kwalifikacji dla kierunku Fizyka Medyczna
- Koordynator prac w Katedrze Fizyki Medycznej i Biofizyki związanych z obchodami 90-lecia Polskiego Towarzystwa Fizycznego

S. M. DUBIEL

- Member of the Senate Commission for Discipline of Students
- Fellow of the Institute of Physics, London (since 2002)
- Member of the Mössbauer Century Club, USA (since 2005)
- Member of the Research Board of Advisors of The American Biographical Institute (since 2005)
- Vice-president of the Krakow Branch of the Polish Physical Society (since 2009)
- Panel Member for Fellows at the Institute of Physics (IOP), London
- Panel's Chair for Fellows at IOP
- Chairman of session at 4th Seeheim Conference on Magnetism, SCM2010, Frankfurt a/Main, 17 March-1 April, 2010
- Reviewer for Intermetallics
- Member of the Editorial Board for *Applied Sciences*

- Członek Senackiej Komisji ds. Dyscyplinarmych Studentów
- Członek Instytutu Fizyki w Londynie w randze Fellow
- Członek Mössbauer Century Club, USA
- Członek Komitetu Doradczego Amerykańskiego Instytutu Biograficznego (ABI)
- Zastępca Przewodniczącego Krakowskiego Oddziału PTF
- Członek Komisji ds. Fellows w Instytucie Fizyki w Londynie (IOP)
- Przewodniczący Komisji ds. Fellows w Instytucie Fizyki w Londynie (IOP)
- Przewodniczący sesji podczas 4th Seeheim Conference on Magnetism, SCM2010, Frankfurt a/Main, 17 March-1 April, 2010
- Recenzent czasopisma *Intermetallics*
- Członek Komitetu Redakcyjnego czasopisma *Applied Sciences*

POST-GRADUATED FELLOWS

- Mr. Christian Priesley Kofi DAGADU
  Department of Nuclear Engineering & Material Science
  National Nuclear Research Institute, Ghana Atomic Energy Commission
  P.O. Box Lg 80, Legon, Accra, Ghana.
  Fellowship from IAEA Vienna

- Sugiharto
  Department of Physics, Faculty of Mathematics and Natural Sciences
  Bandung Institute of Technology,
  Jl. Ganesa 10, Bandung 40132, Indonesia

Department of Condensed Matter Physics
Katedra Fizyki Materii Skondensowanej

STAFF

HEAD

prof. dr hab. inż. Krzysztof Wierzbanowski full professor.

prof. dr hab.Stanisław Kaprzyk full professor
prof. dr hab. Janusz Wolny full professor
prof. dr hab. inż. Wojciech Łużny full professor.
prof. dr hab. Wiesława Sikora full professor
prof. dr hab. inż. Andrzej Zięba associate professor.
prof. dr hab. inż. Janusz Toboła associate professor
dr hab. inż. Andrzej Baczmański associate professor.
dr hab. inż. Andrzej Bernasik associate professor
dr hab. inż. Jacek Tarasiuk associate professor.
dr inż. Paweł Armatys assistant professor
dr inż. Jakub Haberko assistant professor
dr inż.Jan Kulka assistant professor
drJacek Nizioł assistant professor
dr Lucjan Pytlik assistant professor
dr inż. Bartłomiej Wiendlocha assistant professor
dr inż. Sebastian Wroński assistant professor
mgr inż. Roman Wawszczak teaching assistant
Władysław Błaszczyk
Ryszard Skotnicki

PROFILE

Scientific activities of the Department are mainly focused on the following topics:

- Properties and symmetry analysis of selected phases of ordered structures
- Studies of aperiodic structures
- Deformation, recrystallization and internal stresses in polycrystalline materials
- Electron structure of the solid state
- Polymer research
- Theory of measurement uncertainty

Działalność naukowa Katedry dotyczy następujących zagadnień:

- Własności i analiza symetryczna wybranych faz struktur uporządkowanych
- Badanie struktur aperiodycznych
- Odkształcenia, rekrystalizacja oraz naprężenia wewnętrzne w materiałach polikrystalicznych
- Struktura elektronowa ciał stałych
- Teoria niepewności pomiarów

ACHIEVEMENTS

- Characterization of interface formed by a self-assembled monolayer placed between a thin polymer film and metal using Kelvin Probe Force Microscopy.
- Development of a new approach of calculation of lattice rotation accompanying the slip.
- Neuron diffraction method for stress determination in each phase and in single polycrystalline grain of multiphase materials was developed. In addition, the X-ray method of measuring stress in the surface layers at depths of the order of 1-10 μm was tested using synchrotron radiation.
- Using Compton scattering technique and KKR-CPA calculations orbital character of holes in HTS (high temperature superconductor) La2−xSrxCuO4 (LSCO) was analyzed. It was shown, that depending on substitution, holes change location from 2p-O orbitals to 3d-Cu ones.
- It was confirmed, for the first time basing on electronic structure calculations, that Y4Co3 exhibits weak ferromagnetism, generated by one cobalt atom. It was shown, that combination of quasi-one-dimensional magnetic chains of Co and diamagnetic Y-Co prisms allows for occurrence of classical superconductivity.
- It was shown, that it is possible to combine resonant electronic levels in PbTe:Tl and alloy scattering of phonons due to Te/S substitution to reach a high thermoelectric figure of merit zT.

- Charakterystyka mikroskopią kelwinowską granicy złącza utworzonego przez warstwę samoorganizującą się ułożoną pomiędzy cienką warstwą polimerową a metalem.
- Rozwinięcie nowego podejścia do obliczania obrotu sieci krystalicznej, towarzyszącego poślizgowi.
- Opracowano metodologię badawczą pozwalającą wyznaczać, przy użyciu dyfrakcji neutronowej, naprężenia powstające w każdej z faz oraz w ziarnach materiałów wielofazowych. Ponadto, za pomocą promieniowania synchrotronowego przetestowano rentgenowską metodę pomiaru naprężeń w warstwach powierzchniowych na głębokościach rzędu 1-10 μm
- Przy pomocy techniki rozpraszania Comptona oraz obliczeń metodą KKR-CPA przeanalizowano charakter orbitalny stanów dziurowych w nadprzewodniku wysokotemperaturowym La2−xSrxCuO4 (LSCO). W zależności od stopnia podstawienia, dziury zmieniają lokalizację z orbitali 2p-O na orbitale 3d-Cu.
- Potwierdzono po raz pierwszy na podstawie obliczeń struktury elektro-nowej występowanie w Y4Co3 słabego ferromagnetyzmu, generowanego przez pojedynczy atom kobaltu. Wykazano, że specyficzne połączenie magnetycznych quasi-jednowymiarowych łańcuchów atomowych Co oraz dia-magnetycznych pryzm Y-Co zezwala na występowanie klasycznego nadprzewodnictwa w tym układzie.
- Pokazano, że jest możliwe jednoczesne wykorzystanie istnienia rezonansowego stanu elektronowego w PbTe:Tl, dającego wysoką termosiłę, oraz podstawienia Te/S, obniżającego przewodnictwo termiczne, w celu osiągnięcia wysokiego współczynnika sprawności zT.

ACTIVITY

A. BACZMAŃSKI

- Member of Scientific Committee of International Conferences: “European Conference on Residual Stresses (ECRS)” and “Size-Strain Conference”
- Reviewer of : “Scripta Materialia” and Z. Angew. Math. Mech.

- Członek Komitetów Naukowych Międzynarodowych Konferencji: European Conference on “Residual Stresses (ECRS)” oraz “Size-Strain oraz Size and Strain”
- Recenzent czasopism: “Scripta Materialia” oraz Z. Angew. Math. Mech.

W. ŁUŻNY

- Dean of the Faculty of Physics and Applied Computer Science
- Expert of National Science Centre, panel ST5 "Materials and synthesis".

- Dziekan Wydziału Fizyki i Informatyki Stosowanej
- Ekspert Narodowego Centrum Nauki w panelu ST5 "Synteza i materiały"

W. SIKORA

- Member of Committee of Crystallography, Polish Academy of Science
- Member of Commission on Magnetic Structures of the International Union of Crystallography
- Member of Polish Society of Neutron Diffraction

- Członek Komitetu Krystalografii Polskiej Akademii Nauk
- Członek Komisji Struktur Magnetycznych Międzynarodowej Unii Krystalograficznej
- Członek Polskiego Towarzystwa Rozpraszania Neutronów

J. TARASIUK

- Member of Rectors’s jury for: Lecture Notes in Internet

- Członek jury JMK Rektora Notatki w Internecie

J. TOBOŁA

- Reviewer of Physical Review Letters & Physical Review B
- Member of International Scientific Committees of ECT Conferences by European Thermo-Electrical Society
- Member of International Advisory Board of the International Conference on Thermoelectrics, Kobe, Japan (2013).

- Stały recenzent APS (American Physical Society) czasopism Physical Review Letters & Physical Review B.
- Członek międzynarodowych komitetów naukowych organizujących konferencje: ECT Europejskiego Towarzystwa Termoelektrycznego
- Członek międzynarodowego komitetu konferencji: Thermoelectrics, Kobe, Japonia (2013)

K. WIERZBANOWSKI

- Member of Board of Reviewers: Archives of Metallurgy and Materials
- Reviewer of American Physical Society for journals: Physical Review Letters and Physical Review B
- Dean's representative for Assurance of Quality of Teaching
- Member of International Scientific Committees of Conferences on: Mechanical Stress Evaluation by Neutrons and Synchrotron Radiation (MECA SENS)

- Członek komitetu recenzentów czasopisma Archives of Metallurgy and Materials
- Recenzent American Physical Society do czasopism: Physical Review Letters Letters oraz Physical Review B
- Pełnomocnik Dziekana ds. Jakości Kształcenia
- Członek międzynarodowych komitetów naukowych organizujących konferencje z cyklu: Mechanical Stress Evaluation by Neutrons and Synchrotron Radiation (MECA SENS)

J. WOLNY

- Deputy Dean for General Affairs of the Faculty of Physics and Applied Computer Science
- Member of Committee of Crystallography, Polish Academy of Science

- Prodziekan ds. Ogólnych Wydziału Fizyki I Informatyki Stosowanej
- Członek Komitetu Krystalografii Polskiej Akademii Nauk

A. ZIĘBA

- Polish Physical Society: belongs to Main Board and member of Commission for Rewards and Distinctions
- Member of Section of Foundations of Metrology of Committee of Metrology and Measurement Equipment, Polish Academy of Sciences

- Polskie Towarzystwo Fizyczne: należy do Zarządu Głównego oraz członek Komisji Nagród i Wyróżnień
- Członek Sekcji Podstaw Metrologii Komitetu Metrologii i Aparatury Pomiarowej, Polska Akademia Nauk

Department of Applied Informatics and Computational Physics
Katedra Informatyki Stosowanej i Fizyki Komputerowej

STAFF

HEAD

prof. dr hab. Kułakowski Krzysztof, full professor

COMPLEX SYSTEMS GROUP
ZESPÓŁ UKŁADÓW ZŁOŻONYCH

prof. dr hab. Kułakowski Krzysztof, full professor
prof. dr hab. Maksymowicz Andrzej, professor em.
prof. dr hab. Spałek Józef, full professor
prof. dr hab. inż. Kąkol Zbigniew, full professor
dr hab. inż. Saeed Khalid, associate professor
dr hab. Lenda Andrzej, associate professor
dr inż. Dydejczyk Antoni, assistant professor
dr inż. Gawroński Przemysław, assistant professor
dr inż. Gronek Piotr, assistant professor
dr inż. Krawczyk Małgorzata, assistant professor
dr inż. Malarz Krzysztof, assistant professor
dr inż. Wołoszyn Maciej, assistant professor
dr inż. Kawecka-Magiera Barbara, senior lecturer
dr inż. Krupińska Grażyna, senior lecturer
dr inż. Malinowski Janusz, senior lecturer
mgr inż. Chodak Jacek, teaching assistant
mgr inż. Misztal Krzysztof, teaching assistant
mgr inż. Szczepański Adam, teaching assistant

THEORY OF NANOSTRUCTURES AND NANODEVICES GROUP
ZESPÓŁ TEORII NANOSTRUKTUR I NANOURZĄDZEŃ

prof. dr hab. Stanisław Bednarek, full professor
prof. dr hab. Janusz Adamowski, full professor
dr hab. inż. Bartłomiej Szafran, associate professor
dr inż. Tomasz Chwiej, assistant professor
dr inż. Bartłomiej Spisak, assistant professor

PROFILE

COMPLEX SYSTEMS GROUP

Research is conducted in a few threads; below the topics are mentioned which are concentrated in the Complex Systems Group. One of them is connected with the collaboration with laboratories of material sciece at the Universidad del Pais Vasco, San Sebastian, and Instituto de Ciencia de Materiales de Madrid, CSIC. In particular, we are modeling hysteresis loops in micro- and nanoscopic systems.

Other directions of research deal with modeling sociological processes in general frames of game theory and with statistical mechanics of complex networks. Since 2009, the subject is conducted in frames of 7FP EU SOCIONICAL on applications of complexity theory to socio-technical systems. Our contribution is based, among other things, on simulations of crowd dynamics within the social force model.

Within the group, the biometric team is also developed. The scientific subject of the team consists of:

- Automatic verification of a human identity
- Automatic techniques of a human recognition
- Analysis and processing of digital images

Research on the identification and verification of a human identity is focused, both around the characteristics associated with anatomy and functioning of the human body. The aim of the team work is to create an automatic biometric system based on the features contained in the fingerprints, the iris, ECG signal, the face anatomy and the voice.

In the studies, which are concentrated around the biometric issues, attention of the team researchers is focused on the techniques of feature extraction and signal classification methods.

Badania prowadzone są w kilku kierunkach; wymieniamy tu tematy skoncentrowane w Zespole Układów Złożonych. Jeden z tych kierunków wiąże się z współpracą z laboratoriach fizyki materiałowej na Universidad del Pais Vasco, San Sebastian, i w Instituto de Ciencia de Materiales de Madrid, CSIC. Modelowane są m. in. pętle histerezy układów mikro- i nanosko-powych. Inne kierunki badań to modelowanie procesów społecznych w ramach szeroko pojętej teorii gier oraz mechanika statystyczna sieci złożonych. Od 2009 te tematy są badane w ramach grantu 7FP EU SOCIONICAL dotyczącego zastosowań teorii złożoności w układach technospołecznych.

W ramach Zespołu rozwija się również grupa badań biometrycznych. Tematyka badawcza obejmuje następujące zagadnienia:

- Automatyczna weryfikacja tożsamości człowieka
- Techniki automatycznego rozpoznawania tożsamości ludzkiej
- Analiza i przetwarzanie obrazów cyfrowych

Badania dotyczące rozpoznawania i weryfikacji tożsamości ludzkiej koncentrują się zarówno wokół cech związanych z budową jak i funkcjonowaniem organizmu ludzkiego. Celem działań zespołu jest stworzenie automatycznego systemu biometrycznego bazującego na cechach ukrytych w: liniach papilarnych, tęczówce oka, EKG, anatomii twarzy, głosie.

W badaniach dotyczących zagadnień biometrycznych uwagę skoncentrowano nad analizą technik ekstrakcji cech z sygnałów biometrycznych oraz metodami klasyfikacji uzyskanych sygnałów.

The analysis of Toeplitz matrices minimal eigenvalues in the above mentioned issues is carried out for the aim of constructing an image simple feature vector.
Several studies are conducted on the purpose of developing novel methods for the biometric digital image analysis, with the emphasis focused on the medical images.

Prowadzone są obszerne analizy użyteczności macierzy Toeplitza w opisie sygnałów. Prowadzone są badania, których celem jest opracowanie nowatorskich metod opisu obrazów cyfrowych, z naciskiem położonym na analizę obrazów medycznych.

THEORY OF NANOSTRUCTURES AND NANODEVICES GROUP

- Theory of electronic properties of quantum dots
- Computer simulations of qubits and logic gates in nanodevices
- Theory of electron quantum transport in quantum wells and nanowires
- Modeling spin-orbit coupling effects in quantum dot
- Simulation of electron spin transport through resonant tunnelling diodes and quantum rings
- Investigation of the conductivity in quantum rings

- Teoria elektronowych własności kropek kwantowych
- Symulacje komputerowe kubitów i bramek logicznych w nanourządzeniach
- Teoria kwantowego transportu elektronów w studniach i drutach kwantowych
- Modelowanie oddziaływania spin-orbita w kropkach kwantowych
- Symulacja transportu spinu w rezonansowych diodach tunelowych i pierścieniach kwantowych.
- Badanie przewodnictwa elektronowego pierścieni kwantowych

ACHIEVEMENTS

COMPLEX SYSTEMS GROUP

- New applications of symmetry induced compression of phase space in discrete systems
- Generalization of magnetic phase transitions to athermal phenomena
- Calculations on the spin model and the voter model on exotic lattices
- Traffic data analysis for M30 Madrid autoroute
- Utilizing the Toeplitz matrices in biometrics systems
- New algorithms for ECG signal analysis and recognition,
- Further approaches to vascular pattern recognition

- Nowe zastosowania kompresji przestrzeni stanów dla układów dyskretnych
- Uogólnienie magnetycznych przejść fazowych na zagadnienia atermiczne
- Obliczenia modelu spinowego i modelu głosowania w egzotycznych sieciach
- Analiza danych ruchu drogowego dla madryckiej obwodnicy M30
- Zastosowania macierzy Toeplitza w układach biometrycznych
- Nowe algorytmy do analizy i rozpoznawania sygnałów EKG
- Kontynuacja badań rozpoznawania obrazu naczyń krwionośnych

THEORY OF NANOSTRUCTURES AND NANODEVICES GROUP

- Designing and simulation the work of the nanodevice for high precision readout of electron spin without magnetic field.
- Study of avoided crossings opened by spin-orbit interaction in the energy spectra of two-electron anisotropic quantum dots in perpendicular magnetic field.
- Computer simulations of the spin-dependent electron transport through resonant tunnelling diode
- Explanation of the appearance of Fano resonances in the conductance in quantum ring
- The simulation of electron flow through a semiconductor quantum ring perturbed by a charged tip of a scanning microscope.

- Opracowanie i symulacja działania nanourządzenia do odczytu spinu elektronu bez użycia pola magnetycznego.
- Przebadanie efektów oddziaływania spin-orbita dla pary elektronów w kropce kwantowej w funkcji jej orientacji względem osi krystalicznych i pola magnetycznego.
- Przebadanie zależnego od spinu transportu elektronowego w paramagnetycznej rezonansowej diodzie tunelowej
- Wyjaśnienie przyczyn pojawienia się rezonansów Fano w przewodnictwie w pierścieniu kwantowym.
- Symulacja eksperymentu mapowania przewodności pierścienia kwantowego metodą bramki skanującej.

ACTIVITY

Z. KĄKOL

- Vice Rector for Education
- Member of Jury of the Małopolska Grant Foundation „Sapere Auso”
- Member of Board of the Zielinscy Foundation of Educational Help for Young People
- Member of Jury of the Prize of Prof. Taklinski
- President of the Board of the Foundation of Students and Alumni AGH ACADEMICA

- Prorektor ds. kształcenia AGH;
- Jury Małopolskiej Fundacji Stypendialnej „Sapere Auso”;
- Zarząd Fundacji Pomocy Edukacyjnej dla Młodzieży im. H. i T. Zielińskich;
- Jury Nagrody im. Prof. Władysława Taklińskiego;
- Przewodniczący rady fundacji studentów i absolwentów AGH ACADEMICA;

K. KUŁAKOWSKI

- Referee of scientific journals: Physica A, Journal of Artificial Societies and Social Simulation

- Recenzent czasopism naukowych: Physica A, Journal of Artificial Societies and Social Simulation

A. LENDA

- Deputy Dean of the Faculty of Physics and Applied Computer Sciences, AGH-UST (since 2005)
- Coordinator of International Contacts for Students of AGH-UST

- Prodziekan ds Kształcenia Wydziału Fizyki i Informatyki Stosowanej AGH (od 2005)
- Koordynator Praktyk Zagranicznych Studentów AGH

K. MALARZ

- Managing Editor, Central European Journal of Physics (since 2006)
- Member of the Scientific Council of Polish Conferences on Computer Games Engineering (since 2005)
- Deputy Dean of the Faculty of Physics and Applied Computer Sciences, AGH-UST (since 2005)
- Member of the Auditorial Commission for Section of Physics in Economy and Social Sciences, Polish Physical Society (since 2009)
- Referee of scientific journals: Physical Review Letters, Physical Review E, Physica A, The Physical European Journal B, International Journal of Modern Physics C
- Member at the Ministry of Science and Higher Education, Experts Group for Sciences and Engineering Sciences to assess applications for funds for statutory activity (since 2011)

- Redaktor Central European Journal of Physics (od 2006)
- Członek Rady Naukowej Ogólnopolskich Konferencji Inżynierii Gier Komputerowych (od 2005)
- Prodziekan ds Studenckich Wydziału Fizyki i Informatyki Stosowanej AGH (od 2005)
- Członek Komisji Rewizyjnej Sekcji Fizyki w Ekonomii i Naukach Społecznych Polskiego Towarzystwa Fizycznego (od 2009)
- Recenzent czasopism naukowych: Physical Re-view Letters, Physical Review E,Physica A, The Physical European Journal
- Członek Zespołu Specjalistycznego Nauk Technicznych i Ścisłych (ZS-3) do oceny wniosków o przyznanie środków finansowych na działalność statutową, MNiSzW (od 2011)

J. SPAŁEK

- Member of the Science Council, Ministry of Science and Higher Education for the period 2008-11.

- Członek Rady Naukowej przy MNiSzW na 2008-11

K. SAEED

- Editor-in-Chief of International Journal on Computer Information Systems and Industrial Management Applications since 2008, Publishers: MIR Labs, USA
- Editor-in-Chief of International Journal of Biometrics (since 2007) Publishers: Inderscience, UK
- Conference General Chair, ICBAKE 2009 – International Multi-Conference on Biometrics and Kansei Engineering, June 25-28, Cieszyn, Poland
- Conference General Chair, CISIM 2010, October 8-10, Cracow, Poland
- IEEE Computer Society Senior Member (Member since 1994); 2011-2013 nominated for IEEE CS DVP Distinguished Visitor Program
- Program and Workshop Chair, BIA 2011 – Springer CCIS, Workshop within ICDIPC, July 7-9 Ostrava, Czech
- Conference Chair, IEEE-ICBAKE 2011 – International Multi-Conference on Biometrics and Kansei Engineering, September 19-21, Kagawa, Japan
- Conference Chair, CISIM 2011 - Springer CCIS, December 14-16, Kolkata, India
- Conference Chair, ASM 2011 – Miedzyzdroje, Poland
- Conference Chair, HuCare 2011 - Daejeon, South Korea
- Naczelny Redaktor International Journal on Computer Information Systems and Industrial Management Applications (od 2008),
- Naczelny Redaktor International Journal of Bio-metrics (od 2007)
- Organizator konferencji ICBAKE 2009 – International Multi-Conference on Biometrics and Kansei Engineering, 25-28.06.2009, Cieszyn
- Organizator konferencji CISIM 2010, 8-10.10.2010, Kraków
- Członek IEEE Computer Society; nominowany do programu Distinguished Visitor Program na lata 2011-13
- Członek rady do spraw programowych i warsztatów, BIA 2011 – Springer CCIS, Workshop within ICDIPC, 7-9.07.2011 Ostrava, Czech
- Członek rady konferencji, CISIM 2011 - Springer CCIS, 14-16.12.2011, Kolkata, India
- Członek rady konferencji, ASM 2011 – Miedzyzdroje, Poland
- Członek rady konferencji, HuCare 2011 - Daejeon, South Korea

S. BEDNAREK

- Member of Editorial Advisory Board, The Open Nanomedicine Journal
- Referee of scientific journals: Physical Review Letters, Physical Review B etc.
- Member of the Physics Committee of the Polish Academy of Sciences
- Członek Komitetu Fizyki PAN
- Członek Redakcyjnego Komitetu doradczego czasopisma The Open Nanomedicine Journal
- Recenzent czasopism naukowych: Physical Review Letters, Physical Review B i innych.

J. ADAMOWSKI

- Director of Interdisciplinary PhD Study
- Member of the Programme Committee of the Laboratory for Physical Fundamentals of Information Processing
- Referee of scientific journals: Physical Review Letters, Physical Review A, Physical Review B, Journal of Physics B, Journal of Physics: Condensed Matter, Semiconductor Science and Technology, Nanotechnology, Physics Letters A, Solid State Communications, Physica B & E, Physica Status Solidi, International Journal of Modern Physics B, Acta Physica Polonica

- Kierownik Interdyscyplinarnych Studiów Doktoranckich
- Członek Rady Programowej Laboratorium Fizycznych Podstaw Przetwarzania Informacji
- Recenzent czasopism naukowych: Physical Review Letters, Physical Review A, Physical Review B, Journal of Physics B, Journal of Physics: Condensed Matter, Semiconductor Science and Technology, Nanotechnology, Physics Letters A, Solid State Communications, Physica B & E, Physica Status Solidi, International Journal of Modern Physics B, Acta Physica Polonica

B. SZAFRAN

- Coordinator of Krakow Interdisciplinary PhD Programme in Nanoscience and Advanced Nanostructures,
- Editor in Central European Journal of Physics
- Referee of scientific journals: Physical Review Letters, Physical Review B, Applied Physics Letters, Journal of Applied Physics, Nanotechnology, Journal of Physics Condensed Matter etc.

- Koordynator programu Krakow Interdisciplinary PhD Programme in Nanoscience and Advanced Nanostructures finansowanego za pośrednictwem Fundacji na rzecz Nauki Polskiej z funduszy strukturalnych
- Edytor w Central European Journal of Physics
- Recenzent we wszystkich znanych czasopismach z zakresu fizyki ciała stałego oraz w Physical Review Letters oraz w Nanotechnology

Department of Particle Interaction and Detection Techniques
Katedra Oddziaływań i Detekcji Cząstek

STAFF

HEAD

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ELEMENTARY PARTICLES PHYSICS GROUP
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prof. dr hab. Jeleń Kazimierz, full professor
dr inż. Fiutowski Tomasz, assistant professor
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dr inż. Kowalski Tadeusz, assistant professor
dr inż. Mindur Bartosz, assistant professor
dr inż. Skoczeń Andrzej, assistant professor
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mgr Ambalathankandy Prasoon, research assistant
mgr Imran Ahmed Mohammed, research assistant
inż. Terlecki Przemysław
Filipek Wiesław
Jędrzejowski Franciszek

PROFILE

The scientific activity of Department cover three areas of research:

- basic research of elementary constituents of the matter and their interactions in high energy collisions
- design and construction of detectors and readout electronics for high energy physics experiments,
- development of detectors and readout electronics for neuroscience experiments and medical imaging.

The high energy experiments are long term projects and because of high cost of large accelerators and detection facilities they are performed by large international collaborations. Our participation in experiments is as complete as possible and covers all phases of the projects: preparations of the research programs, design and construction of the experimental apparatus, data analyses as well as maintaining and upgrading detector systems.

Currently we participate in analysis of data from three experiments, which have finished data taking:

- ZEUS e±p at HERA (DESY),
- DELPHI e+e- at LEP (CERN),
- OPAL e+e- at LEP (CERN).

Over last decade have contributed to design and construction of two new experiments:

- ATLAS pp and Pb-Pb at LHC (CERN),
- LHCb pp at LHC (CERN),

and in 2010 we started running these two experiments and we participated in data acquisition and analysis and in preparation of the trigger system for ATLAS Pb-Pb interactions.

A special attention is paid to processes leading to a New Physics, particularly to Higgs and supersymmetric particles discoveries in ATLAS experiment. Study of CP violation in beauty and charm sector in the LHCb experiment can explain matter - antimatter asymmetry observed in the Universe.

Tematyka naukowa Katedry obejmuje trzy kierunki badań:

- badania podstawowe elementarnych składników materii i ich oddziaływań metodą zderzeń wysokoenergetycznych wiązek,
- rozwój detektorów i aparatury elektronicznej dla eksperymentów fizyki wysokich energii,
- projektowanie i budowę detektorów i aparatury elektronicznej dla eksperymentów neurobiologicznych oraz dla obrazowania medycznego.

Eksperymenty wysokich energii są projektami długofalowymi, a budowa akceleratorów i aparatury detekcyjnej wymaga dużych nakładów finansowych prace z dziedziny fizyki cząstek elementarnych mogą być prowadzone tylko w ramach dużych międzynarodowych zespołów. Nasz udział w eksperymentach obejmuje wszystkie ich fazy od przygotowania programu fizycznego poprzez projektowanie i budowę elementów aparatury detekcyjnej, jej obsługę i modernizację, po analizę danych.

Zespół pracowników Katedry uczestniczy w trzech eksperymentach, które zakończyły już zbieranie danych, ale analiza materiału doświadczalnego trwa nadal:

- ZEUS na akceleratorze $e^{\pm}p$ HERA w ośrodku DESY
- DELPHI na akceleratorze $e^{+}e^{-}$, LEP w CERN-ie
- OPAL na akceleratorze $e^{+}e^{-}$, LEP w CERN-ie

W ostatnim dziesięcioleciu uczestniczyliśmy w projektowaniu i budowie aparatury dla dwu nowych eksperymentów na akceleratorze LHC w CERN-ie:

- ATLAS – *p-p* i *Pb-Pb*
- LHCb *p p,*

a od 2010 roku po uruchomieniu akceleratora LHC uczestniczymy w procesie zbierania i analizy danych oraz w eksperymencie ATLAS w przygotowaniu aktualnej konfiguracji systemu wyzwalania danych dla zderzeń Pb-Pb.

Also, searching for rare decays of B mesons - that can also be sensitive to phenomena related to New Physics is being exploited.
In parallel, we carry out R&D programs aiming at development of the detector concepts and new detector technologies for an upgrade of the ATLAS and LHCb experiments and for the future experiment at the International Linear Collider. A large part of activities related to the LHCb experiment concerns providing software for the detector calibration, monitoring and test beam.
The activity in the area of detectors and front-end electronics focuses on development of readout systems for position sensitive detectors employing Application Specific Integrated Circuits. We carry out development of readout ASICs for the following detector technologies:

- tracking detectors for high energy physics experiments based on silicon microstrip detectors,
- detectors for X-ray imaging based on silicon microstrip detectors,
- detectors for charge particles and X-ray imaging based on Gas Electron Multipliers (GEM).

In parallel, investigation of radiation effects in semiconductor devices and circuits is carried out, which are of primary importance in the front-end electronics for readout of silicon strip detectors in the high energy physics experiments.
In the area of neuroscience we develop systems for imaging of neural activity in live neural tissues. including retina and cortex. A common aim of various research projects carried out in collaboration with neuroscientists is to develop two ways communication between live neurons and electronic circuits.

Specjalną uwagę zwraca się na bezpośrednie odkrycie obiektów związanych z tzw. Nową Fizyką. Poszukiwanie cząstki Higgsa oraz cząstek supersymetrycznych jest priorytetowym zadaniem eksperymentu ATLAS. Z kolei badanie stopnia łamania symetrii CP oraz rzadkich rozpadów w eksperymencie LHCb może również prowadzić do odkrycia Nowej Fizyki i być może wyjaśnienia głębokiej asymetrii pomiędzy materią i antymaterią. Poszukiwania rzadkich rozpadów mezonów zawierających kwark b są czułym narzędziem w badaniu praw tzw. Nowej Fizyki.
Równolegle prowadzone są prace projektowe w celu zastosowania nowych technologii detektorowych dla przyszłej modernizacji detektora ATLAS and LHCb oraz przygotowania aparatury detekcyjnej dla eksperymentu na akceleratorze liniowym ILC. Niezależnie dla potrzeb LHCb przygotowywane i udoskonalane jest oprogramowanie dla monitorowania i kalibracji detektora VELO (VErtex LOcator).
Działalność w dziedzinie detektorów i systemów elektroniki odczytu koncentruje się na rozwoju systemów odczytu detektorów pozycjo-czułych z wykorzystaniem techniki specjalizowanych układów scalonych. Obecnie prowadzone są prace na rozwojem układów scalonych do systemów odczytu następujących typów detektorów:

- detektory torów cząstek dla eksperymentów fizyki wysokich energii oparte na mikropaskowych detektorach krzemowych,
- detektory promieniowania X-ray oparte na mikropaskowych detektorach krzemowych,
- detektory cząstek naładowanych i promieniowania X oparte na gazowych powielaczach elektronów (GEM - Gas Electron Multipliers).

Równolegle prowadzone są badania nad efektami radiacyjnymi w przyrządach półprzewodnikowych i obwodach elektronicznych, które są szczególnie istotne dla elektroniki front-end do odczytu krzemowych detektorów mikropaskowych w eksperymentach fizyki wysokich energii.
W dziedzinie badań neurobiologicznych rozwijane są systemy do obrazowania aktywności neuronalnej w żywych tkankach nerwowych, takich jak siatkówka oka i kora mózgowa. Wspólnym celem różnych projektów badawczych prowadzonych we współpracy z neurobiologami jest opracowanie dwukierunkowej komuni-kacji pomiędzy żywymi neuronami i obwodami elektronicznymi.

ACHIEVEMENTS

- Participation in the first determination of the energy dependence of the total photon-proton cross section from a single experiment (published by ZEUS collaboration in Physics Letters)
- Participation in determination experimental limits on the Higgs boson mass from ATLAS in three decay channels (2 papers published in Physical Review Letters and 2 in Physics Letters)
- Preparation of a new configuration of the trigger system for ATLAS Pb-Pb runs in 2011 period.
- Searches for New Physics in rare B semileptonic decays in the LHCb experiment (2 papers published in Phys. Lett. B)
- Precise measurement of B mesons parameters - oscillation frequency D - $\overline{D}$ and new decay channels (6 papers published in Phys. Rev. D, Phys. Lett. B and J. High Energy Phys.)

- Udział w wyznaczeniu po raz pierwszy w jednym eksperymencie zależności energetycznej całkowitego przekroju czynnego na oddziaływania foton-proton (praca opublikowana przez współpracę ZEUS w Physics Letters).
- Udział w wyznaczeniu eksperymenttalnych ograniczeń na masę bozonu Higgsa w eksperymencie ATLAS w oparciu o trzy kanały rozpadu (2 prace opublikowane w Physical Review Letters i 2 w Physics Letters).
- Przygotowanie nowej konfiguracji systemu wyzwalania w eksperymencie ATLAS dla zderzeń Pb-Pb w naświetlaniach w 2011 roku.
- Poszukiwanie procesów związanych z tzw. Nową Fizyką poprzez badanie rzadkich półleptonowych rozpadów mezonów B w eksperymencie LHCb (2 prace opublikowane w Phys. Lett. B).

- Determination of phase φ_s breaking the CP symmetry (paper published in Phys. Lett. B).
- Novel method to determine the absolute beam luminosity using the LHCb VELO detector (paper published in Journal of Instrumentation).
- Demonstration of wireless multichannel system for recording signals for cortex of freely moving animals (paper published in Nature Neuroscience).
- Development and tests of a readout system for the LUMICAL detector to be used in future experiments at the International Linear Collider (paper published in Journal of Instrumentation).

- Precyzyjny pomiar parametrów mezonów B – częstości oscylacji D-D, szerokości rozpadów oraz poszukiwania nowych procesów rozpadu (6 prac opublikowanych w Phys. Rev. D, Phys. Lett. B i J. High Energy Phys.)
- Wyznaczenie fazy φs powodującej łamanie kombinowanej symetrii CP (publikacja w Phys. Lett. B).
- Nowa metoda wyznaczenia świetlności wiązki na podstawie danych detektora VELO (praca opublikowana w Journal of Instrumentation).
- Demonstracja bezprzewodowego wielokanałowego systemu do rejestracji sygnałów z kory mózgowej wolno poruszających się zwierząt (praca opublikowana w Nature Neuroscience).
- Opracowanie i testy systemu odczytu detektora LUMICAL dla przyszłych eksperymentów na akceleratorze International Linear Collider (praca opublikowana w Journal of Instrumentation).

ACTIVITY

K. JELEŃ

- Head of AGH Centre of Energy Studies (from 2009)
- Member of Scientific Council of the Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences (2008-2011)
- Member of Scientific Council of the Institute of Atomic Energy POLATOM (2008-2011)
- Chairmen of Scientific Council of Małopolska & Podkarpacie Clean Energy Cluster (from 2009)
- Member of Council for Atomic Energy Matters of National Atomic Energy Agency (2009-2012)
- Member of Monitoring Committee EURATOM Fission – National Contact Point.
- Member of the Council of the National Centre for Research and Development (2010-2012)

- Kierownik Centrum Problemów Energetycznych AGH (od 2009)
- Członek Rady Naukowej Instytutu Fizyki Jądrowej PAN im Henryka Niewodniczańskiego (2008-2011)
- Członek Rady Naukowej Instytutu Energii Atomowej POLATOM (2008-2011)
- Przewodniczący Rady Naukowej Małopolsko-Podkarpackiego Klastra Czystej Energii (od 2009)
- Członek Rady d.s. Atomistyki Państwowej Agencji Atomistyki (2009-2012)
- Członek Komitetu Monitorującego dla KPK EURATOM Fission and Fusion
- Członek Rady Narodowego Centrum Badań i Rozwoju (2010 – 2012)

D. KISIELEWSKA

- Member of Scientific Council of The Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences (2011-2014)
- Member of Scientific Council of the National Centre for Nuclear Research (2011-2014)
- Member of High Energy Physics Committee of Council for Atomic Energy Matters of National Atomic Energy Agency (2008-2012)
- Member of Central Committee of the Scientific Degrees (2011-2014)
- Member of Collaboration Board of the ATLAS Collaboration at CERN
- Member of Collaboration Board of the ZEUS Collaboration at DESY

- Członek Rady Naukowej Instytutu Fizyki Jądrowej PAN im Henryka Niewodniczańskiego (2011-2014)
- Członek Rady Naukowej Narodowego Centrum Badań Jądrowych, Świerk (2011-2014)
- Członek Komitetu Fizyki Wysokich Energii Państwowej Rady Atomistyki (2008-2012)
- Członek Centralnej Komisji ds. Stopni i Tytułów (2011-2014)
- Reprezentant WFiIS w Radzie Współpracy ATLAS w CERN
- Reprezentant WFiIS w Radzie Współpracy ZEUS w DESY

W. DĄBROWSKI

- Member of the Consortium Council of the National Centre for Hadron Radiotherapy.
- Member of the editorial board of the Journal of Instrumentation.

- Członek Rady Zarządzającej Narodowego Centrum Radioterapii Hadronowej
- Członek komitetu redakcyjnego czasopisma Journal of Instrumentation

T. BOŁD

- Coordinator of Core Software Trigger Project in ATLAS experiment, CERN
- Member of Trigger/DAQ Institute Board in ATLAS experiment,

- Koordynator Projektu Oprogramowania Systemu Wyzwalania w eksperymencie ATLAS, CERN
- Reprezentant WFiIS w komitecie Trigger/DAQ eksperymentu ATLAS, CERN

I.GRABOWSKA - BOŁD

- Member of Trigger Menu Coordination Group in ATLAS experiment, CERN

- Członek Zespołu Koordynującego Konfigurację Systemu Wyzwalania w eksperymencie ATLAS, CERN

B. MURYN

- Member of High Energy Physics Committee of Council for Atomic Energy Matters of National Atomic Energy Agency (2008-2011).
- Member of Collaboration Board of the LHCb experiment at CERN.

- Członek Komitetu Fizyki Wysokich Energii Państwowej Rady Atomistyki (2008-2011)
- Członek Komitetu Współpracy Eksperymentu LHCb w CERN-ie.

T. SZUMLAK

- The LHCb VELO (VErtex LOcator) software project deputy leader (2010 - 2012)
- Honorary Fellowship position with School of Physics and Astronomy - University of Glasgow (2010-2013).
- Honorary Fellowship position in the School of Physics and Astronomy - University of Manchester (2011 - 2014).
- The LHCb VELO VETRA Software and Calibration Project leader (2010-2012).
- The Krakow VELO group leader (2011 - 2013).

- Honorowy członek kolegium Szkoły Fizyki i Astronomii Uniwersytetu w Glasgow.
- Koordynator grup oprogramowania i kalibracji detektora VELO w eksperymencie LHCb.
- Honorowy członek kolegium Szkoły Fizyki i Astronomii Uniwersytetu w Manchester.
- Koordynator grupy oprogramowania dla detektora LHCb VELO (VErtex LOcator)

M. IDZIK

- Technical Coordinator of FCAL (International Collaboration for Forward Detectors in future Linear Collider ILC/CLIC).

- Koordynator techniczny międzynarodowej współpracy FCAL (Forward Detectors in Future Linear Colliders ILC/CLIC)

Department of Applied Nuclear Physics
Katedra Zastosowań Fizyki Jądrowej

STAFF

HEAD

prof. dr hab. inż. Różański Kazimierz, full professor

PHYSICS OF FUNCTIONAL MATERIALS GROUP
ZESPÓŁ FIZYKI MATERIAŁÓW FUNKCJONALNYCH

prof. dr hab. Pszczoła Jarosław, full professor

ENVIRONMENTAL PHYSICS GROUP
ZESPÓŁ FIZYKI ŚRODOWISKA

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dr inż. Kuc Tadeusz, assistant professor
dr inż. Nęcki Jarosław, assistant professor
dr hab inż. Nguyen Dinh Chau, associate professor
dr inż. Przybyłowicz Wojciech, assistant professor
dr inż. Wachniew Przemysław, assistant professor
dr inż. Zimnoch Mirosław, assistant professor
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dr inż. Jodłowski Paweł, teaching assistant
mgr Fiedorowicz Justyna
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Pach Franciszek
Wróblewski Ryszard

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dr Bolewski Andrzej, assistant professor
dr inż. Ciechanowski Marek, assistant professor
dr Czapliński Wilhelm, assistant professor
dr hab. inż. Markowicz Andrzej, associate professor

PROFILE

Department of Applied Nuclear Physics (DANP) is composed of three groups: (i) Environmental Physics Group, (ii) Nuclear Methods Group, and (iii) Physics of Functional Materials Group. Research activities of DANP cover selected topics of nuclear physics and its applications in areas such as environmental sciences, material sciences as well as industrial applications of nuclear methodologies. Moreover, DANP is responsible for two specializations being thought in the framework of the Technical Physics discipline offered by the Faculty at B.Sc. and M.Sc. level.

Major instrumentation available at DANP:

- An arc melting system with contactless ignition for synthesis of materials,
- A system for synthesis of monocrystals using Czochralski method,
- A system to measure electrical resistivity,
- A system to measure magnetostriction,
- A measuring system for magnetoelectric effect of materials,
- Electrolytic enrichment system for low-level tritium assay in natural waters,
- Analytical systems for determination of trace gases in the atmosphere,
- Analytical systems for determination of stable isotope ratios of light elements (H, C, O, N) in environmental materials,
- Liquid scintillation spectrometers for measurements of low-level activities of selected radionuclides (^{3}H, ^{14}C, ^{90}Sr, ^{210}Pb, ^{222}Rn, isotopes of uranium, thorium and radium) in environmental materials,
- Low-level gamma spectrometry for measurements of low-level activities of selected radionuclides in environmental materials,

Katedra Zastosowań Fizyki Jądrowej składa się z trzech zespołów badawczych: (i) Zespołu Fizyki Środowiska, (ii) Zespołu Metod Jądrowych oraz (iii) Zespołu Fizyki Materiałów Funkcjonalnych. Badania naukowe prowadzone w Katedrze obejmują wybrane zagadnienia fizyki jądrowej w kontekście jej zastosowań takich jak nauki o środowisku, nauki o materiałach, a także przemysłowe zastosowania metod jądrowych. Katedra i jej zespoły sprawują opiekę merytoryczną nad dwoma specjalnościami nauczanymi w ramach kierunku Fizyka Techniczna, na studiach drugiego stopnia Wydziału, a poprzedzonymi analogicznymi kierunkami dyplomowania na studiach pierwszego stopnia.

Ważniej-sza aparatura naukowa będąca w posiadaniu Katedry:

- Układ do syntezy materiałów w łuku elektrycznym;
- Aparatura do otrzymywania monokryształów metodą Czochralskiego;
- Aparatura do pomiaru efektu magnetoelektrycznego w materiałach;
- Aparatura do pomiaru oporności elektrycznej;
- Aparatura do pomiaru magnetostrykcji;
- Aparatura do elektrolitycznego wzbogacania prób wody w tryt;
- Systemy analityczne do pomiaru gazów śladowych w atmosferze;
- Systemy analityczne do pomiaru stosunków izotopowych pierwiastków lekkich (H, C, O, N) w różnych matrycach;
- System do pomiaru aktywności naturalnych i sztucznych nuklidów gamma-promieniotwórczych w próbkach stałych i ciekłych z wykorzystaniem spektrometrii gamma;
- Spektrometry ciekło-scyntylacyjne do pomiarów niskich aktywności izotopów promieniotwórczych (^{3}H, ^{14}C, ^{90}Sr, ^{210}Pb, ^{222}Rn, izotopy uranu, toru i radu);

- Analytical set-up for measuring neutron parameters of materials.

- Stanowisko pomiarowe do pomiarów parametrów neutronowych materiałów.

ACHIEVEMENTS

- Determination of the influence of 3d-electrons on the crystal structure, electrical and magnetic properties as well as hyperfine interactions observed in: (i) Terfenol-D (=$Tb_{0.27}Dy_{0.73}Fe_2$) type intermetallic compounds with Fe/Co, Fe/Ni substitutions in the transition metal sublattice, and (ii) $Ho(Fe/Co)_2$ intermetallics;
- Development of a new probabilistic formula for Curie temperatures of intermetallics;
- Determination of magnetoelectric properties observed in the rare earth – transition metal intermetallic/PVDF type composites;
- Publication of a review paper entitled "Natural radioactivity in groundwater – a review";
- Acquiring a novel technology of measurements of atmospheric mixing ratios of carbon dioxide and its carbon isotope composition, based on laser spectrometry;
- Development of a novel methodology of measurement SF_5CF_3 concentrations in air and in water.

- Określenie wpływu elektronów 3d na strukturę krystaliczną, właściwości elektryczne; magnetyczne oraz oddziaływania nadsubtelne w związkach międzymetalicznych typu: (i) Terfenol-D (=$Tb_{0.27}Dy_{0.73}Fe_2$) z podstawieniami Fe/Co, Fe/Ni w podsieci metalu przejściowego, oraz (ii) w związkach $Ho(Fe/Co)_2$;
- Zaproponowanie nowego wzoru probabilistycznego opisującego temperatury Curie związków międzymetalicznych;
- Określenie właściwości magnetoelektrycznych występujących w kompozytach typu związek międzymetaliczny ziemia rzadka – metal przejściowy/PVDF;
- Publikacja artykułu przeglądowego zatytułowanego "Promieniotwórczość naturalna w wodach podziemnych" ;
- Wprowadzenie nowej technologii pomiaru stężenia i składu izotopowego dwutlenku węgla w oparciu o spektrometrię laserową;
- Opracowanie innowacyjnej techniki pomiaru stężenia SF_5CF_3 w atmosferze i w wodzie.

ACTIVITY

K. RÓŻAŃSKI

- Member of the Polish National Committee, International Geosphere and Biosphere Programme of the International Council for Science, Polish Academy of Science.
- Member of the Editorial Board of the journal "Isotopes in Environmental and Health Studies (since 2000)
- Vice-chairman of the Society of research on Environmental Changes "GEOSPHERE"
- Chairman of the Didactics Commission of the Faculty Council
- Member of the KRK (National Framework of Qualification) Commission at the Faculty level.

- Członek Polskiego Komitetu "Global Change" Międzynarodowego Programu Badań Geosfery i Biosfery Międzynarodowego Komitetu Nauki, przy Polskiej Akademii Nauk
- Członek komitetu redakcyjnego czasopisma "Isotopes in Environmental and Health Studies (od 2000 roku)
- Vice-prezes Towarzystwa Badania Przemian Środowiska "GEOSFERA"
- Przewodniczący Komisji Dydaktycznej Rady Wydziału Fizyki i Informatyki Stosowanej
- Członek Komisji KRK na Wydziale Fizyki i Informatyki Stosowanej

A. KREFT

- Member of the Physics Committee of the Polish Academy of Sciences (2011-2014)
- Member of the Coordination team of the Clean Energy Cluster
- Member of the Organizing Committee of NUTECH-2011 (International Conference on Development and Applications of Nuclear technologies), Krakow, 11-14 September 2011

- Członek Komitetu Fizyki Polskiej Akademii Nauk (2011-2014)
- Członek zespołu koordynującego Klaster Czystej Energii
- Członek Komitetu Organizacyjnego konferencji NUTECH-2011 (International Conference on Development and Applications of Nuclear technologies), Krakow, 11-14 September 2011

J. PSZCZOŁA

- Member of the Interfaculty Commission of Technical Sciences of the Polish Academy of Arts and Sciences

Członek Komisji Nauk Technicznych przy Polskiej Akademii Umiejętności

PhD Students

NAME	YEAR	SUPERVISOR
Boberek Marzena	1 ISD	prof. dr hab. Michał Waligórski IFJ PAN
Gałkowski Michał	1 ISD	prof. dr hab. inż. Kazimierz Różański,
Habina Iwona	1 ISD	dr hab. Kvetoslava Burda
Konieczny Piotr	1 ISD	prof. dr hab. Tadeusz Wasiutyński IFJ PAN
Kubiak Katarzyna	1 ISD	prof.dr hab. inż. Zbigniew Adamczyk IKiFP PAN
Kuterasiński Łukasz	1 ISD	dr hab. inż. Mirosław Derewiński IKiFP PAN
Mierzwińska Gabriela	1 ISD	prof. dr hab. Michał Waligórski IFJ PAN
Piaskowska Anna	1 ISD	prof. dr hab. Paweł Olko IFJ PAN
Rusinek Dariusz	1 ISD	dr hab. Łukasz Gondek
Sądel Michał	1 ISD	prof. dr hab. Paweł Olko IFJ PAN
Siemek Krzysztof	1 ISD	dr hab. inż. Jerzy Dryzek IFJ PAN
Strzałka Radosław	1 ISD	prof. dr hab. Janusz Wolny
Wandzilak Aleksandra	1 ISD	prof. dr hab. inż. Marek Lankosz
Winiarska Barbara	1 ISD	prof. dr hab. Jarosław Pszczoła
Dobrzański Michał	1	prof. dr hab. inż. Zbigniew Kąkol
Nasulewicz Michał	1	dr hab. inż. Marek Duliński
Batys Piotr	2 ISD	doc. dr hab. Paweł Weroński IKiFP PAN
Biernacka Kamila	2 ISD	prof. dr hab. Czesław Kapusta
Chrobak Maciej	2 ISD	prof. dr hab. Andrzej Kołodziejczyk
Działo Artur	2 ISD	dr hab. Antoni Paja
Dziedzicka Anna	2 ISD	prof. dr hab. Bogdan Sulikowski IKiFP PAN
Firlej Mirosław	2 ISD	dr hab. inż. Marek Idzik
Grzesiak Marta	2 ISD	prof. dr hab. Wiesław Łasocha IKiFP PAN
Janowski Paweł	2 ISD	doc. dr hab. Jerzy Mietelski IFJ PAN
Jędrychowski Mariusz	2 ISD	dr hab. inż. Jacek Tarasiuk
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Kupczak Arkadiusz	2 ISD	prof. dr hab. Wiesława Sikora
Marzec Mateusz	2 ISD	dr hab. inż. Andrzej Bernasik
Miecznik Magdalena	2 ISD	dr hab. inż. Zbigniew Łodziana IFJ PAN
Miłaczewska Anna	2 ISD	dr hab. Tomasz Borowski IKiFP PAN
Moroń Jakub	2 ISD	dr hab. inż. Marek Idzik
Niemiec Piotr	2 ISD	prof. dr hab. Małgorzata Witko IKiFP PAN
Osiecka Natalia	2 ISD	prof. dr hab. Maria Massalska-Arodź IFJ PAN
Ramza Piotr	2 ISD	prof. dr hab. inż. Andrzej Zięba
Szczepanik-Ciba Magdalena	2 ISD	prof. dr hab. Józef Korecki
Szepietowska Dorota	2 ISD	prof. dr hab. Bogdan Sulikowski IKiFP PAN
Szymańska Anna	2 ISD	prof. dr hab. Wiesław Łasocha IKiFP PAN
Tatko Maciej	2 ISD	doc. dr hab. Paweł Nowak IKiFP PAN
Twardak Anna	2 ISD	prof. dr hab. Paweł Olko IFJ PAN
Zwoleński Piotr	2 ISD	prof. dr hab.inż. Janusz Toboła
Gąska Karolina	2	prof. dr hab. Czesław Kapusta
Guzik Marcin	2	dr hab. inż. Mariusz Przybycień

Jasek Alina	2	prof. dr hab. inż. Kazimierz Różański
Karwan Jakub	2	dr hab. inż. Khalid Saeed
Stanisz Przemysław	2	dr hab. inż. Jerzy Cetnar
Brożek Marcin	3 ISD	dr hab. inż. Zbigniew Łodziana IFJ PAN
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Jamrozik Agnieszka	3 ISD	dr hab. Kvetoslava Burda
Janc Krzysztof	3 ISD	dr hab. inż. Jacek Tarasiuk
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Kołodziej Tomasz	3 ISD	dr hab. inż. Andrzej Kozłowski
Krzak Małgorzata	3 ISD	prof. dr hab. Piotr Wraszyński IKiFP PAN
Kuczera Paweł	3 ISD	prof. dr hab. Janusz Wolny
Kutorasiński Kamil	3 ISD	prof. dr hab. inż. Janusz Toboła
Marciszko Marianna	3 ISD	dr hab.inż. Andrzej Baczmański
Nosek Magdalena	3 ISD	doc. dr hab. Paweł Weroński IKiFP PAN
Oćwieja Magdalena	3 ISD	prof. dr hab. Zbigniew Adamczyk IKiFP PAN
Onik Katarzyna	3 ISD	doc. dr hab. Mirosław Derewiński IKiFP PAN
Pajor Anna	3 ISD	prof. dr hab. inż. Piotr Warszyński IKiFP PAN
Pasek Wojciech	3 ISD	dr hab. inż. Bartłomiej Szafran IKiFP PAN
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Perzanowski Marcin	3 ISD	prof. dr hab. inż. Marta Wolny-Marszałek IFJ PAN
Przyborowski Dominik	3 ISD	dr hab. inż. Marek Idzik
Wójcik Anna	3 ISD	doc. dr hab. Jerzy Mietelski IFJ PAN
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Ambalathankandy Prasoon	3	dr hab. inż. Marek Idzik
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Gach Grzegorz	3	prof. dr hab. Danuta Kisielewska
Kocjan Przemysław	3	dr hab. inż. Khalid Saeed
Kutorasińska Justyna ?	3	prof. dr hab. inż. Wojciech Łużny
Proniewski Bartosz	3	prof. dr hab. Henryk Figiel
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Kulis szymon	4	dr hab. inż. Marek Idzik
Łysoń-Sypień Barbara	4	dr hab. inż. Katarzyna Zakrzewska
Nowak Jakub	4	dr hab. inż. Nguyen Dinh Chau
Nowak Michał	4	dr hab. inż. Bartłomiej Szafran

Oettingen Mikołaj	4	dr hab. inż. Jerzy Cetnar
Poniedziałek Maciej	4	dr hab. inż. Bartłomiej Szafran
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Rydygier Przemysław	4	prof. dr hab. inż. Władysław Dąbrowski
Sarna Michał	4	dr hab. Kvetoslava Burda
Senderowska Katarzyna	4	doc. dr hab. Mariusz Witek
Śleziak Monika	4	dr hab. inż. Marek Duliński
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Smoleń Magdalena	5	dr hab. inż. Piotr Augustyniak
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Wójcik Paweł	5	prof. dr hab. Janusz Adamowski
Zaleski Aliaksandr	5	prof. dr hab. Tomasz Stobiecki

Selected results

Kinetics studies of hydrogen storage systems

Ł. GONDEK, J. CZUB
Department of Solid State Physics; Magnetic, Electrical and Structural Research Group

H. FIGIEL
Department of Medical Physics and Biophysics; Biomedical Imaging and Modeling Group

In collaboration with:

N. KARDJILOV
Berlin Neutron Scattering Center, HZB, Berlin, Germany

Hydrogen storage - basics

Hydrogen offers excellent prospects as potential energy carrier, and a lot of effort is being put into the development of technologies allowing introducing it into common usage. Hydrogen can be stored in several ways, including in high-pressure vessels, liquid hydrogen tanks, metal-organic frameworks (MOF) based on cryogenic bottles, or metal-hydrides systems. For safety as well as technological and economical reasons, metal-hydrides are the most interesting candidates and are being extensively investigated around the world.

The performance of metal-hydride storage systems depends on the selection of an appropriate active material with high capacity, reversibility, and good thermal conductivity. On the other hand, the internal structure of the storage tank must be optimized in order to keep hydrogenation/ dehydrogenation kinetics as high as possible. Namely, the heat released upon introducing hydrogen into the metallic bed should be dissipated as the rise of the active material's temperature leads to the hampering of the hydrogenation reaction.

Although metallic hydride-based storage systems are commonly used and commercially available, the processes occurring inside such devices have been deduced from external parameters, such as changes of H2 pressure or the container's temperature, characterizing the whole container, rather than directly studied from the container's interior.

Thanks to the *in-situ* imaging of a $LaNi_{4.8}Al_{0.2}$- based hydrogen storage container, using the cold neutron high-resolution instrument V7-CONRAD at BENSC, we are able to get first-hand quantitative description of phenomena happening inside storage vessel.

What do neutrons see?

When one thinks of radiography or tomography, X-ray medical imaging is usually the first thing that comes to mind. Although this technique is excellent for imaging the soft-tissues of a human body, it is useless for dense metallic objects a few centimeters thick, due to the attenuation of X-rays, which rises with the atomic number of the attenuator. In contrast to X-rays, neutrons possess properties that make them perfectly suited for the investigation of processes inside hydrogen storage tanks.

Our results show that neutron imaging allows the qualitative as well as quantitative analysis of hydrogen absorption/desorption kinetics, with a

spatial resolution of 70 µm (0.07mm). Comparing to other elements (e.g. simple metals), hydrogen has a very high attenuation coefficient; therefore it is possible to track even small quantities of hydrogen within the filling alloy.

Thus, we are able to study the kinetics with respect to spatial distribution of hydrogen. Therefore, for the first time a tool for determining the diffusion into active bed was shown.

Our results hint at a crucial role of heat dissipation during the exothermic reaction of hydrogen loading into the bed. Apart from the above, other factors, such as compression of the $LaNi_{4.8}Al_{0.2}$ powder under the hydrogen pressure applied, were noticed. It is obvious, that complementary imaging studies using both radiography and tomography may be crucial for the development of more efficient hydrogen storage devices.

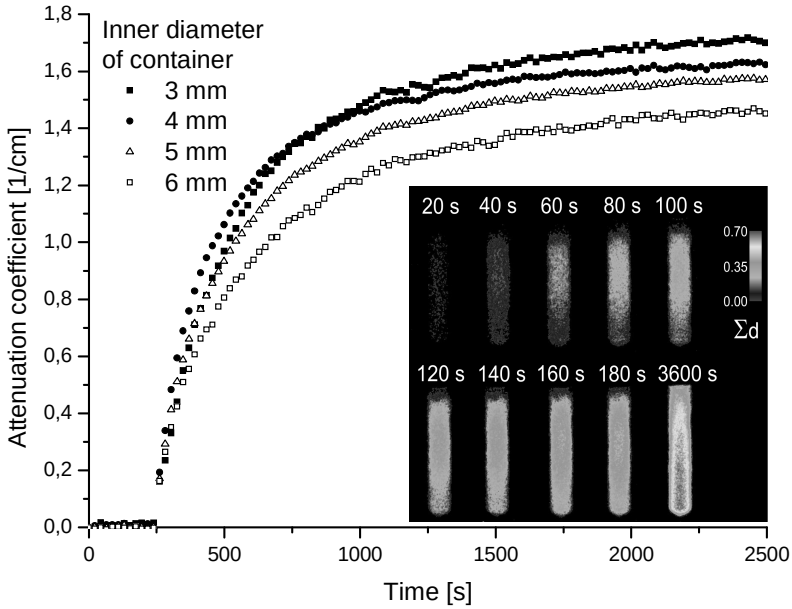

Fig. 1 Kinetics of hydrogen (at p = 4 bar) loading into cylindrical vessels of inner diameters in between 3-6 mm. In the inset images collected during hydrogen uptake are given.

Electronic structure, magnetism, and spin fluctuations in the superconducting weak ferromagnet Y_4Co_3

B. WIENDLOCHA, J. TOBOŁA, S. KAPRZYK,
Department of Condensed Matter Physics, Faculty of Physics and Applied Computer Science, AGH University of Science and Technology,

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Introduction. Unusual properties of Y_4Co_3, that is the coexistence of superconductivity and ferromagnetism, were observed with the superconducting and ferromagnetic critical temperatures at about $T_s \cong 2.5$ K and $T_C \cong 4.5$ K, respectively. Y_4Co_3 is, up to now, a unique compound containing transition-metal elements only, where coexistence of ferromagnetism and superconductivity occurs, since other systems always contain f -like elements, e.g., UGe_2 [2], UCoGe [3]. Y_4Co_3 was likely the first example, where superconductivity occurred below a transition to ferromagnetism, with both phenomena coexisted at least in the range between 1 K and 2.5 K. This was another difference to previously known magnetic superconductors where magnetism appeared below T_s, suppressing superconductivity [4].

Results and their analysis. Results of the first principles study on the electronic structure and magnetism of the superconducting weak ferromagnet Y_4Co_3 are presented [5]. Using the full potential Korringa-Kohn-Rostoker (FP-KKR) [6] method, densities of states, dispersion curves, and magnetic moments were calculated for a quasi-ordered structural model of the compound in the framework of the local-density approximation. Spin-polarized KKR calculations confirm that weak ferromagnetic properties of Y_4Co_3 can be attributed to only one cobalt atom located on the (2b) site in the unit cell, while another 20 Co and Y atoms act as a diamagnetic environment (Fig.1 and Fig. 2). Moreover, the magnetic Co atoms form quasi-one-dimensional chains along the z-axis direction (Fig.2). The magnitude of the Co(2b) magnetic moment ($0.55\mu_B$) markedly overestimates the experimental value ($0.23\mu_B$), which suggests the importance of spin fluctuations in this system. Calculated distribution of spin magnetization in the unit cell provides a background for discussion of the coexistence of ferromagnetism and superconductivity in Y_4Co_3. Finally, the effect of pressure on magnetism is discussed and compared with experimental data, also supporting weak ferromagnetic behaviors in the system.

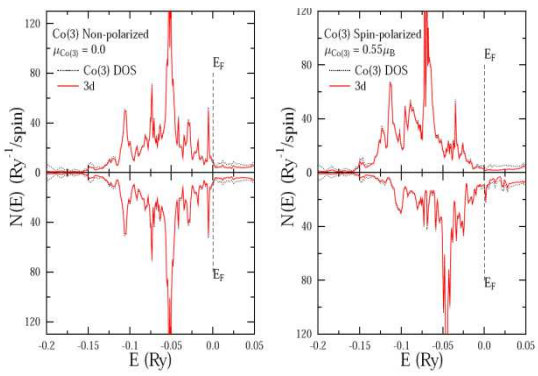

Fig. 1 Comparison of the Co(3) partial DOS from non-spin-polarized (left) and spin-polarized (right) calculations. Peak under EF in non-magnetic state, responsible for magnetic transition, is well visible.

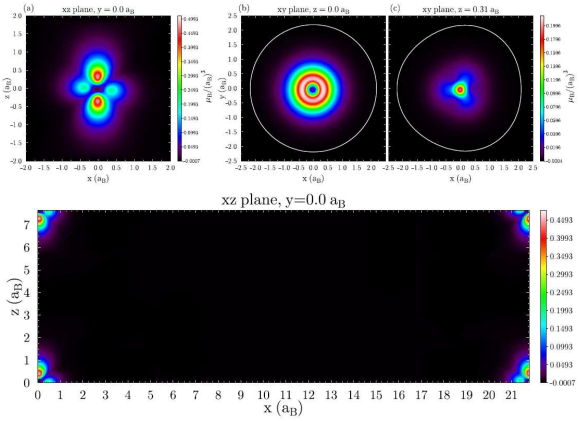

Fig.2 Spin magnetization distribution in the xy, xz and yz planes showing the 'shape' of the Co(3) magnetic moment. Bottom figure shows that the charge density in the large areas of the unit cell is almost not polarized, allowing for s-wave superconductivity to appear.

Conclusions

1. The ferromagnetic state obtained from spin-polarized computations can be attributed to the single Co atom located on the (2b) site, being the only magnetic atom among 21 in the unit cell, and forming quasi-one-dimensional magnetic chains [5].
2. The LDA values of the magnetization ($M \cong 0.13\mu_B$/f.u.), Co(3) magnetic moment ($\mu \cong 0.55\mu_B$), and critical pressure ($p_c \cong 7$ GPa) are overestimated compared with experiments, which can be tentatively explained in terms of weak ferromagnetism with moderate spin fluctuations ($\lambda_{sf} \cong 0.1$) [5].
3. The calculated spin-magnetization distribution [5], as well as other band structure parameters from the FP-KKR results leads to the conclusion that the conventional, singlet-like superconductivity may coexist with quasi-one-dimensional ferromagnetism in Y_4Co_3, due to relatively weak magnetic moments arranged along thin chains (the unit cell edges) and the presence of nonpolarized electrons at the Fermi level.

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Electronic and magnetic properties of ultra-thin epitaxial magnetite films on MgO(001)

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Magnetite nanostructures have been the subject of numerous studies concerning corrosion and passivation, environmental chemistry, sensors, spintronics and many others. This tremendous interest results from the wealth of structural, electronic and magnetic properties combined in this common but still intriguing material. Strong magnetism persisting up to 800 K is accompanied by conductivity (unusual for oxides) of the hopping character. The Verwey metal–insulator transition, which takes place when the temperature is lowered to 125 K, is still puzzling and probably involves a complex interplay of electronic and orbital ordering in the inverse spinel sublattices, affected by electron–phonon interactions. This intricate picture complicates further under reduced dimensionality, which occurs naturally or is introduced artificially to functionalize magnetite based materials, e.g., for medical, catalytic, or spintronic applications. Whether in nanoparticles or ultra-thin films, the surface-to-volume ratio increases dramatically, which makes the electronic and magnetic properties very sensitive to surface stoichiometry, termination, or defects.

We studied electronic and magnetic properties of epitaxial Fe3O4 (001) films on MgO(100) substrates throughout the 2.5- to 30-nm thickness range using conversion electron Mössbauer spectroscopy [1]. The samples were prepared on MgO(001) substrates cleaved in air prior to introduction into the UHV system. Magnetite was grown by reactive Fe-vapor deposition at a rate of approximately 1 nm/min in the presence of oxygen, with the substrate maintained at 520 K. To perform the Mössbauer spectroscopy experiments, all magnetite films were prepared using the ^{57}Fe isotope (enrichment 95%). The room temperature CEMS spectra were measured for the 2.5, 3, 10 and 30 nm Fe_3O_4 films, as shown in Figure 1. The spectra for the thinnest samples present a relaxation character typical for superparamagnetism. For the 2.5-nm film, the dynamical effects entirely mask the static hyperfine pattern, which usually unambiguously defines an oxide phase. This situation partially changes for films as thin as 3 nm, for which, not withstanding its dynamical character, the Mössbauer spectrum could be decomposed into components corresponding to characteristic magnetite sites in the framework of a static approximation, which becomes obvious for 10- and 30-nm thick films. Despite the superparamagnetism that was observed for film thickness below 5 nm, the Verwey transition persisted even for the thinnest film. Temperature-dependent Mössbauer measurements between 80 K and 400 K revealed that the activation energy for the magnetic moment fluctuations in the 3-nm magnetite film is higher than the magnetic anisotropy energy by an order of magnitude.

The superparamagnetism that arises from frustration of magnetic interactions at the antiphase boundaries leads to averaging of the magnetization over the characteristic time of the used experimental method. Fitting the Mössbauer spectra with a dynamical model, we found that the temperature dependence of the spectra can be explained by assuming inter-domain interactions, which exceeds the anisotropy energy by an order of magnitude. Despite the superparamagnetism that masks the characteristic hyperfine pattern, we found that the Verwey transition persists down to the thinnest film (2.5 nm), which remains stoichiometric. The Verwey temperature is strongly reduced to 90 K.

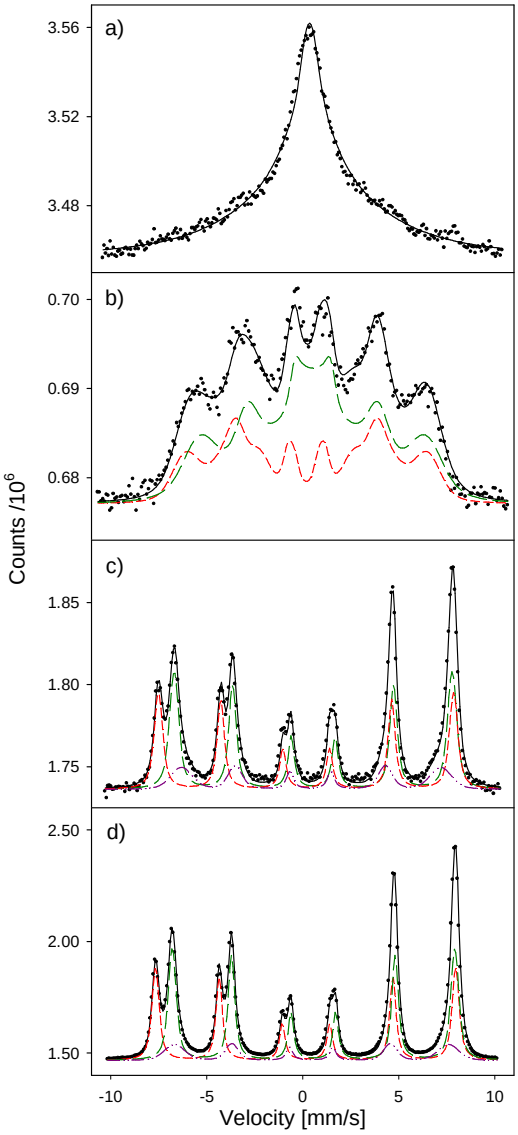

Figure 1(a-d). Room temperature CEMS spectra for the 2.5-, 3- 10- and 30-nm magnetite films, respectively. The spectra were fitted using a relaxation theory (a) or a static model (b-d), The red (short-dash) component corresponds to tetrahedral A sites; the green (long-dash) component corresponds to octahedral B sites; the purple (dash-dot) component corresponds to iron ions at octahedral sites with properties deviating from bulk.

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Magnetic and electronic properties of granular nano-materials and composites

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We present results on magnetometric, and Moessbauer spectropy studies of iron oxide nanoparticle material [1] and thin films of Fe-Co-Zr nanogranular composites in Al_2O_3 matrix [2,3,4]. For the thin films XAS spectra, the electrical resistivity and its temperature and magnetic field dependencies were studied.

The Fe oxide nanoparticle materials were prepared using novel method enabling synthesis of iron oxide nanoparticles, which are composed mainly of maghemite according to X-ray diffraction and Mössbauer spectroscopy studies. The proposed process is realized by anodic iron polarization in deaerated LiCl solutions containing both water and ethanol. Water seems to play an important role in the synthesis. In the solution containing almost 100% of water a black suspension of round shaped maghemite nanoparticles of 20 - 40 nanometer size is obtained. Regulating water concentration allows to control nanoparticle size, which is reduced to 4 – 6 nm for 5 % of water with a possibility to reach intermediate sizes. Coercivities of the materials are similar to those reported for nanoparticle magnetite powders, whereas the magnetization values are considerably smaller and do not reach saturation even at the field of 9 Tesla, Fig.1. The particles of 10-15 nm and 35 nm size are magnetically in a pseudo-single domain state and their saturation magnetization is of 40-56% of that reported for nanocrystalline magnetite materials of similar particle sizes.

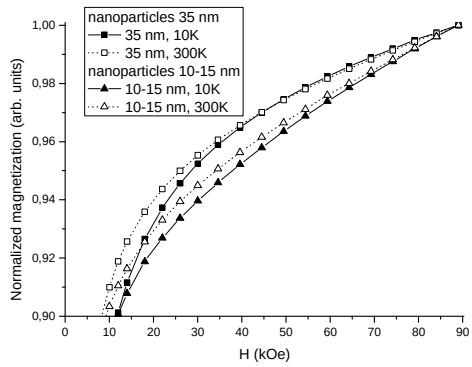
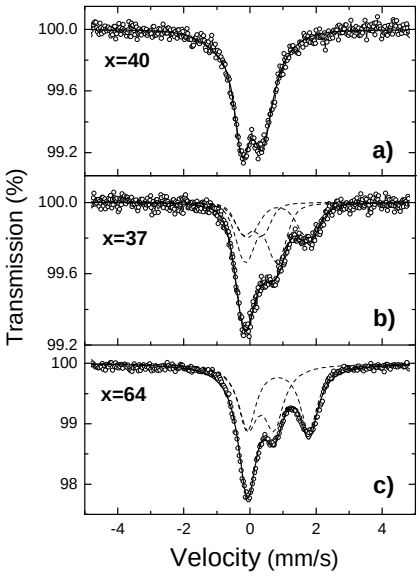


Fig.1. Normalized magnetization curves in the enlarged region showing approach to saturation for the nanoparticles of 35 nm and 10-16 nm size.

Temperature and magnetic field dependencies of electrical conductivity have been studied for granular films of $(Fe_{45}Co_{45}Zr_{10})_x(Al_2O_3)_{100-x}$ ($31 \leq x \leq 64$) containing "metallic core-oxide shell" nanogranules in an amorphous Al_2O_3 matrix [2,3,4]. The structure of core and shell is governed with the difference in the oxidation states of Fe and

Co ions investigated with EXAFS, XANES and Mössbauer spectroscopy.

Mössbauer spectra recorded at room temperature and around 80 K are presented in Fig. 2. Figs. 2 a and b show the spectra of non-oxidized film $(FeCoZr)_{40}(Al_2O_3)_{60}$, that corresponds to almost isolated FeCoZr nanoparticles below percolation limit. The transition from superparamagnetic to magnetically split Mössbauer spectrum occurs on the temperature decrease from 300 K down to 78 K. Room temperature spectra of $(FeCoZr)_{37}(Al_2O_3)_{63}$ and $(FeCoZr)_{64}(Al_2O_3)_{36}$ films containing nanogranules with "core-shell" structure are shown in Figs. 2 d and f, respectively. They resemble superparamagnetic (or paramagnetic) iron oxides. At 78 K the spectrum of $(FeCoZr)_{37}(Al_2O_3)_{63}$ film is still nonmagnetic (Fig. 2 c), while for $(FeCoZr)_{64}(Al_2O_3)_{36}$ film spectrum reveals partly resolved magnetic relaxational sextet (see Fig. 2 e).



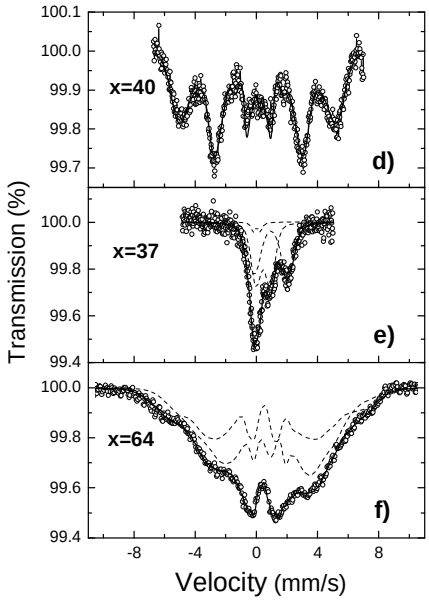


Fig.2. The fitted ^{57}Fe Mössbauer spectra of nonoxidised $(FeCoZr)_{40}(Al_2O_3)_{60}$ a),d), oxidised $(FeCoZr)_{37}(Al_2O_3)_{63}$ b),e) and oxidised $(FeCoZr)_{64}(Al_2O_3)_{36}$ c),f) films at RT and 78 K, respectively. Solid lines denote the best fits and the dashed lines represent the contributions from the subspectra.

K-edge X-ray absorption spectra were measured for three samples: fully oxidized $(FeCoZr)_{36}(Al_2O_3)_{64}$ film, pure FeCoZr film, and intermediate composition, $(FeCoZr)_{56.5}(Al_2O_3)_{43.5}$. Near-edge spectra (XANES) shown in fig.3 confirm the significant differences in the chemical composition reflected in evolution of the electronic structure of unoccupied bands. Both, Fe and Co, absorption edges of pure FeCoZr film are simillar to each other, characterized by a rapid increase of absorption, up to the value close to the half of the edge step, with inflection point at the binding energy of 7112 eV and 7709 eV, respectively. Further on, a kink at ~5 eV above edge energy and weak maximum at ~19 eV followed by a flat oscillations are revealed. This shape is characteristic to the absorption edge of bcc iron foil.

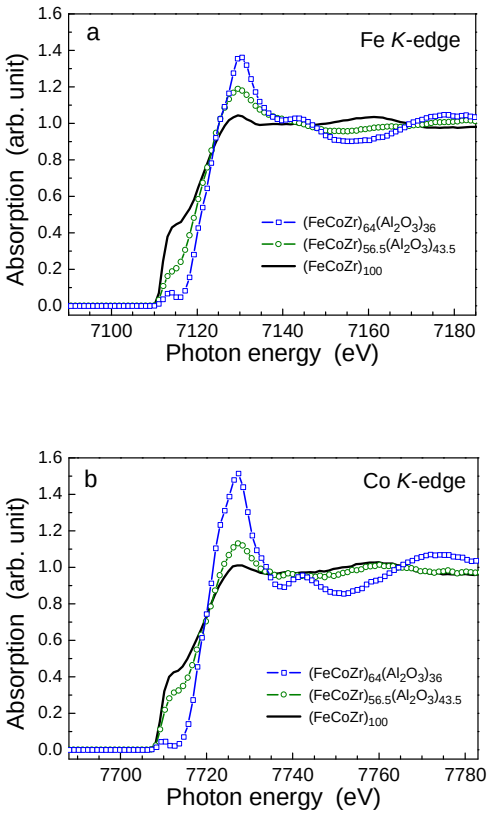


Fig.3. The Fe (a) and Co (b) *K*-edge XANES spectra of selected samples.

Significantly different shape of absorption edges is revealed in the spectra of $(FeCoZr)_{36}(Al_2O_3)_{64}$ film. Both, Fe and Co, edges show a small pre-edge feature above binding energy and main absorption edge shifted by ~10 eV that is characterized by strong maximum (white line) and significant amplitude of post-edge oscillations. All these is characteristic for oxide spectra of high symmetry of local coordination, likely octahedral. In the case of Co *K*-edge, the white line consists of double peak structure that can be tentatively attributed to mixed valence or charge fluctuations. XANES spectra of $(FeCoZr)_{56.5}(Al_2O_3)_{43.5}$ film reveal a shape that is intermediate to the other two samples studied that is attributed to an average of Fe and Co spectra of two (or more) local environments as expected in thecase of core/shell structure. Interestingly, the Fe spectrum consists of a larger oxide contribution, in contrast to that of Co, which is closer to pure alloy spectrum. That suggests that oxidation process is not spatially uniform, but favors oxidation of iron prior to cobalt.

Negative tunneling MR (TMR) of spin-dependent nature is observed for granular films with "core-shell" structure in the whole range of x values, Fig.4. The decrease of TMR with increasing temperature is correlated with the magnetic saturation of superparamagnetic metallic nanogranules.

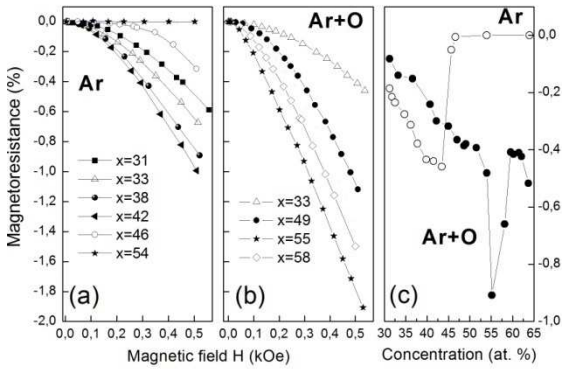


FIG.4. Room temperature magnetoresistance in oxidized (a) and non-oxidized (b) granular films $(FeCoZr)_X(Al_2O_3)_{100-X}$ ($31 \le x \le 58$) as a function of magnetic field and metal content x at $H \approx 0.3$ kOe (c).

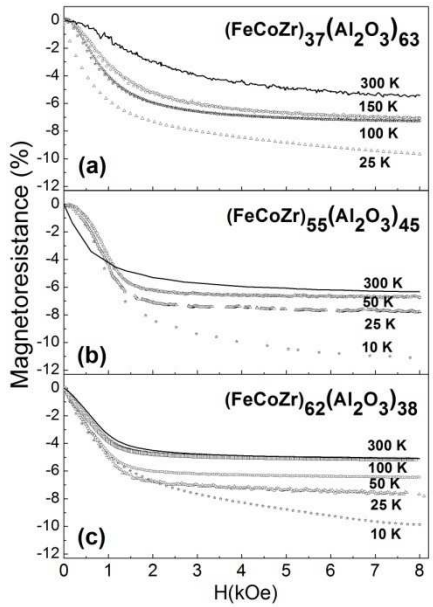


Fig.5. Magnetic field dependencies of magnetoresistance for granular films

with “core-shell” structure measured in the temperature range of 10-300 K.

The enhanced TMR effect in “core-shell” granular films is attributed to stabilization of metallic cores sizes as well as to the influence of magnetic oxide shell through spin accumulation and filtering processes. A considerable high field magnetoresistance appearing for core-shell samples at low temperatures, Fig.5 and the resulting deviation of magnetoresistance and squared magnetization dependences are attributed to a high magnetic anisotropy introduced by the magnetic oxide shell.

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Measurement control and data acquisition system for scanning micro-beam X-ray fluorescence spectrometer

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Introduction

Micro-beam X-ray fluorescence spectroscopy (μ-XRF) is a non-destructive technique of elemental analysis widely used for the determination of metals in environmental and biological samples, in archaeological research, and in forensic science. In confocal setup the analysis is performed with primary radiation beam focused by a polycapillary and the secondary radiation emitted by the sample focused by a half-lens polycapillary. The primary beam focusing lens sits in the path between the X-ray source and the sample, whereas the polycapillary half-lens is located between the sample and the detector. The foci of both polycapillaries overlap creating an ellipsoidal testing (probing) volume through which the sample can be translated independently in the 3 spatial dimensions. Typical spatial resolution for a tabletop setup is of the order of few tens of micrometers [1–2].

Instrumentation

The main aim of this work was to create a user friendly software interface for a tabletop confocal micro-beam X-ray fluorescence microscope (confocal μ-XRF). The main area of application of the spectrometer is two and three-dimensional (2D/3D) mapping of elemental distributions in environmental, biological and geological samples. The spectrometer was assembled by using commercially available components: Mo-anode X-ray tube (maximum power 50W) with polycapillary X-ray optics, 10 mm^2 active area silicon drift detector (SDD) with 8μm Be window, two sets of motorized XYZ stages, one for positioning the detector and the other for positioning the sample during a scan. Optical microscope with video camera is utilized for on-line sample preview and selection of analyzed region. The detector can be also equipped with polycapillary conical collimator for 3D measurements in confocal geometry. A triangulation laser distance sensor is used for accurate positioning of the analyzed sample. A scheme of the experimental setup is shown in Fig. 1.

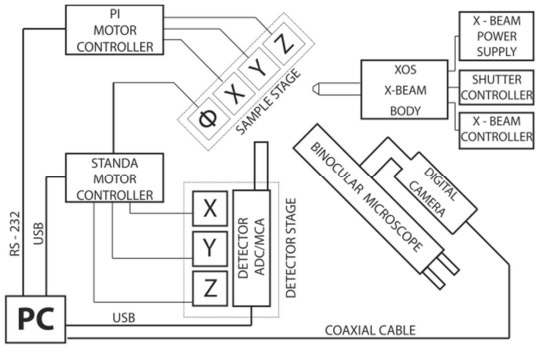

Fig. 1. Schematic diagram of scanning micro-beam X-ray fluorescence spectrometer.

The National Instruments' LabVIEW graphical programming language was used to create complete measurement control and data acquisition software integrating various elements of the spectrometer system. Practical advantage of the LabVIEW is that the features typical for real-time systems can be easily achieved, e.g. events handling, process synchronization and code execution parallelization. Almost any hardware component can be controlled using either a dedicated Virtual Instrument (VI) driver or some Windows specific technique (e.g. DDE, DLL). A set of LabVIEW provided software tools can be integrated into VI, allowing realization of a data base, remote program control through Internet, report generation,

emergency notification, etc. Moreover it makes the process of exchanging/upgrading and eventual further expansion of the system relatively easy. The front panel of the virtual instrument (graphical user interface) can be designed by using controls and indicators from a palette of available elements.

The developed LabVIEW software consists of two main modules. The first module controls the video camera and handles sample positioning. A live camera image allows the user to define spatial regions and program μ-XRF scans. The second module executes the programmed scan(s) controlling the measurement and data acquisition. This module handles the sample stage movement, X-ray spectra acquisition, simple data preprocessing, and data storage. Several user-defined spatial regions (either 2D or 3D) can be scanned this way.

Characterization of the setup

Size of primary X-ray beam was investigated by using wire scan method [3]. Tungsten wire of 3 μm diameter was used. Vertical and horizontal size of the beam was measured to check the symmetry. The size of the focal spot of the capillary full lens was 16.6 μm vertically and 16.2 μm horizontally. Minimum detection limits were determined by measuring several certified thin film samples of different elements (pure elements: Ti, Cr, Fe, Cu, Se, Au, Pb and compounds: KI, ZnTe, TbF3, SrF2) For each standard sample 25 measurements at different points were performed (50 s per point, 50 kV operating voltage, 1 mA tube current). The cumulative spectrum of all points was used for calculations. Minimum detection limits vary from 15.19 ng/cm^2 for iron to 68.52 ng/cm^2 for lead.

The reliability of the spectrometer and its control software was examined. Preliminary measurements in 2D/3D mode were carried out [4].

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MÖSSBAUER STUDIES OF ERYTHROCYTES EXPOSED TO NEUTRON RADIATION

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Within the frame of this work we studied the influence of neutron radiation on the stability of erythrocytes. The applied dose of 50 μGy is several orders of magnitude lower than those used in radio-immunotherapy (~keV) or in prevention of posttransfusion-associated graftversus- host disease (25 – 50 Gy). It is even 3 orders of magnitude lower than doses at which hormesis phenomena were reported (5-200 mGy). Moreover, the rate dose of the radiation (1.1 μGy/min) is only about 200 times higher than doses estimated for the background radiation. It is known, that neutrons can produce observable damage at lower absorbed doses than β- , γ- or X-radiation because they show higher relative biological effectiveness (RBE) which depends on the energy transfer (LET). It was observed that mGy doses of ionizing radiation, independently of its type, may cause serious oxidative stress in living organisms. They may damage lipids and proteins, especially enriched in -SH groups [1, 2]. Therefore we wanted to check if there is a detectable influence of ionizing irradiation at an exposure time of a few minutes and at a very low dose rate of ionizing radiation on the in red blood cells (RBCs) and hemoglobin (Hb) states. We have chosen RBCs because they can serve as a good model system for studying action of ionizing radiation on the biomembranes of mammalian cells. Washed RBCs were suspended in a phosphate buffer at the cell concentration of $8 \cdot 10^{10}$ red cells/ml. ^{239}Pu-Be was our source of neutron radiation and the average energy of the emitted neutrons was 4 ± 2 MeV. Energy of the accompanying γ-rays was about 59 keV. The activity of this neutron source at the position of the sample was $1{,}36 \cdot 10^{4}$ Bq, what was equivalent to about 1.1 μGy/min or about 2 μSv/min. Mössbauer spectroscopy was applied to monitor the hemoglobin states inside red blood cells. The measurements were performed at 80 K in a home-built cryostat. Topography of erythrocytes was studied using Atomic Force Microscopy Agilent 5500 AFM. The scans of the red blood cell surfaces were performed in the contact mode using V-shaped Si_3N_4 cantilevers with a spring constant of 0.01 N/m. Experiments were carried on in air at room temperature, 2h after the sample deposition on the mica surface. We did not use any chemicals for stabilization of the erythrocytes' structure.

In Fig. 1 we present examplary Mössbauer spectra of non-irradiated and

irradiated red blood cells isolated from healthy donor. The contribution of oxyhemoglobin (OxyHb) and deoxyhemoglobin (DeoxyHb) component decreases from about 72% to 66 % and from 12% to 7% due to the action of neutrons, respectively. In the case of irradiated erythrocytes methemoglobin (MetHb) occurs (about 12%). In Fig. 2 changes of the shape and membrane skeleton of irradiated red blood cells are shown.

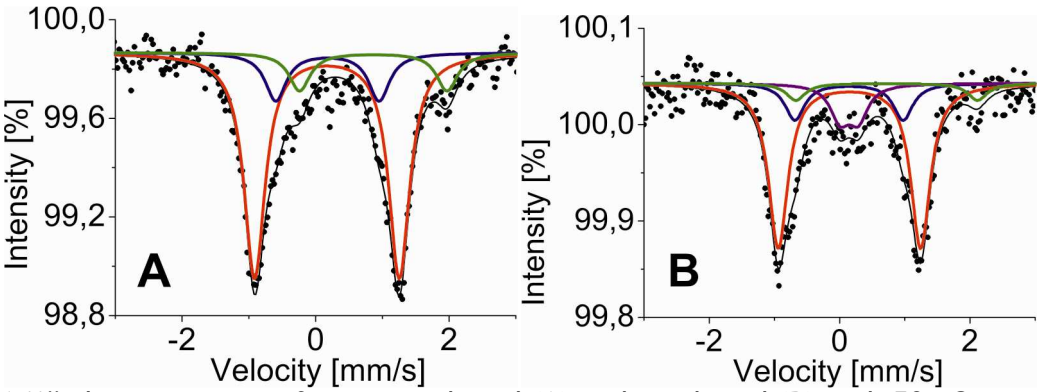

Fig. 1 Mössbauer spectra of non – irradiated (A) and irradiated (B) with 50 μGy neutron rays RBCs from healthy donors. Line: red - OxyHb, blue - HbOH/H_2O, green - DeoxyHb, violet – MetHb [3, 4].

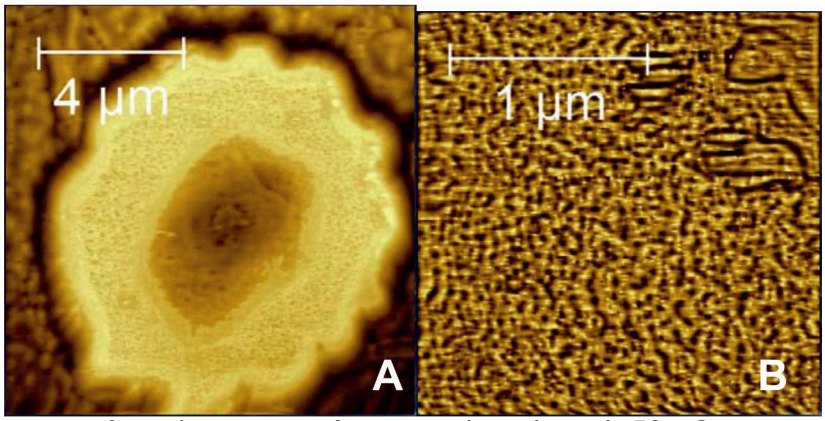

Fig 2. AFM images of erythrocyte surfaces irradiated with 50 μGy neutron rays. RBCs isolated from healthy donor. In (A) and (B) a changed shape of red cell and a modified honeycomb erythrocyte membrane skeleton are visible, respectively

Mössbauer spectroscopy allowed us to gain an insight into possible changes of hemoglobin (Hb) in the red blood cells irradiated with neutrons at a very low dose of 50 μGy. We observed that only two Hb forms (OxyHb and DeoxyHb), which are physiologically active in O_2 transport, are sensitive to such a low dose of neutron radiation. Inactive HbOH/H_2O form seems to be resistant to the action of neutrons. Our AFM measurements showed that this low dose of radiation caused also modifications of the membrane-skeleton network resulting in changes of the shape of the red cells.

Acknowledgements
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Increased frequency of creatine inclusions in the rat hippocampal formation following pilocarpine-induced seizures – SRFTIR and Raman microspectrocsopy study

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Although epilepsy has been a serious problem of clinical neurology for many years, the mechanisms of its pathogenesis are still not fully understood. The analysis of nervous tissue from the period of epileptogenesis is possible based on the animal models of the disease. Animal models of epilepsy help better understand the mechanisms leading to spontaneous seizure activity, allow observations of the progress and character of seizures as well as evaluation of the action of new antiepileptic drugs [1,2]. The most frequently occurring type of epilepsy in adults is the temporal lobe epilepsy (TLE) and the most frequently used and highly isomorphic with human cases of TLE animal model is one with seizures induced with pilocarpine [3].

In frame of this work the role of creatine in the pathogenesis and progress of pilocarpine evoked seizures and seizure-induced neurodegenerative changes in the rat hippocampal tissue was examined. The main goals of the study was to identify creatine deposits within the examined tissues, to analyze their frequency in epileptic animals and naive-controls and to examine correlations between the number of inclusions in the hippocampal formation of epileptic rats and the quantitative parameters describing animal behavior in the acute phase after pilocarpine injection.

Synchrotron radiation Fourier transform infrared (SRFTIR) and Raman microspectroscopies were used to realize the purposes of the work. The measurements were carried out at SOLEIL beamline SMIS. Inclusions present in hippocampal formation tissue were the subject of the following studies. The point IR maps were recorded for all the deposits located within the area of interest for 10 epileptic and 6 control samples. The presence of creatine in nervous tissue was confirmed based on the vibrational bands specific for this compound in the infrared and Raman spectra. These were the bands occurring at the wavenumbers around 2800 cm^{-1}, 1621 cm^{-1}, 1398 cm^{-1} and 1304 cm^{-1} in IR spectra and around 1056, 908 and 834 cm^{-1} in the Raman spectra. In the Figure 1 infrared and Raman spectra recorded for normal hippocampal tissue, hippocampal deposit and pure creatine were compared.

The creatine was found in 8 of 10 epileptic samples and the number of deposits varied from 1 to 100. Only in one of the control samples the creatine inclusions were detected and their number was equal to 25. The topographic analysis of the creatine depos-

its showed that most of them were localized in the multiform cell layer and inside the dentate gyrus (DG) of hippocampal formation. Moreover, the number of inclusions detected in the epileptic animals was positively correlated with the total time of seizure activity within the 6-hour observation period. The obtained results may suggest seizure-induced disruption of creatine kinase function, impairement of neuromodulatory function of creatine or increased permeability of the blood-brain barrier for creatine from periphery [4].

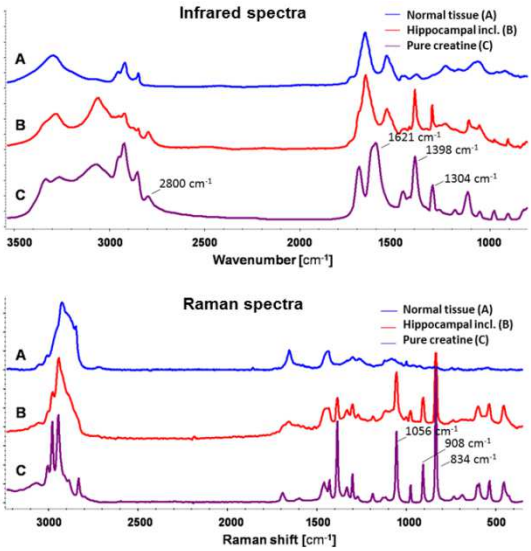

Figure 1. The comparison of infrared and Raman spectra recorded in normal hippocampal tissue, hippocampal creatine inclusion and for pure creatine.

Acknowledgements
This work was supported by the Polish Ministry of Science and Higher Education and its grant for scientific research IUVENTUS PLUS n. JP2010005370 as well as SOLEIL experimental grants: 20060063 and 20090749.
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Joanna Chwiej is also grateful for support from the Foundation for Polish Science (Start Programme).

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Relationship between COLOURS OF OCHRES FROM ROUSSILLON and content of iron-bearing minerals

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Ochres are earthy minerals having a wide spectrum of colours that spans from pale yellow to dark red or purple. For this reason and because they are very stable, non-fading, non-bending, have a strong tinting strength and reproducible shades, they have been used as natural pigments since ancient times. Their colour was suggested to be determined by [1,2]: (a) the presence of hematite and/or goethite as chromophore for red and yellow, respectively, (b) the exact chemical composition, and (c) the range of particle sizes. According to a recent study, the positive a^* coordinate in the CIE-$L^*a^*b^*$ space is the only relevant colorimetric parameter to quantitatively characterize the colour of the ochres [3]. We found evidence that also b^* coordinate was correlated with the colour, at least, in the case of the ochres from Roussillon, France, the subject of this report.

Samples were collected in field in Sentier des Ocres near Roussillon, France. In order to study a possible dependence of their colour on size of grains, each of the nine samples, having visually different colour, was separated into four fractions with different grain sizes viz. (1) < 20 μm, (2) 20-50 μm, (3) 50-100 μm, and (4) > 100 μm. The separation process was carried out using a wet method [4].

Most of the investigated samples were also classified according to the Munsell colour system - the colour space that specifies colours based on three colour dimensions: hue, value (lightness), and chroma (colour purity or colourfulness) – see Table 1.

Table 1 A list of the investigated samples that have been classified with Munsell symbols and corresponding colours.

Sample #no	Grain size [μm]	Munsell symbol	Colour
1	All fractions	2.5YR8/4	Pale yellow
2	All fractions	5YR7/6	Reddish yellow
3	20-50, 50-100	10YR7/4	Very pale brown
4	< 20	10YR6/6	Brownish yellow
5	Not classified		
6	< 20	7.5YR7/4	Pink
6	Other fractions	7.5YR6/4	Light brown
7	< 20	2.5YR5/6	Red
7	20-50, 50-100	5YR5/4	Yellowish red
8	< 20	5YR6/8	Reddish yellow
9	< 20	2.5YR6/8	Light red
9a	50-100	2.5YR5/8	Red
9b	>100	2.5YR5/6	Red

The quantitative phase analysis with respect to minerals containing iron (hematite, goethite and kaolinite) was done by means of ^{57}Fe-site Mössbauer spectroscopy (MS) on the finest fraction as it had the highest iron content.

Typical examples of the spectra recorded at 295 K on various samples are shown in Fig. 1.

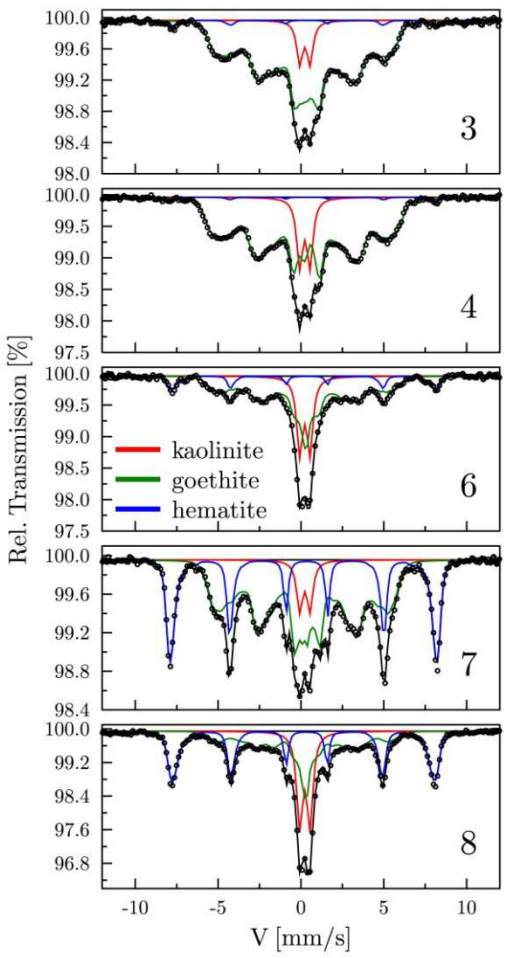

Fig. 1 ^{57}Fe Mössbauer spectra recorded at 295 K on the finest fraction of the ochre samples labeled with their numbers – see Table 1.

Determination of the colour coefficients $L^*a^*b^*$ was based on the measured reflectance spectrum for each sample as described in detail elsewhere [4].
The data shown in Figs. 2 and 3 give a clear evidence that the colorimetric co-ordinates a^* and b^* are linearly correlated with the content of goethite and hematite, respectively. However, the correlation revealed for goethite is reversed to that found for hematite. This kind of correlations is rather expected to occur as a^* corresponds to the colour balance between red (or more accurate magenta) and green, and b^* is responsible for the colour balance between yellow and green. On the other hand, there was also a negative such correlation found for a^* and amount of kaolinite, but b^* seemed not to be correlated with the relative abundance of that mineral. These findings only partly agree with the previous ones [3], where only the coordinate a^* was shown to be correlated with the relative amount of hematite and with that of the white pigment, hence quantitatively responsible for the colours of ochres. Here we found a clear evidence that both a^* and b^* played such role.

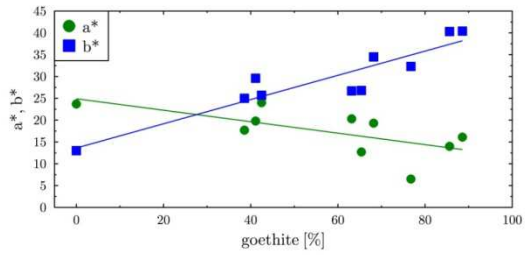

Fig. 2 Relationship between the colorimetric co-ordinates a^* and b^* and the content of goethite in the studied samples.

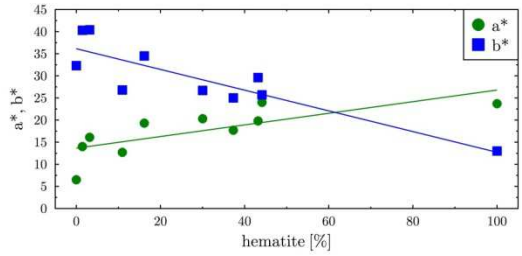

Fig. 3 Relationship between the colorimetric co-ordinates a^* and b^* and the content of hematite in the studied samples.

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Kelvin Probe Force Microscopy studies of buried polymer/metal interfaces

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Interactions between thin polymer films and a metal substrate are important for many applications. Charge transport through the interface between an organic layer and an electrode plays a key role in the design of organic electronic devices such as light-emitting diodes, solar cells, transistors or chemical sensors. Electrical impedance of this interface has a strong impact on the performance of such devices. Although this problem has been examined since polymers were employed to organic electronics, it is still intensively investigated. The mechanism of energy level alignment at the polymer/metal interface is the main issue under consideration [1] here.

To improve the efficiency of various devices, a self-assembled monolayer (SAM) is often placed at the interface [2]. The SAM monolayers can control not only dipole moment across the junction, but also can modify morphology of deposited organic layers. Both aspects are intensively studied. Deposited SAM monolayers, commercially available with a variety of molecular architectures, or their mixtures allow for a controlled modification of surface tension and for a tunable variation of wettability. This can affect solvent-casting processes and modify morphology of spin-cast polymer films. In addition, SAM micro-patterns prepared over large substrate areas can align the domains of spin cast mixtures of insulating and conjugated polymers, e.g. polystyrene blended with poly(3-alkylthiophene) [3] or polyaniline [4], suggesting a simple method to fabricate polymer-based circuitries.

This work demonstrates the capabilities of Kelvin Probe Force Microscopy (KPFM) as a tool that can determine inhomogeneities of electronic properties of buried polymer/metal interfaces, with sub-micrometer lateral resolution, for polymer films with thickness up to some tens of nanometers. It shows that KPFM can examine not only surface properties but also interfacial electronic structures.

The KPFM is based on Atomic Force Microscopy (AFM) technique and it is used to measure the contact potential difference (CPD) between an AFM tip and a sample [5]. Three modes of KPFM method are available: lift mode, amplitude modulation (AM) and frequency modulation (FM). In AM-KPFM mode the oscillating tip, with mechanical resonance frequency (ω_m) and applied voltages: DC and AC with frequency ω_e, is approached to the surface sample. Detection of the tip deflections enables simultaneous determination of topography and CPD, in addition to the measurement of capacitance gradient dC/dz.

Samples preparation was as follows. The substrates were prepared by thermal evaporation of Au onto silicon wafers. The gold surface were further on patterned with self-assembled monolayers (SAMs) of CH3-terminated ($HS(CH_2)_{15}CH_3$) and/or COOH-terminated ($HS(CH_2)_{15}COOH$) thiols. The SAM patterns were micro-contact printed (μCP) on gold surfaces with a PDMS stamp, consisting of relief structures repeated with ~20 μm periodicity, inked with thiols dissolved in ethanol. Three types of SAM patterns were pre-

pared: COOH-SAM/Au - obtained with one-step micro-contact printing; COOH-SAM/CH3-SAM with the same shape but enhanced contrast of surface tension - fabricated with μCP of COOH-SAM, followed by immersion in the solution of CH3-terminated thiols; CH3-SAM/COOH-SAM with inversed contrast of surface tension - resulting from μCP of CH3-SAM regions and subsequent COOH-SAM formation in empty areas. In the next step polystyrene dissolved in toluene was spin cast on the patterned substrates. As a result the PS films were formed with a thickness ranging from 80 to 100 nm.

The self-assembled monolayers deposited on the Au surface change its physical properties. The surface covered with the CH3-terminated SAM becomes hydrophobic while the SAM with COOH-end group makes the surface hydrophilic. Depending on the terminating groups SAMs possess various dipole moments and modify the metal work function Φ_M in a different manner. Deposition of the CH3-SAM on gold decreases Φ_M value by about 1.2 eV while the COOH-SAM increases Φ_M by about 1.0 eV [6]. Lengths of both SAM-forming molecules were very similar and equal to about 2.0 nm.

The results obtained here for different SAM micro-patterns on Au covered with thin polystyrene PS films lead us to the following conclusions: First, the CPD signal indicates local dipole moment orientation induced by SAM placed at the buried interface between the gold substrate and non-polar PS film (cf. Figs. 1 b, e). Second, PS topography is essentially flat (Figs. 1 a, d) and the dC/dz signal is uniform (Figs. 1 c, f). This supports the interpretation of CPD signal, as examining the buried interface and not related with the free surface (topography) neither with overall lateral material arrangement (dC/dz, permittivity) in the examined films.

The interpretation of observations made above for the model system can be employed to discuss the KPFM results for thin film blends composed of conjugated polymers such as polystyrene and polyaniline doped with camphorsulfonic acid [7].

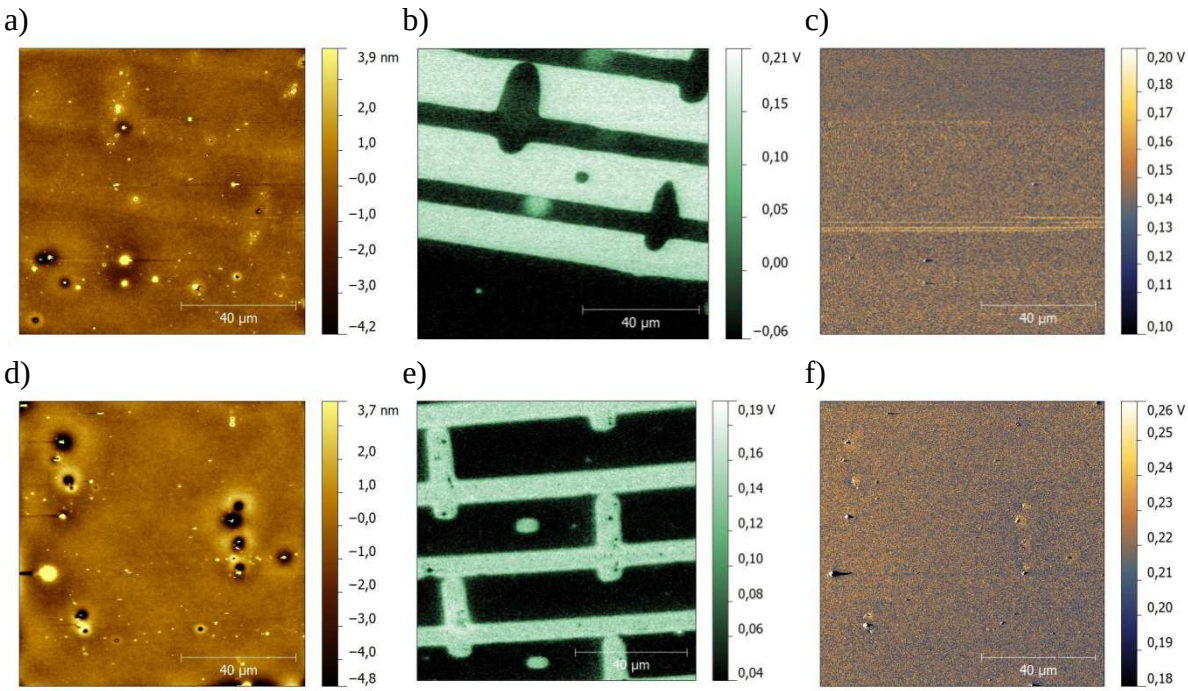

Fig. 1. Thin polystyrene PS film spin-coated on a COOH-SAM/CH3-SAM (a, b, c) and CH3-SAM/COOH-SAM (d, e, f) pattern on Au substrate: (a, d) surface topography, (b, e) CPD image where lower signal/dark areas correspond to COOH-SAM regions, and (c, f) dC/dz signal.

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Symmetry analysis of the behavior of the family R_6M_{23} compounds upon hydrogenation

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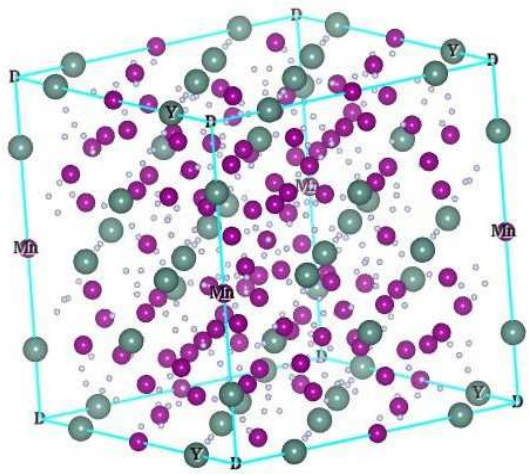
The family of R_6 M_{23} (where R - rare earth element, M - transition metal) structures were intensively investigated in the 1980's due to the discovery that these compounds had the ability to absorb, store and desorb large quantities of hydrogen, and had interesting structural and magnetic transitions caused by hydrogenation. These types of crystals (isostructural with Th_6 Mn_{23}) are described by the Fm3m space group and contain 116 atoms per unit cell occupying the positions 24e(R), 4b, 24d, 32f1 and 32f2 (M). Additionally in the elementary cell, depending on the concentration, there can be up to 100 atoms of hydrogen (or deuterium) occupying the interstitial positions 4a, 32f3 , 96j1 and 96k1 [1]. The determination of hydrogen ordering and accompanying magnetic structures in these compounds is not easy, and interpretation of experimental data can be ambiguous. Many authors write about diferent structural transformations and magnetic properties, depending on the type of R and M atoms and hydrogen (deuterium) concentrations. For example in $Ho_6Fe_{23}D_{12}$ (at T = 4 K) the distortion to the I4/mmm structure related to deuterium implementation have been reported [2], whereas in Y6 $Mn_{23}D_{23}$ (at T < 180 K) [3] and $Th_6Mn_{23}D_{16}$ (at T < 78 K) [4] it has been observed that hydrogen ordering leads to the crystallographic distortion to the P4/mmm structure, but $Th_6Mn_{23}D_{30}$ conserves the parent cubic Fm-3m structure (down to T = 4 K). The transition to P4/mmm under deuteration occurs also in $Ho_6Mn_{23}D_{22}$ (at T = 9 K) [5].



Different types of accompanying orderings of magnetic moments have been found in these compounds. Thus it would be interesting to discuss the properties of these compounds from the symmetry point of view. Therefore symmetry analysis based on the theory of group and representations (SA) [6] was applied in this work to discuss the possibility of behavior of the family R_6 M_{23} compounds upon hydrogenation (deuteration). Detail results are presented in [7]. Here the discussion of transition in $Y_6Mn_{23}D_{23}$ is quoted.

The analysis was conducted for all positions occupied by the atoms of R, M and D by the MODY [8] computer program, using the options: types of Modes: – scalar for describing changes of probability of site occupation, polar for describing displacements of atoms from equilibrium positions in high symmetry structure and axial for describing orderings of magnetic moments. The representations of space groups used in SA are in agreement with [9]. The symmetry considerations indicate that no representation of the Fm3m space

group with k=(0,0,0) is active in transition to the group P4/mmm. Structural transformations described by representation τ_1 belonging to k=(0,0,1) (another arms of this k-vector star lead to another domains of the same structure) lead to such transition and positions of atoms as indicated in [4] as the result of hydrogenation (deuterisation). The results show full agreement with predictions of deuterium ordering, but no agreement between predictions given by symmetry analysis and the type of magnetic structure proposed as interpretation of experimental data [4]. The accompanying magnetic transition occurring around 175 K is reported in [4] as collinear antiferromagnetic, where only the Mn atoms localized on 4b and 32f (in Fm3m description) positions have non zero magnetic moments. In the P4/mmm description of the structure, this proposed magnetic ordering corresponds to the Mn moments on the b and t2 sites coupled antiparallel to those on the c and s2 sites. No magnetic moment was found on Mn at d and f1 sites in the Fm3m structure [4].

Our results have shown that in $Y_6Mn_{23}D_{23}$ the magnetic structure should be antiferromagnetic (as in the experiment), but noncollinear. The symmetry analysis - as had been shown in [7] - indicates that the collinear antiferromagnetic ordering and structural deformation to P4/mmm is not possible at the same temperature, because they do not belong to the same irreducible representation. The collinear antiferromagnetic ordering is allowed by the τ_8 and τ_9 IR-s with k=(0,0,0). No sets of mixing coefficients for these representations lead to the P4/mmm crystal structure. As had been shown the deformation to P4/mmm structure is allowed by τ_1 irreducible representation belonging to k=(0,0,1). Additionally for positions 4b representation τ_1 is not active which means that at these positions the ordering of magnetic moments should not appear (on the contrary to experiment). Symmetry analysis admits magnetic ordering for positions 32f2 . There are two groups of atoms in positions 32f2, of which the configurations of magnetic moments are exactly orthogonal to each other. (on the contrary to interpretation of experimental results). It could be that the structural and magnetic orderings in the R_6M_{23} hydrides are not strictly accompanying, but occur in two steps, or that the magnetic structure is not strictly collinear. This should be experimentally verified.

In a similar way as presented in the paper [7] we obtained all types of modes for all Wyckoff positions occupied in R_6 M_{23} family hydrates, and for all active representations.

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Evacuation from evacuation - simulations within the Social Force Model

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The Social Force Model (SFM) is a simulation framework for crowd dynamics. It has been designed by Dirk Helbing and cooperators in 90's [1,2]. The idea is to treat human bodies as particles, where the interaction between them includes mechanical as well as psychological forces. The latter is the known tendency to keep some distance between strangers. The psychological forces can be modified by the pedestrians according to their conscious decisions. Also, a pedestrian's intention to move in a given direction with a given velocity is encoded as her desired velocity. The details on these parameters are given in [2]. All the forces contribute to the equations of motion, which are solved numerically for all pedestrians. The overall simulation is akin to the molecular dynamics.

In our recent paper [3], SFM has been applied to simulate an evacuation of some hundreds pedestrians from a rectangular room with a narrow exit. The novelty of the approach is to ask for the conditions when a single pedestrian is dragged by the crowd to the exit, irrespectively of her will. To investigate this, we endow a pedestrian X in the middle of the crowd by a desired velocity directed from the exit, on the contrary of all others. This opposite intention is switched on at the time instant when the sum of radial physical forces acting on any pedestrian exceeds some threshold *Sc*. In other words, the pedestrian which happen to be subject of a largest pressure 'changes her mind' and wants to evacuate from the crowd; all others tend to the exit. The outcome is the probability *P* that X is dragged through the exit, despite her reversed desired velocity.

In the attached picture, the probability *P* is shown as dependent on the crowd size *N*. The plot is close to a sigmoidal curve. According to the numerical results, the shape *P(N)* depends only weakly on the threshold *Sc*. Namely, two curves can be distinguished: one for *Sc*=50 and 100 N and another for *Sc* larger or equal 150 N. Still, these curves remarkably differ onlyaround *N*=100 pedestrians. In any case, for *N*=150 and larger, *P* is not less than 0.8. These results are valid as long as the absolute values of the desired velocities of all pedestrians are equal.

Our numerical results indicate that once a crowd size N exceeds 150-200 persons, it is unlikely that a single individual can withdraw under one's own steam. Then, any large gathering of people should be treated as a potentially dangerous medium. This conclusion is supported by the historical data on crowd disasters [4].

Summarizing, in a crowd of some hundreds of people the difference between an autonomous human being and a piece of passive body is less than we would like to admit. Although at the exit the individuals leave the room one by one, in the middle of the crowd their mutual positions cannot be changed. In these conditions, the unpredictability of the human mind does not influence the trajectory of its owner. The obtained results should be helpful to evaluate human resources which are needed to tackle emergency situations in large gatherings of people.

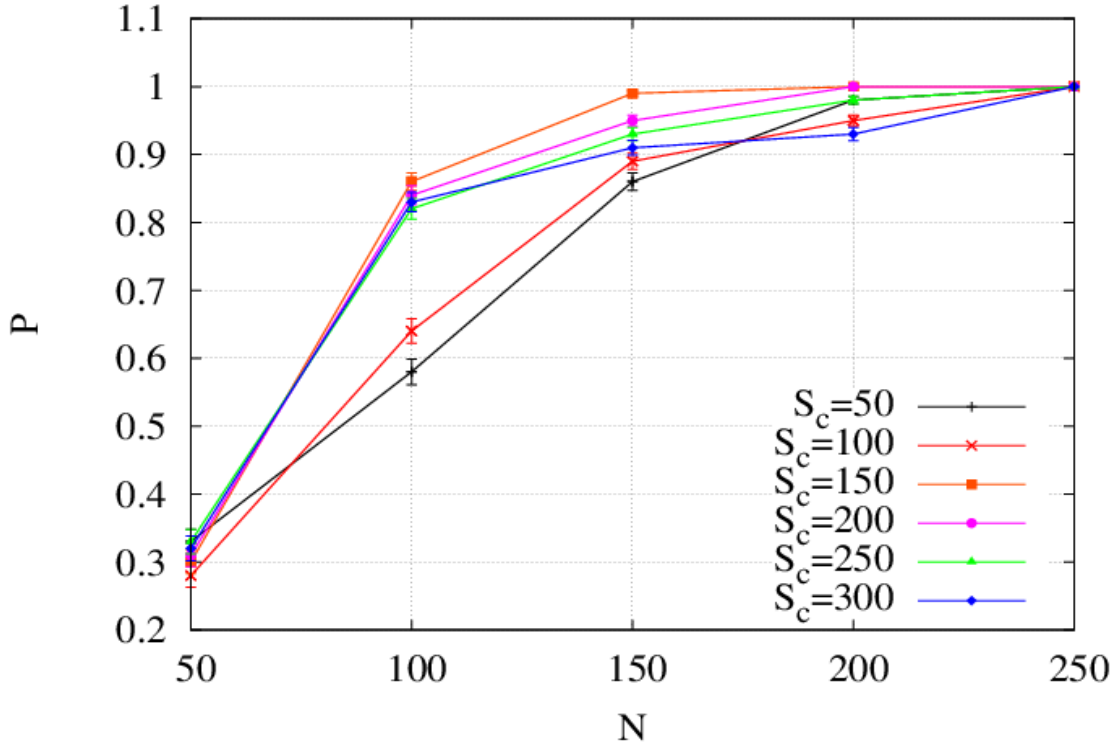

Fig. 1. The probability *P* of being thrown though the exit as dependent of the number *N* of pedestrians in the crowd, for different values of the threshold *Sc*.

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Development of Luminosity Detector for Future Linear Collider

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The Department of Particle Interaction and Detection Techniques at AGH-UST is a member of international FCAL Collaboration, which develops special calorimeters for the forward region of detector in an e+e− future collider, a probable successor of the LHC experiments. The forward region of future linear collider (Fig.1) will be comprised of two finely segmented and compact cylindrical sampling calorimeters, BeamCal, adjacent to the beam-pipe, and LumiCal at larger polar angles, for the luminosity measurement.

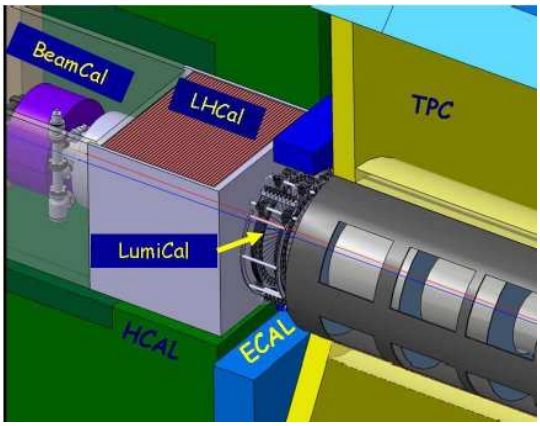

Figure 1. ILC detector forward region

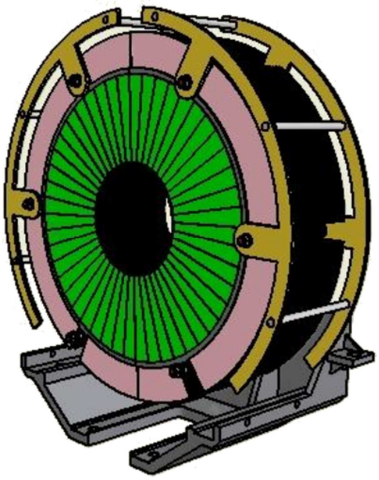
Figure 2. LumiCal detector barrel

The LumiCal (Fig. 2) will be a sandwich type calorimeter built of tungsten absorber plates interlaced with silicon sensor layers. There will be 30 layers in a single detector barrel corresponding to the depth of 30 radiation lengths. Two barrels on both sides of interaction point will need in total about 200 000 readout channels.

The works of FCAL, initially linked to the International Linear Collider (ILC) project have been recently extended to the Compact Linear Collider (CLIC) project [9]. The group from AGH-UST actively participates in the R&D on the LumiCal detector for ILC/CLIC. These works are supported by the European Commission within FP7 programs MC-PAD (Initial Training Network on particle detectors in physics experiments), AIDA (Advanced European Infrastructures for Detectors at Accelerators), and are co-funded by the Polish Ministry of Science and Higher Education.

At the present development stage the main responsibilities of the AGH-UST group are concentrated on:

1. Design and fabrication of the dedicated readout electronics for the LumiCal detector,
2. Design and construction of the LumiCal detector prototypes,
3. Performing the tests of the LumiCal detector modules on electron beam and analysis of test beam results.

The last two tasks are performed together with the group from IFJ PAN, Cracow, which is also a member of FCAL Collaboration. The crucial and technologically the most advanced is the first task, i.e. the development of dedicated ASICs (Application Specific Integrated Circuits) to read and process the signals from silicon sensors. The design and fabrication of the chips is

done in the modern deep sub-micron CMOS technologies. In 2011 we have completed the design and fabricated the first prototypes of multichannel ASICs comprising the whole readout chain (Fig. 3), i.e. the front-end amplifier chip and the digitizer and data serialization chip [1,2,3,4,5].

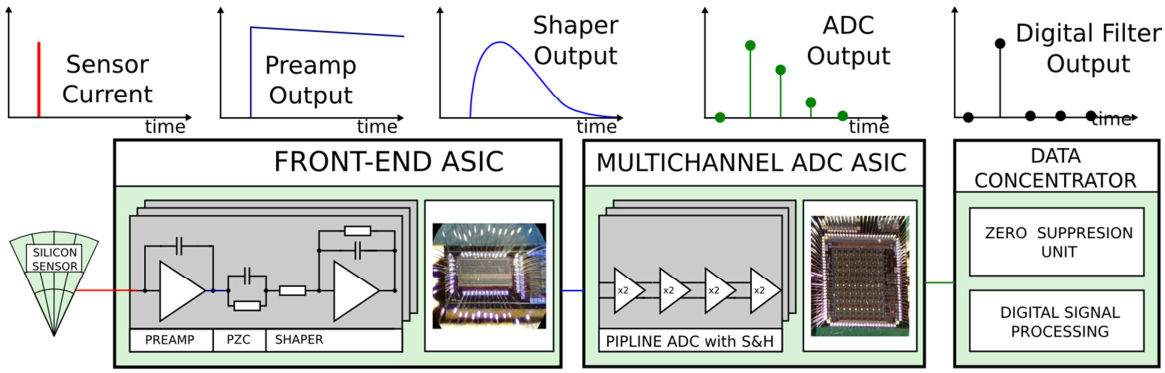

Figure 3. Schematic diagram of LumiCal readout chain

The ASICs were fabricated in the Austrian Microsystems AMS 350nm technology. Because of very challenging requirements on readout electronics power consumption (particularly for CLIC), in 2011 we have also started the works on design of the readout in deeper 130nm sub-micron CMOS technology, with the aim of reduction the power by an order of magnitude and at the same time making it significantly faster.

The design and fabrication of the first prototype of the LumiCal readout chain have been completed in the 2011 [6]. The prototype detector module consist of the readout board (comprising the whole readout chain with the dedicated front-end and digitizer ASICs) and the sensor board (silicon sensors were designed at the IFJ PAN Cracow).

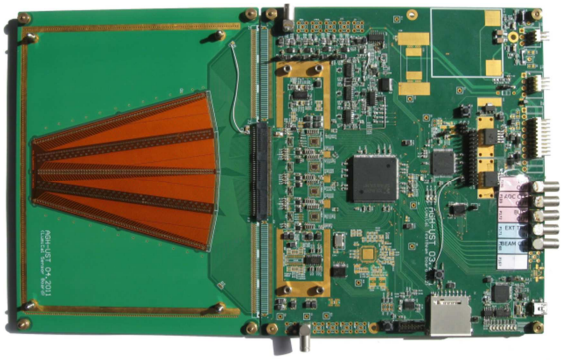

Figure 4. Prototype module of LumiCal detector

Presently the system processes 32 readout channels. It passed extensive laboratory tests showing the full expected functionality.

The described above LumiCal detector module was used two times in 2011 on the 4.5 GeV electron beam at DESY Hamburg, Germany. During these tests a lot of data was collected in order to study the sensor behavior, geometrical precision, showering effects in tungsten, and the overall system performance [7,8]. The data is being presently analyzed.

In 2011 the group at AGH-UST has also started the works on some aspects of LumiCal detector operation at the CLIC collider. Because of very high collision rate at CLIC the readout can not be synchronized with clock as in the ILC, but a triggerless readout of the events is needed. We have studied various possible readout schemes in such challenging environment [9,10].

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Excess of events in the Higgs boson mass widow in the ATLAS experiment at the LHC (ATLAS Collaboration)

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The Higgs boson is predicted by the Standard Model (SM), the theory that physicists use to describe the behavior of fundamental particles and the forces that act between them. Via the Higgs field, the Higgs boson gives mass to fundamental particles. It is so short-lived that it decays almost instantly, and the experiment can only observe the particles that it decays into. The Higgs boson is expected to decay in several distinct combinations of particles. One example of such decays is an event containing four muons (see Fig. 1). This event is consistent with coming from two Z particles decaying to two muons each. Such events are mainly produced by SM processes without Higgs particles being involved. However they are also a possible signature for Higgs particle production, but many events (collisions) must be analyzed in order to discover the Higgs boson. Fig.1 is a view of the Higgs candidate event in the central part of the detector.

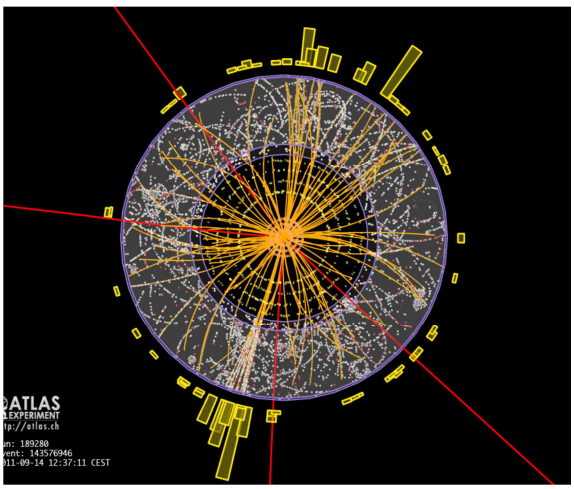

Fig.1 Higgs boson candidate event. The four muons are picked out as red tracks. Other tracks and deposits of energy in the calorimeters are shown in yellow.

A SM Higgs boson would confirm a theory first put forward in the 1960s. However there are other possible forms the Higgs boson could take, linked to theories that go beyond SM. A SM Higgs could still point the way to new physics, through subtleties in its behavior that would only emerge after studying a large number of Higgs particle decays. A non-SM Higgs, currently beyond the reach of the LHC experiments with data so far recorded, would immediately open the door to new physics, whereas the absence the SM Higgs would point strongly to new physics at the LHC's full design energy, set to be achieved after 2014.

More than 5 fb-1 of integrated luminosity has been accumulated in 2011 by the ATLAS experiment, and up to 4.9 fb-1 has been used to update the searches for the Higgs boson. At present, not all channels use the full integrated luminosity, but nevertheless the sensitivity of the analysis allows searches for the SM Higgs boson in a significantly greater range than has been possible before. With this dataset, Higgs boson masses between 124.6 GeV and 520 GeV are expected to be excluded at the 95% confidence level (C.L.) or considerably higher. The observed Higgs boson mass exclusion at the 95% C.L. ranges from 112.7 GeV to 115.5 GeV, 131 GeV to 237 GeV and 251 GeV to 468 GeV. An exclusion of the SM Higgs boson production cross-section at the 99% C.L. is reached in the regions between 133 GeV and 230 GeV and between 260 GeV and 437 GeV.

With the entire 2011 data statistics the ATLAS collaboration reports, for the first time, an excess of events in the $H \rightarrow \gamma\gamma$ and $H \rightarrow ZZ^{(*)} \rightarrow \ell^+\ell^-\ell^+\ell^-$ decay

modes, at Higgs mass hypotheses close to 126 GeV, which is also supported by a broad low significance excess in the $H \rightarrow WW^{(*)} \rightarrow \ell^+\nu\ \ell^-\nu$ channel [1]. The expected sensitivities in terms of local significance for a 126 GeV Higgs boson for each of these three channels are approximately 1.4σ. The observed local significances of the individual excesses are 2.8σ, 2.1σ and 1.4σ, respectively. The combined local significance of these excesses is 3.6σ. Taking the look-elsewhere effect into account the global probability of such an excess to occur in the full search range is approximately 1%, corresponding to 2.3σ.

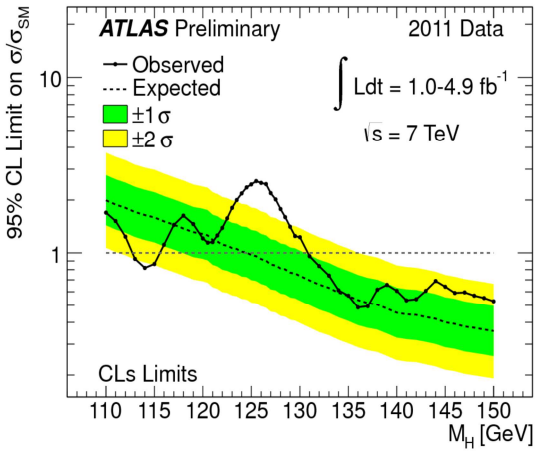

Fig. 2 Experimental limits on the Higgs boson mass from ATLAS.

Figure 2 shows experimental limits from ATLAS on SM Higgs production in the mass range 110-150 GeV based on data collected in 2011. The solid curve reflects the observed experimental limits for the production of Higgs of each possible mass value (horizontal axis). The region for which the solid curve dips below the horizontal line at the value of 1 is excluded at the 95% C.L. The dashed curve shows the expected limit in the absence of the Higgs boson, based on simulations. The green and yellow bands correspond (respectively) to 68%, and 95% C.L. regions from the expected limits.

The Cracow group (INP PAS and FPACS AGH UST) has participated in ATLAS since its very beginning. We contributed to design and construction of the Inner Detector (SCT – semiconductor tracker, TRT – transition radiation tracker) and ATLAS trigger system (for both proton-proton and heavy-ion collisions). These two activities play a crucial role in Higgs searches in ATLAS.

In particular the team from AGH UST had a significant contribution in preparation of a trigger menu designed for SM and new physics searches in ATLAS. A trigger menu is a set of triggers, which are designed to select data for physics and performance studies in real time. Each physics trigger defines selection criteria for events to be either accepted for storage or permanently rejected. In 2011 the LHC machine was delivering proton-proton collisions at conditions being not far from the nominal ones i.e. with a maximum collisions rate of 40 MHz out of which the ATLAS trigger system is designed to record approximately 200 Hz. This implies a requirement of the huge rejection power, which the trigger system has to handle.

The Higgs boson program in ATLAS requires a dedicated set of triggers, which would adopt to quickly evolving LHC conditions and at the same time look at a broad spectrum of decay products with their relatively low transverse momentum. These resulted in design, implementation and optimization of the big set of triggers, which are able to select events by rapidly identifying signatures of muon, electron, photon, tau lepton, jet and b-jet candidates, as well as using global event signatures, such as missing transverse energy. The AGH UST group was playing a key role in this project, also designing and implementing core software for the ATLAS trigger system.

Also our Inner Detector contribution is essential in detection and identifying decay products of the Higggs boson. In particular the golden Higgs decay mode with two photons in the final state, requires some sophisticated approach, which combines information from three sub-systems of the Inner Detector (SCT and TRT among them). A dedicated reconstruction sequence of algorithms was developed for photons to preserve a big sample of events, which converted to electron pairs on their way through the Inner Detector. This is a unique feature of ATLAS and the AGH UST contribution is a key ingredient of this project.

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Natural radionuclides in mineral waters

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Natural radioactivity of mineral water results from the presence of radionuclides belonging to the uranium and thorium decay series, as well as ^{40}K and tritium. These elements may present a certain hazard for human health, related to consumption of mineral water. According to WHO recommendations, the tritium concentration in drinking water must be lower than 100 Bq/L and the annual committed dose due to intake of radionuclides present in this water should be kept below 0.1 mSv [1]. The tritium concentration in most of groundwater systems in Poland is below 1 Bq/L, so the share of this nuclide in the committed dose is in most cases negligible.

The concentrations of natural radionuclides in groundwater depend on many factors such as recoil effect accompanying alpha decays, uranium and thorium concentrations in water-bearing formation, geological and hydrogeological conditions and the chemical composition of water. The Monte Carlo simulations performed by the authors allowed to quantify the influence of some of these parameters on radionuclide concentrations observed in groundwater. It appears that:

(i) in underground environment characterized by moderate desorption and adsorption coefficients the ratio of the activity concentration of radium isotopes ($^{226}Ra/^{228}Ra$) in groundwater should be equal to the ratio of the activity concentration of ^{238}U to ^{232}Th ($^{238}U/^{232}Th$) in the aquifer matrix.

(ii) if the ^{238}U activity concentration in the aquifer matrix is similar to that of ^{232}Th, the activity concentration of ^{226}Ra in groundwater should be higher than those of ^{228}Ra if the desorption process prevailed, whereas the proportion of two mentioned isotopes would be reversed ($^{226}Ra < {}^{228}Ra$) if the adsorption dominates.

The radiochemical methods developed at laboratories of Environmental Physics Group for the determination of the concentrations of natural radionuclides in water samples were verified in periodic intercomparison test runs organized by the National Atomic Agency in Warsaw, EU Research Center in Geel, Belgium, and the International Atomic Energy Agency in Vienna.

The chemical composition and concentrations of natural radionuclides were determined in water samples collected from selected sources of mineral waters (springs and boreholes) occurring in the Polish Carpathians. The mineralization of investigated waters varied in a broad range, from a few hundreds mq/L to above 25 000 mg/L. The analysed Carpathian mineral waters were classified as HCO_3-Ca-Mg, HCO_3-Na-Ca, Cl-Na and SO_4-Ca-Na hydrochemical water types.

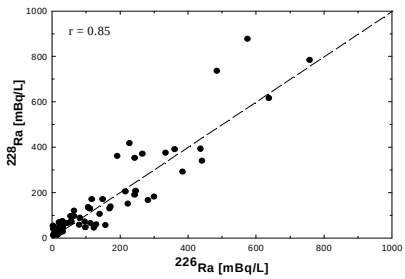

Fig. 1. Relation between activity concentration of ^{228}Ra and ^{226}Ra in Carpathian mineral waters.

The activity concentrations of ^{226}Ra and ^{228}Ra in the analyzed waters depend on the type of water and its mineralization and vary from a few mBq/L to near 900 mBq/L. The relation between the activity concentrations of of ^{226}Ra and ^{228}Ra in the investigated waters is presented in Fig.1.

The data points in the Fig.1 are clustering around the 1:1 line, pointing to similar concentrations of these two isotopes of radium in the analyzed waters. This similarity has its roots in the geology of the region. The Outer Carpathians are built of the flysh formations such as sandstone, shale and conglomerate. The average concentration of uranium and thorium in the Carpathian water bearing formations (sandstone) amounts to ca. 35.4 and 32.6 Bq/kg respectively [2], and the average ratio of the uranium and thorium activity concentrations is equal approximately 1.08. In the non-weathered rocks the radioactive equilibrium between the primary isotope (^{238}U or ^{232}Th) and its progenies is often established, so the activity concentrations of ^{226}Ra and ^{228}Ra in the rock should be equal to these of ^{238}U and ^{232}Th, respectively. Consequently, the ratio of the activity concentrations of the radium isotopes (^{226}Ra/^{228}Ra) in the rock should be equal to that of ^{238}U/^{232}Th. As a result, in the Carpathian groudwaters the ^{226}Ra activity concentration should be equal to that of ^{228}Ra and average value of ^{226}Ra/^{228}Ra $\approx$1.

Analyses of radium isotopes in waters representing different hydrochemical types reveal that the highest values of ^{226}Ra and ^{228}Ra activity concentrations as well as their ratio (^{226}Ra/^{228}Ra) are observed in waters representing Cl-Na hydrochemical type. Medium values are observed in HCO_3-Ca-Mg group of waters while the lowest values were found in the SO_4-Ca-Mg group [3]. This differentiation effect has its roots in high desorption coefficient for the Cl-Na water type and medium one for the HCO_3-Ca-Mg water type. Adsorption processes prevail in waters dominated by sulphate ions.

The concentrations of uranium isotopes in the investigated waters were significantly lower than those of radium isotopes and varied from a fraction of mBq/L to several tens of mBq/L. The inverse correlation between activity concentrations of radium and uranium in these waters was observed. This is a consequence of differences in the geochemical properties of uranium and radium elements in aqueous environment. The concentration of uranium was not related to the total mineralization or concentration of particular chemical constituent in the investigated waters. The ^{222}Rn concentrations varied from less than 0.5 Bq/L to around 30 Bq/L. Consequently, the Carpathian mineral waters can be classified as radon-poor waters.

The concentrations of ^{210}Pb and ^{40}K generally increase with water mineralization. Their concentration in the analyzed waters varied from values below the detection limit to above 300 mBq/L for ^{210}Pb and from 0.024 to 9 Bq/L for ^{40}K.

The annual committed dose *E(g)* for the people in the *g*-age group, caused by intake of natural radionuclides present in drinking waters, can be estimated by the following formula:

$$E(g) = \left(\sum_{i=1}^{N} \left(A_i \cdot e_i(g) \right) \right) \cdot V$$

where A_i stands for activity concentration of *i*-th isotope in water (Bq/L), $e_i(g)$ is the conversion coefficient [Sv/Bq] for *i*-th isotope and people in the *g*-age group and *V* is the annual average water volume consumed by person of the *g*-age group. In our calculation the consumption of water was assumed to be 115 L for infants [3] and 71 L for remaining age groups (the annual consumption *per capita* of bottled water in Poland – [4]). The committed dose estimations were performed for three groups of waters: (i) of the mineralization below 1000 mg/L, (ii) mineralization between 1000 and 3000 mg/L, and (iii) mineralization between 3000 – 10 000 mg/L. The calculated committed doses are summarized in Tables 1, 2 and 3 representing three groups of waters defined above. The doses higher than 0.1 mSv are marked in bold font.

Table 1. Estimated annual committed doses for waters characterized by mineralization < 1000 mg/L

	Annual committed dose [mSv]					
	≤ 1 a	1–2a	2-7a	7-12a	12-17a	≥17a
min	0.044	0.003	0.003	0.004	0.005	0.001
max	**0.217**	0.014	0.012	0.018	0.025	0.004
median	0.054	0.005	0.005	0.007	0.010	0.002
average	0.088	0.006	0.005	0.008	0.011	0.002

Table 2. Estimated annual committed doses for waters characterized by mineralization 1000 -3000 mg/L

	Annual committed dose [mSv]					
	≤ 1 a	1–2a	2-7a	7-12a	12-17a	≥17a
min	0.041	0.003	0.003	0.004	0.005	0.001
max	**0.718**	0.046	0.041	0.062	0.087	0.015
median	**0.233**	0.015	0.013	0.019	0.027	0.004
average	**0.255**	0.016	0.015	0.023	0.029	0.005

Table 3. Estimated annual committed doses for waters characterized by mineralization 3000 -10000 mg/L

	Annual committed dose [mSv]					
	≤ 1 a	1–2a	2-7a	7-12a	12-17a	≥17a
min	0.066	0.004	0.004	0.006	0.008	0.001
max	**3.182**	**0.194**	**0.175**	**0.272**	**0.388**	0.057
median	**0.536**	0.034	0.030	0.047	0.066	0.010
average	**0.725**	0.046	0.040	0.062	0.087	0.014

The following conclusions can be drawn from the tables presented above and from the calculations of shares of individual radionuclides in the committed effective dose: (i) the committed doses increase with water mineralization, (ii) mineral waters should not be used for preparation of meals for children of age below 1 year, (iii) the largest contribution to the total annual committed dose is due to presence of ^{228}Ra (66.7%). The second in importance is ^{226}Ra (12.1%). ^{210}Pb contribute with ca. 18%, and ^{40}K with 1.8%. The smallest contribution (ca 0.5%) is due to presence of uranium (Fig.2).

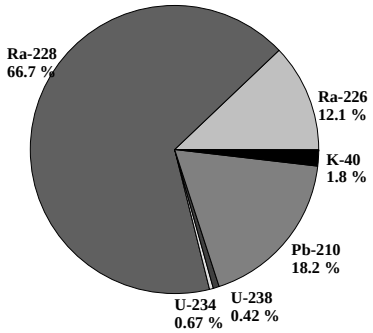

Fig. 2. The contribution of individual isotopes to the total annual committed dose for the waters characterized by mineralization lower than 1000 mg/L

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Resonant enhancement of the formation of hydrogen-helium muonic molecules and their rotational deexcitation

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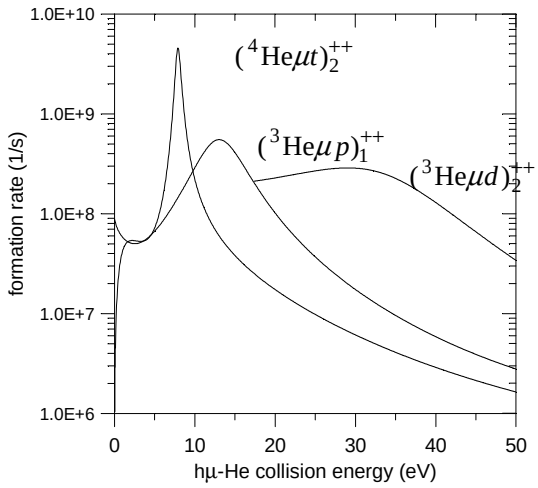
The present work deals with the formation of hydrogen-helium muonic molecules, $(\mathrm{He}\mu h)_J^{++}$, where $h = p, d, t$ and $J = 0,1,2$ denotes the rotational state of the molecule, in electron conversion process

$$(h\mu)_{1s} + \mathrm{He} \rightarrow [(\mathrm{He}\mu h)_J^{++}, e]^+ + e.$$

Due to small dimensions of the molecules and consequently the possible nuclear fusion of their nuclei, the molecules belong to the most interesting objects examined by the so called Muon Catalyzed Fusion (μCF) being a branch of low-energy muon physics. According to our calculation, shape-resonances discovered in elastic $(h\mu)_{1s} + {}^{3,4}\mathrm{He}$ scattering [1] lead to significant enhancement of cross sections and reaction rates corresponding to the formation of $({}^3\mathrm{He}\mu d)_2^{++}$ and $({}^4\mathrm{He}\mu p)_1^{++}$ [2] as well as $({}^4\mathrm{He}\mu d)_2^{++}$, $({}^3\mathrm{He}\mu p)_1^{++}$, and $({}^{3,4}\mathrm{He}\mu t)_2^{++}$ molecular states [3]. The reaction rates have been calculated in [3] for collisions of $(h\mu)_{1s}$ atoms with the ground-state and singly excited helium atoms and ions for the principal quantum number $1 \le n \le 10$ and for collision energies ranging between 10^{-3} eV and 50 eV. According to the results obtained in [3], dominant contribution to the formation processes comes from collisions with the ground-state helium atoms. The corresponding exemplary results are presented in the figure.



Bearing in mind a possible experimental verification of the results in H-He plasma populations of excited helium atoms and ions as well as average formation rates have been calculated for the plasma temperatures $T \le 50$eV. Another evidence of the resonantly enhanced formation may provide hydrogen-helium triple mixtures (H-H'-He) at temperatures ranging between 30K and 5000K. The corresponding average formation rates have been also presented.

It is well theoretically justified fact that nuclear fusion comes mostly from the rotational ground-state ($J = 0$) of the molecule (e.g. $({}^3\mathrm{He}\mu d)_{J=0}^{++}$), however formation of excited states ($J = 1$ and 2) is resonantly enhanced leading to large values of the corresponding cross sections and reaction rates. Therefore, reaction rates of the possible rotational deexcitation $J \rightarrow J$-1 due to Auger electron emission from $[(\mathrm{He}\mu h)_J^{++}, e(1s), e(nlm)]^+$ and $[(\mathrm{He}\mu h)_J^{++}, e(nlm)]^+$ complexes have been calculated.

Results obtained weakly depend on isotope compositions of the muonic molecules and increase from about 10^7 s^{-1} for $n = 10$ to about 10^{14} s^{-1} for $n = 1$. The corresponding paper is now in preparation. Muonic molecule $(\mathrm{He}\mu h)_J^{++}$ geometrically resembles ground-state muonic hydrogen trapped by electric field of helium ion. One can expect therefore that abandoning of the dipole approximation by inclusion of higher multipole terms in $[(h\mu)_{1s}\text{-He}]^{++} - (ee)$ interaction potential will lead to considerable corrections to the formation cross section. Any numerical result confirming this idea is however still absent. Analytical formula for the formation cross section, which includes all the aforementioned multipole terms has been obtained and the corresponding computer program is now in preparation.

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Curie temperatures and electronic band structure of $Ho(Fe_{1-x}Co_x)_2$ compounds

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The heavy rare earth (*R*) - transition metal (*M*) compounds of the RM_2 type have been investigated extensively due to scientific and application purposes. The origin of magnetic and electrical properties of these materials has been an enduring subject of interest. Heavy rare earth - transition metal compounds are ferrimagnets, as a result of the coexistence between the 4f(5d) and 3d electron magnetism. Both the 4f5d electrons of the rare earth sublattice and the 3d band-type electrons of the transition metal sublattice are a source of the magnetic properties of *R-M* intermetallics. The influence of 3d electrons is predominant [1,2].
A driving force to change across the series the number *n* of 3d electrons (calculated per transition metal atom) in the transition metal sublattice, is a substitution of one transition metal by another transition metal in the RM_2 system. This substitution changes band properties, related to them magnetic properties and, in consequence, hyperfine interactions [3-6].
Electrical measurements performed for the $Ho(Fe_{1-x}Co_x)_2$ series in wide range of temperature and FLAPW method calculations of electronic band structure as well as Curie temperatures are presented and discussed.

Synthesis and X-ray studies of polycrystalline compounds of series $Ho(Fe_{1-x}Co_x)_2$ (x = 0, 0.2, 0.3, 0.5, 0.7, 0.8, 0.9 and 1.0) were described elsewhere [3]. Assuming that substitution of transition metal atoms in *M*-sublattice causes the distribution of iron and cobalt atoms in a random way, *M*-sublattice can be described by some probabilistic features. For instance, probability of occurring two iron atoms in nearest neighbourhood (and in result their magnetic connection) can be expressed as $p_{Fe\text{-}Fe} = (1-x)^2$. Analogously, for other nearest neighbour combinations of transition metal atoms, probabilities can be described by: $p_{Fe\text{-}Co} = p_{Co\text{-}Fe} = x(1-x)$ and $p_{Co\text{-}Co} = x^2$.

Method of electrical measurements was presented elsewhere [6]. The observed resistivity can be described by the Matthiessen formula [7-9], the phonon scattering resistivity is expressed by the Bloch-Grüneisen formula [10]. Basing on these formulae, the residual resitivities ρ_0, the phonon $\rho_f(T)$ and the magnetic $\rho_m(T)$ resistivity dependences were calculated (Fig. 1) [6,9]. The dependence $\rho_m(T)$ was used to determine the magnetic ordering temperatures: the ordering temperature T_C is situated in the temperature region with a maximal change of the numerically estimated parameter $\Delta\rho_m/\Delta T$. The intersection of the two fitted straight lines corresponds to the Curie temperature (Fig. 1) [6,9].
The Curie temperatures of miscellaneous RM_2-type compounds are described well by Taylor formula: $T_C = T_R + T_M$, where T_R is contribution coming from rare-earth sublattice and T_M is contribution coming from transition metal

sublattice [11]. The T_R contribution can be estimated as being close to the Curie temperature of compound with nonmagnetic *M*-sublattice, such as RAl_2. The Curie temperature of $HoAl_2$ is 27K [11], so T_M contributions for the $Ho(Fe_{1-x}Co_x)_2$ were calculated.
The experimental points for T_M are presented in Fig.3. The ordering temperature rises in the iron-rich region, reaches maximum at x = 0.3 and then rapidly drops in the cobalt-rich region. This dependence varies parabolically following the numerical formula $T_M(x) = (595 + 738x - 1241x^2)$ K.

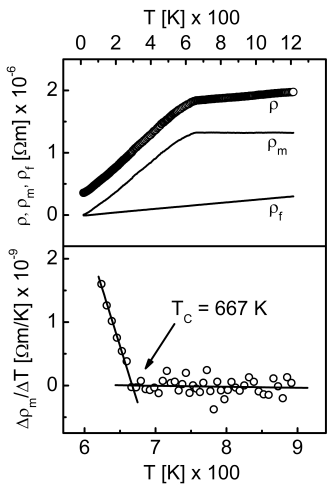

Fig.1 Upper case: the total electrical resistivity ρ, phonon contribution ρ_f and magnetic contribution ρ_m against temperature T of $Ho(Fe_{0.5}Co_{0.5})_2$ compound. Lower case: an example $\Delta\rho_m/\Delta T$ as a function of temperature T of the $Ho(Fe_{0.5}Co_{0.5})_2$ compound. Curie temperature T_C is designated by the intersection of lines [6].

Electronic band structure calculations for $Ho(Fe_{1-x}Co_x)_2$ series were made using Full-Potential Linearized Augmented Plane Wave (FLAPW) method and computing package WIEN2k [5,6,12]. Example results of FLAPW calculation were presented in Fig. 2. Specifically, the density of states (DOS) was calculated for Fe, Co and stoichiometrically weighted transition metal atom M (3d electrons) in majority (spin up) and minority (spin down) subbands, for $Ho(Fe_{0.5}Co_{0.5})_2$ compound. Fermi energy corresponds to zero value.

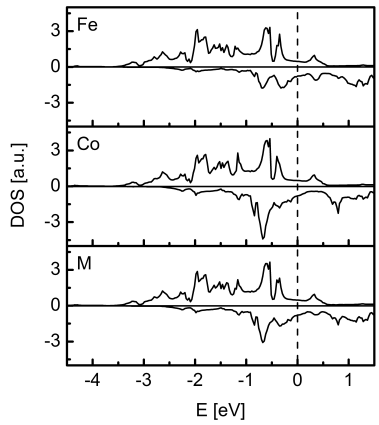

Fig.2 Example individual DOS for majority subbands (upper case) and minority subbands (lower case) of 3d electrons for Fe, Co and stoichiometrically weighted transition metal atom M as functions of energy E for the $Ho(Fe_{0.5}Co_{0.5})_2$ compound. Fermi energy corresponds to zero value [5].

A qualitative inspection of the filling process of both 3d subbands across the series confirmed that the population in the majority 3d subband increases up to x = 0.3 (a region of weak ferromagnetism) and above x = 0.3 is almost constant (the majority subband is fully occupied, this is region of strong ferromagnetism), while the minority 3d subband population increases across the whole series [5,6].

Magnetic moments m_{Fe}, m_{Co} and m_M of the 3d band were calculated for whole studied series. The m_M magnetic moment for stoichiometrically weighted transition metal atom M as a function of x resembles Slater-Pauling curve [5,6].

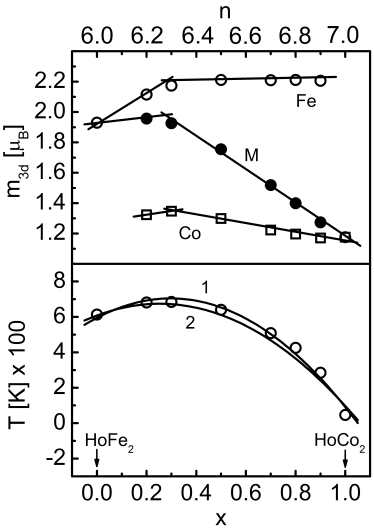

Fig. 3 Upper case: The calculated magnetic 3d moments per atom: m_{Fe}, m_{Co} and stoichiometrically weighted m_M versus composition parameter x (or average number n of 3d electrons) for the $Ho(Fe_{1-x}Co_x)_2$ intermetallics. Lower case: Experimentally obtained transition metal contribution T_M to the Curie temperature T_C (open circles and curve 1) and the calculated function T_M (curve 2) as a function of the composition parameter x or the average number n of 3d electrons, for $Ho(Fe_{1-x}Co_x)_2$ intermetallics [5,6].

Up to date there is no analytical formula to describe Curie temperature for metallic ferro- and ferrimagnetic compounds treated as electron band system, so following method to describe Curie temperature by some parameters obtained from FLAPW calculations was presented.

In this case a simplified approach i.e. a comparison between the exchange magnetic energy (magnetic ordering energy at 0K temperature) and the thermal agitation energy at the Curie temperature can be used. Magnetic order among the magnetic moment of atoms is caused by the exchange magnetic energy. In other hand, the thermal agitation energy causes among these magnetic moments magnetic disorder, so, the thermal agitation energy and the magnetic ordering energy act contrary each other. It can be assumed, that the Curie temperature is proportional to the average energy of exchange interactions between two neighbouring transition metal atoms.

The energy of the magnetic *M-M* exchange interaction between magnetic moments of two neighbouring M atoms, based on molecular field approach, can be introduced as [13]:

$$E_{i,j} = \left(2 g_i g_j \mu_B^2\right)^{-1} J_{i,j} m_i m_j = c_{i-j} m_i m_j$$

where g_i, g_j are Lande factors and $g_i = g_j$, μ_B is Bohr magneton, $J_{i,j}$ is the exchange integral between nearest neighbours and $J_{i,j} = J_{j,i}$, m_i, m_j are the magnetic moments of neighbouring atoms, subscripts i and j distinguish Fe and Co atoms. Considering, discussed above, the probabilistic features of the M-sublattice the averaged energy for the substituted $Ho(Fe_{1-x}Co_x)_2$ intermetallics can be expressed by following formula [6]:

$$E_{i,j} = (1-x)^2 c_{Fe-Fe} m_{Fe} m_{Fe} + x(1-x) c_{Fe-Co} m_{Fe} m_{Co} + x^2 c_{Co-Co} m_{Co} m_{Co}$$

Assuming that $k_B T_M$ is proportional to the average energy E of magnetic connection, an expression for T_M can be written in a form [6]:

$$T_M = (1-x)^2 K_{Fe-Fe} m_{Fe} m_{Fe} + x(1-x) K_{Fe-Co} m_{Fe} m_{Co} + x^2 K_{Co-Co} m_{Co} m_{Co} \quad (1)$$

where K_{i-j} are suitable parameters. A method to estimate K_{Fe-Fe} and K_{Co-Co} parameters is comparing experimental T_M values and calculated magnetic moments for border x parameters, and then calculate K_{Fe-Co} parameter basing on m_{Fe}, m_{Co} and T_M values for $x = 0.5$. Last step was to adjust K parameters to better fit the formula (1) to the experimental values of $T_M(x)$. Figure 3 presents experimental and calculated values of temperature $T_M(x)$. Open circles and curve 1 shows experimental points and fitted function of T_M, curve 2 shows semiempirical T_M dependence, based on formula (1). Despite the above-

mentioned simplfications the semiempirical formula follows well the experimental dependence of the T_M parameter [6].

Replacement of transition metal atom - iron to cobalt - changes average number n = 6 to n = 7 of 3d electrons and introduces an important changes of studied properties: additional 3d electron per transition metal atom reduces lattice parameter and in consequence unit cell volume [3], thus reducing the average distance between the neighbouring transition metal atoms. In consequence, the band structure (especially structure of 3d band) changes across the series, along with all tested properties of compounds.
Magnetic moment dependence on the composition parameter x or the average number n of 3d electrons resembles Slater-Pauling curve [5].
It was found that measured Curie temperature also depends on x or n parameters and, in consequence, measured contribution T_M, originated from transition metal sublattice, resembles to some extent Slater-Pauling dependence.
A description of T_M parameter considering FLAPW calculations and the statistical properties of the transition metal sublattice with Fe/Co substitution has been made. Despite the simplicity of the statistical approach used, the description of T_M parameter may be useful.
Presented measurements and calculations, especially changes of Curie temperature of presented series, may be helpful in potential applications of $Ho(Fe_{1-x}Co_x)_2$ intermetallic compounds, as for instance, constituents of novel magnetoelectric media, such as Terfenol-D and its derivatives.

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ZLECENIA Z FUNDACJI

Nr umowy	Kierownik	Temat	Czas trwania
2.2.220.720	Kazimierz Różański	Wykonanie ekstrakcji dwutlenku węgla z 23 próbek wody.	01.07.2011 20.07.2011

ZLECENIA DOTYCZĄCE
ZAGRANICZNYCH PROJEKTÓW BADAWCZYCH

Nr umowy	Kierownik	Temat	Czas trwania
4.4.220.7030	Tomasz Fiutowski	Optymalizacja diagnostyki obrazowej perfuzji mięśnia sercowego metodą SPECT.	15.01.2010 14.12.2011

ZLECENIA Z PRZEMYSŁU

Nr umowy	Kierownik	Temat	Czas trwania
5.5.220.724	Marek Duliński	Badanie składu izotopowego wodoru i tlenu oraz stężenia trytu w solankach z wycieków Kopalni Soli „Wieliczka" pobranych w 2011 roku.	10.10.2011 15.12.2011
5.5.220.721	Paweł Jodłowski	Badanie promieniotwórczości naturalnej próbek popiołów z Kotłowni ZE-7.	01.07.2011 30.12.2011
5.5.220.715	Paweł Jodłowski	Badanie promieniotwórczości naturalnej 2 próbek żużla.	15.03.2011 20.04.2011

ZLECENIA Z INNYCH UCZELNI

Nr umowy	Kierownik	Temat	Czas trwania
6.6.220.719	Marek Duliński	Wykonanie analizy zawartości 210Pb, Alfa, Beta-total, delta H-2, tryt w próbce wody.	15.06.2011 30.07.2011

6.18.220.713	Przemysław Wachniew	Wykonanie analiz aktywności ^{210}Pb oraz interpretacja tempa akumulacji aluwiów pozakorytowych w profilach ze Śladowa (SLA1)) i Ciszycy Przewozowej (CISA4).	02.01.2011 31.03.2011

BADANIA WŁASNE

Nr umowy	Kierownik	Temat	Czas trwania
10.10.220.475	Andrzej Kreft	Fizyka i technika jądrowa i ich zastosowania w fizyce cząstek elementarnych i fizyce medycznej	02.01.2004 31.12.2011
10.10.220.476	Krzysztof Wierzbanowski	Eksperymentalne badania struktury i właściwości fizy-cznych, krystalicznych i amorficznych ciał stałych.	02.01.2004 31.12.2011
10.10.220.675	Stanisław Bednarek	Zastosowanie zaawansowanych metod obliczeniowych i komputerowych w modelowaniu struktury i właściwości fizycznych materii skondensowanej.	02.01.2009 31.12.2011

ZLECENIA Z INSTYTUCJI ZAGRANICZNYCH (EKSPORT)

Nr umowy	Kierownik	Temat	Czas trwania
13.13.220.619	Jan Kulka	Odbiór techniczny oprzyrządowania i sterowania układu kriogenicznego w tunelu wielkie-go zderzacza cząstek LHC.	12.06.2007 30.06.2011
13.13.220.635	Władysław Dąbrowski	Opracowanie jednowymiarowego detektora do dyfrakcji promieni X z polepszoną rozdzielczością energetyczną w oparciu o tech-nologię krzemowych detektorów mikropaskowych.	15.01.2008 31.12.2011
13.13.220.678	Zdzisław Stęgowski	Przeprowadzenie szkolenia dla stypendysty Międzynarodowej Agencji Energii Atomowej w Wiedniu, Pana Chrystian Priesley Kofi DAGADU z Chany.	30.04.2009 30.09.2011

13.13.220.84320	Marek Lankosz	Ilościowe obrazowanie map pierwiastków metodą rentgenowskiej mikroskopii fluorescencyjnej.	19.04.2010 07.04.2012
13.13.220.84540 KE1780/TE/LHC	Jan Kulka	Uczestnictwo AGH w przeglądzie serwisowym osprzętu maszyny LHC w części związanej z Systemami Ochrony przed Przejściami Rezystywnymi oraz Ekstrakcji Energii.	05.11.2010 05.11.11
13.13.220.84580	Kazimierz Różański	Wykonanie i przetestowanie zestawu cel elektrolitycznych do wzbogacania próbek wody do pomiarów niskich stężeń trytu.	10.12.2010 30.06.2011
13.13.220.84590	Jarosław Nęcki	Ciągłe pomiary atmosferycznego stężenia dwutlenku węgla i metanu na stacji Kasprowy Wierch.	02.01.2011 30.06.2013
13.13.220.84690 KE1848/EN/LHC	Jan Kulka	Uczestnictwo AGH w obsłudze serwisowej Systemu Chłodzenia i Wentylacji akceleratora LHC.	05.04.2011 04.04.2012
13.13.220.84710	Kazimierz Różański	Wykonanie badań składu izotopowego próbek wód podziemnych.	23.05.2011 30.09.2011
13.13.220.84810	Jan Kulka	Uczestnictwo AGH w obsłudze serwisowej Systemu Chłodzenia i Wentylacji akceleratora LHC.	19.09.2011 06.09.2012
13.13.220.84840	Kazimierz Różański	Wykonanie i przetestowanie kompletnego systemu elektrolitycznego wzbogacania próbek wody do pomiarów niskich stężeń trytu.	10.10.2011 31.05.2012
13.13.220.84850	Jan Kulka	Udział AGH-UST w Przeglądzie i Modernizacji Sieci Zasilających Wysokiego i Niskiego Napięcia.	19.10.2011 18.10.2012

ZLECENIA Z INNYCH WYDZIAŁÓW

Nr umowy	**Kierownik**	**Temat**	**Czas trwania**
14.17.220.725	Andrzej Bolewski	Wykonanie oznaczeń promieniotwórczości 30 próbek popiołów.	18.10.2011 15.11.2011

DOFINANSOWANIE NAUKI Z INSTYTUCJI ZAGRANICZNYCH

Nr umowy	Kierownik	Temat	Czas trwania
15.13.220.567	Stefan Taczanowski	Obliczenia wzorcowe dla pomiarów aktywności tarczy ADS.	23.02.2006 04.02.2011
15.15.220.717 112/03/E-356/M/2011	Andrzej Kreft	Dofinansowanie prowadzenia badań naukowych służących rozwojowi uczestników studiów doktoranckich. (28 zadań)	02.01.2011 31.12.2011
15.15.220.718 112/03/E-356/M/2011	Stanisław Bednarek	Dofinansowanie prowadzenia badań naukowych służących rozwojowi młodych naukowców. (12 zadań)	02.01.2011 31.12.2011

GRANTY MNISW

Nr umowy	Kierownik	Temat	Czas trwania
18.18.220.657 1950/B/P01/2008/35	Kvetoslava Burda	Mechanizm wydzielania tlenu z wody w procesie fotosyntezy.	12.09.2008 11.09.2011
18.18.220.674 3357/B/T02/2009/36	Władysław Dąbrowski	Rozwój specjalizowanych układów scalonych o małym poborze mocy do wielokanałowej stymulacji elektry-cznej i rejestracji sygnałów z komórek nerwowych w ekspery-mentach in-vivo.	15.04.2009 14.04.2012
18.18.220.687 3626/B/T02/2009/37	Kazimierz Różański	Opracowanie metody datowania wód podziemnych z wykorzystaniem środowiskowych znaczników gazowych (SF5CF3, SF6, CFC-12, CFC-13).	09.10.2009 08.04.2012
18.18.220.688 2288/B/H03/2009/37	Jakub Cieślak	Badania struktury elektronowej i parametrów nadsubtelnych fazy sigma wybranych stopów żelaza.	12.10.2009 11.04.2012
18.18.220.689 2382/B/H03/2009/37	Krzysztof Kułakowski (promotorski A.Mańka-Krasoń)	Magnetyzm sieci nieuporządkowanych.	12.10.2009 30.01.2011

18.18.220.690 3775/B/T02/2009/37	Marek Lankosz	Badania wybranych pierwiastków śladowych i biomolekuł w gle-jowych nowotworach mózgu i ich otoczeniu w relacji do stopnia złośliwości guza.	09.10.2009 08.10.2012
18.18.220.691 1283/B/H03/2009/37	Stanisław Bednarek	Badania teoretyczne wykorzystania oddziaływania spin-orbita w półprzewodnikach do budowy kwantowych bramek logicznych.	12.10.2009 11.10.2012
18.18.220.697 1039/B/HO3/2010/38	Bartłomiej Szafran	Symulacje magnetotransportu w nanostrukrurach półprzewodnikowych.	17.03.2010 16.03.2013
18.18.220.703 1080/B/H03/2010/38	Łukasz Gondek	Właściwości fizyko-chemiczne i charakterystyka aplikacyjna wodorków związków międzymetalicznych ziem rzadkich.	08.04.2010 07.04.2013
18.18.220.706 0715/B/H03/2010/39	Marcin Sikora	Struktura elektronowa i cząstkowe momenty magnetyczne złożonych tlenków metali przejściowych badane techni-kami wysokorozdzielczej spektroskopii promieniowania X.	28.09.2010 27.09.2012
18.18.220.707 4009/B/PO1/2010/39	Jarosław Nęcki	Oszacowanie bilansu wodoru w atmosferze Polski Południowej na podstawie danych pochodzących z pomiarów stężenia i składu izotopowego wodoru Na Kasprowym Wierchu, Krakowie i wybranych punktach Podhala i Górnego Śląska.	30.09.2010 29.09.2013
18.18.220.716 3264/B/H03/2011/40	Janusz Wolny	Struktura i własności fizyczne kwazikryształów i układów międzymetalicznych o gigantycznej komórce elementarnej.	11.04.2011 10.04.2014
18.18.220.722	Joanna Chwiej	Biochemiczne podłoże zmian neurodegeneracyjnych w epileptycznym mózgu szczura.	01.09.2011 31.08.2014
18.18.220.726	Magdalena Kaczmarska	Badanie korelacji między strukturą szkieletu błonowego oraz przepuszczalności 0_2 i Na^+ /K^+ czerwonych ciałek krwi pacjentów z nadciśnieniem.	07.12.2011 06.12.2013

18.18.220.727	Katarzyna Senderowska	Badanie łamania symetrii CP w rozpadach mezonów B_S^o do stanów końcowych zawiera-jących cząstkę wektorową i pseudo-skalarną w eksperymencie LHCb.	13.12.2011 12.04.2013
18.18.220.728	Paweł Kuczera	Badania dyfrakcyjne i analiza strukturalna dekagonalnych kwazikryształów z rodziny Al.-Cu-Me (Me=Co, Rh, Ir).	12.12.2011 11.12.2013
18.18.220.729	Krzysztof Wierzbanowski	Badanie procesu walcowania asymetrycznego metali o sieci regularnej i heksagonalnej w aspekcie uzyskiwania struktury ultra-drobnoziarnistej.	15.12.2011 14.12.2014
18.18.220.730	Sebastian Wroński	Badanie mechanizmów deformacji i rekrystalizacji w materiałach o strukturze heksagonalnej.	14.12.2011 13.12.2015

SPUB - M.

Nr umowy	Kierownik	Temat	Czas trwania
22.22.220.7015 554/6.PRUE/2008/7	Mirosław Zimnoch	Infrastruktura dla pomiaru obiegu węgla w skali Europy.	12.02.2008 30.09.2011
22.22.220.7020 819/7.PRUE/2008/7	Władysław Dąbrowski	Faza przygotowawcza ulepszenia wielkiego zderzacza hadronowego.	01.04.2008 31.03.2011
22.22.220.7028 1262/7.PRUE/2009/7	Wiesława Sikora	Złożony system spcjotechniczny w inteligentnym środowisku.	01.02.2009 31.01.2013
22.22.220.7031 1246/7.PRUE/2010/7	Marek Idzik	MC-PAD sieć szkoleniowa "Marie Curie dla detektorów cząstek.	01.01.2010 31.10.2012
22.22.220.7039 2156/7.PR UE/2011/2	Marek Idzik	Zaawansowane europejskie infrastruktury dla detektorów przy akceleratorach.	28.12.2011 31.01.2015
22.22.220.7041 2216/7.PR EURATOM/2011/2	Stanisław Dubiel	Modelowanie i eksperymentalne badanie efektów radiacyjnych.	30.11.2011 31.12.2011

PROGRAMY EUROPEJSKIE

Nr umowy	Kierownik	Temat	Czas trwania
27.27.220.7007 IMECC	Mirosław Zimnoch	Infrastructure for Measurement of the European Carbon Cycle	1.04.2007 30.09.2011
27.27.220.7017 SLHC-PP	Władysław Dąbrowski	Preparatory Phase of the Large Hadron Collider Upgrade	1.04.2008 31.03.2011
27.27.220.7023 MC-PAD	Marek Idzik	Marie Curie Traiing Network on Particle Detectors	1.11.2008 31.10.2012
27.27.220.2024 SOCIONICAL	Wiesława Sikora	Complex Socio-Technical System in Ambient Intelligence	1.02.2009 31.01.2013
27.27.220.7038 EURATOM	Stanisław Dubiel	The European Atomic Energy Community	1.01.2010 31.12.2013
27.27.220.7035 AIDA	Marek Idzik	Advanced European Infrastructures for Detectors at Accelerators	1.02.2011 31.01.2015
502.220.2001 ISD	Janusz Adamowski	Interdyscyplinarne Studia Doktoranckie Zaawansowane materiały dla nowoczesnych technologii i energetyki przyszłości	01.01.2009 31.12.2015
502.220.2002 TERAZ FIZYKA	Andrzej Lenda	Teraz fizyka. Nowe formy kształcenia bliżej pracodawcy	01.06.2010 30.10.2015
502.220.2003 ESMO	Mariusz Przybycień	Contract Between Surrey Satellite Technology Limited And AGH University of Science and Technology	26.11.2010 25.04.2014

PROGRAMY SPECJALNE

Nr umowy	Kierownik	Temat	Czas trwania
28.28.220.7029 665/N-CERN-ATLAS/2010/0	Danuta Kisielewska	Eksperyment ATLAS: rejestracja i analiza danych oraz utrzymanie i rozwój detektorów.	17.02.2010 16.02.2013
28.28.220.7032 680/N-CERN/2010/0	Bogdan Muryn	Eksperyment LHCb w CERN – obsługa detektora I uczestnictwo w programie badawczym.	02.04.2010 01.04.2013
28.28.220.7033 712/N-POLONIUM/2010/0	Krzysztof Wierzbanowski	Badanie odkształcenia i rekrystalizacji materiałów metalicznych w aspekcie optymalizacji ich własności.	15.06.2010 14.03.2011

28.28.220.7037 817/N-COST/2010/0	Mirosław Zimnoch	Ocena wielkości wymiany dwutlenku węgla miedzy atmosferą, ekosystemami lądo-wymi i wodnymi na obszarze zurbanizowanym Krakowa.	21.12.2010 02.06.2013
28.28.220.7027 598/N-HERA/2009/0	Danuta Kisielewska	Badanie oddziaływań elektronów z protonami w eksperymencie ZEUS na akceleratorze HERA w ośrodku DESY w Hamburgu.	24.11.2009 14.12.2012

PRACE NAUKOWO BADAWCZE
OD INNYCH ZLECENIODAWCÓW

Nr umowy	Kierownik	Temat	Czas trwania
30.30.220.714	Andrzej Bolewski	Badanie makroskopowego przekroju czynnego absorpcji neutronów termicznych dla wyrobów grafitowych oraz równoważnika borowego BE.	15.03.2011 30.11.2011
30.30.220.723	Czesław Kapusta	Wstępne badania nad możliwością otrzymywania zaawansowanych kompozytów o kontrolowanej mikrostrukturze.	01.09.2011 30.09.2011

JUWENTUS PLUS MNISW

Nr umowy	Kierownik	Temat	Czas trwania
68.68.220.712 0053/TO2/2010/70	Joanna Chwiej	Zastosowanie mikrowiązki promieniowania synchrotronowego w badaniach dynamiki zmian biochemicznych hipokampa szczura w pilokarpinowym modelu epilepsji.	22.12.2010 31.12.2011

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Nr umowy	Kierownik	Temat	Czas trwania
72.72.220.8003	Bartłomiej Szafran	Cracow interdisciplinary PhD-project in nanosci-ence and advanced nanostructure	01.10.2008 10.09.2013
72.220.8009 TEAM/2008-2/3	Józef Korecki	Atomic and molecular recel devising of functional nanostructures for magnetic and catalytic applications-AMON	01.03.2009 28.02.2013

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   Radiological hazard of mine water from polymetallic and uraniom deposits In the Karkonosze Mountains, south-west Poland. In: B. Merkel, M. Schipek (eds.) The New Uranium Boom. Springer Verlag, (2011), 771-778.

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3. J. NECKI, Ł.CHMURA
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   Physica A, 390 (2011) 359-364
   IF: 1.522, MNiSW: 27

2. M.BEDNARSKI, P.STOCH, P.ZACHARIASZ, J.PSZCZOŁA, W.BODNAR, J.SUWALSKI
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   Physica Scripta, 83 (2011) 015703
   IF: 0.985, MNiSW: 27

3. P.GUZDEK, J.PSZCZOŁA, J.CHMIST, P.STOCH
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   Journal of Magnetism and Magnetic Materials, 323 (2011) 427–431
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4. G.AAD, [ET AL.], T.BOŁD, W.DĄBROWSKI, M.DWUŻNIK, I.GRABOWSKA-BOŁD, M.IDZIK, K.JELEŃ, D.KISIELEWSKA, T.Z.KOWALSKI, S.KOPERNY, B.MINDUR, E.RULIKOWSKA-ZARĘBSKA, B.TOCZEK, (ATLAS COLLABORATION)
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6. K.MALARZ, P.GRONEK, K.KUŁAKOWSKI
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Patents
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Conferences presentations and seminars

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4. J. WOLNY
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KEYNOTE

14. T. BOŁD (ON BEHALF OF THE ATLAS COLLABORATION)
ATLAS results from lead-lead collisions at 2.76 TeV center-of-mass energy at the LHC Physics at LHC (PLHC2011),
Perugia, Italy, June 5-10, 2011

15. I. GRABOWSKA-BOŁD (ON BEHALF OF THE ATLAS COLLABORATION)
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18. K. SENDEROWSKA (ON BEHALF OF THE LHCB COLLABORATION)
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20. M. IDZIK
Readout Electronics (part I and II)
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Moscow, October 10-14, 2011

21. A. KREFT
Energetyka kompleksowa
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22. K. ROZANSKI, M. DULINSKI, K. BUKOWSKI
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Deuterium influence on structural and magnetic properties of RTIn (R-rare earth, T = Ni, Pd, Pt)
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Boston, USA 16-17.06.2011
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2. M.SIKORA
Valence band of tungsten compounds probed using 2p5d RIXS
IX Krajowe Sympozjum Użytkowników Promieniowania Synchrotronowego,
Warszawa 26-27.09.2011
ORAL

3. M.SIKORA
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4. W. TOKARZ, M. KOWALIK, A. KOŁODZIEJCZYK
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5. T. ŚLĘZAK, M. ŚLĘZAK, A. KOZIOŁ, K. MATLAK, K. FREINDL, N. SPIRIDIS, E. PARTYKA-JANKOWSKA, D. WILGOCKA-ŚLĘZAK, M. ZAJĄC, R. RÜFFER, J. KORECKI
Non-collinear magnetization structure at the thickness and temperature driven spin reorientation transition in ultrathin epitaxial Fe films on W(110)
TEAM-AMON "Atomic and molecular level devising of functional nanostructures for magnetic and catalytic applications" i spotkanie wykonawców projektów współpracy polsko-austriackiej i polsko-francuskiej (POLONIUM),
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6. E. MŁYŃCZAK, J. GURGUL, K. FREINDL, A. KOZIOŁ-RACHWAŁ, K. MATLAK, J. PRZEWOŹNIK, N. SPIRIDIS, T. ŚLĘZAK, D. WILGOCKA-ŚLĘZAK AND J. KORECKI
Structure and magnetic properties of Fe-CoO bilayers
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IEC in epitaxial Fe/MgO/Fe multilayers
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TEAM-AMON "Atomic and molecular level devising of functional nanostructures for magnetic and catalytic applications" i spotkanie wykonawców projektów współpracy polsko-austriackiej i polsko-francuskiej (POLONIUM),
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Bimetallic Au-Fe clusters on TiO_2(110)
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Electronic state of Au adsorbed on defected MgO(100) surfaces
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14. J. KORECKI
Are simple oxides useful for spintronics?
Joint Polish-Japanese Workshop: Spintronics - from new materials to applications,
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15. N. SPIRIDIS, D. WILGOCKA-ŚLĘZAK, K. FREINDL, B. FIGARSKA, J. KORECKI
STM studies of Gold Nanostructures on Vicinal FeO/Pt(997) Surface
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17. T. GIELA, K. FREINDL, N. SPIRIDIS, J. KORECKI
Au films on W(110): reconstruction and dislocations
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15-18.11.2011, Warszawa
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18. J. GURGUL, K. FREINDL, A. KOZIOŁ-RACHWAŁ, K. MATLAK, J. PRZEWOŹNIK, N. SPIRIDIS, T. ŚLĘZAK, D. WILGOCKA-ŚLĘZAK, J. KORECKI
Exchange-bias in epitaxial CoO/Fe bilayer grown on MgO(001)
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19. J. GURGUL, E. MŁYŃCZAK, N. SPIRIDIS, J. KORECKI
Layer- by- layer epitaxial growth of polar FeO(111) thin film on MgO(111)
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20. N. SPIRIDIS, K. FREINDL, W. KARAŚ, K. MATLAK, M. ŚLĘZAK, T. ŚLĘZAK, D. WILGOCKA-ŚLĘZAK, M. ZAJĄC, AND J. KORECKI
Surface electronic properties of Fe(001) probed via hyperfine interactions"
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Room temperature perpendicular magnetic anisotropy in epitaxial $[Fe/MgO]_N$ multilayers.
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Magneotoptic Kerr Effect Imaging of the Magnetization Reversal in Fe/MgO/Fe trilayers
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POSTER

23. R. P. SOCHA, M. SZCZEPANIK, E. MADEJ, B. FIGARSKA, N. SPIRIDIS, J. KORECKI
Synthesis of epitaxial layers of mixed Fe_xMn_yO oxides on MgO(001)
Joint Polish-Japanese Workshop: Spintronics - from new materials to applications,
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The Magnetic Anisotropy of Fe/Au(001) Ultrathin Films in a Function of Fe Thickness and Thickness Driven Polar Spin Reorientation Transition
Joint Polish-Japanese Workshop: Spintronics - from new materials to applications,
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25. D. WILGOCKA-ŚLĘZAK, N. SPIRIDIS, K. FREINDL, T. ŚLĘZAK, K. MATLAK, B. STRZELCZYK, B. FIGARSKA, J. KORECKI
Ultrathin FeO and Fe_3O_4 oxides on Pt(111)
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26. M. ŚLĘZAK, A. KOZIOŁ-RACHWAŁ, K. MATLAK, T. ŚLĘZAK, M. ZAJĄC, R. RÜFFER, J, KORECKI
Growth and Spin Structure of Ultrathin Fe Films on W(110)
Joint Polish-Japanese Workshop: Spintronics - from new materials to applications,
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27. D. WILGOCKA-ŚLĘZAK, M. ŚLĘZAK, N. SPIRIDIS AND J. KORECKI
Nanoscale Spectro-Microscopy For Krakow Synchrotron
Joint Polish-Japanese Workshop: Spintronics - from new materials to applications,
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SPINLAB LEEM / PEEM in Kraków
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Synthesis of epitaxial layers of mixed $Fe_xMn_{1-x}O$ on MgO(001)
14th European Conference on Applications of Surface and Interface Analysis ECASIA'11
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35. E. MŁYŃCZAK, P. LUCHES, A. ROTA, S. VALERI, AND J. KORECKI
Magnetic properties of Fe-NiO bilayers grown on MgO(100)
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Joint Polish-Japanese Workshop: Spintronics - from new materials to applications
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58. M. WYTRWAL, M. SARNA, J. BEDNAR, B. KOZIK, M. KEPCZYNSKI, M. NOWAKOW-SKA
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Austria/Wieden 2011-09-12 2011-09-16
POSTER

148. K. MALARZ, K. KUŁAKOWSKI, R. KORFF
Athermal phase transition in the Ising model 10th International Conference on Unconventional Computation (workshop Summer Solstice 2011)
Finlandia/Turku 2011-06-6 2011-06-10
ORAL

149. A. JARYNOWSKI, P. GAWROŃSKI, K. KUŁAKOWSKI
How the competitive altruism leads to bistable homogeneous states of cooperation or defection
International Conference on Parallel Processing and Applied Mathematics, (workshop on Complex Collective Systems)
Polska/Toruń, 2011-09-10 2011-09-14
POSTER

150. K. KUŁAKOWSKI
Od fizyki do socjologii i z powrotem
Między Ideą a Praktyką. Interdyscyplinarnie o Interdyscyplinarności,
Polska/Wrocław, 2011-09-26 2011-09-28
ORAL

151. Ł. KURZAWSKI, K. MALARZ
Simple cubic lattice random-site percolation thresholds for complex neighborhoods
International Conference on Statistical Physics,
Cypr/Larnaca, 2011-07-11 2011-07-15
POSTER

152. K. MALARZ, K. KUŁAKOWSKI
The Ising phase transition without temperature
47th Winter Schools of Theoretical Physics,
Polska/Lądek Zdrój, 2011-02-7 2011-02-12
POSTER

153. J. TOMKOWICZ, K. KUŁAKOWSKI
Gardens of Eden in systems of bistable nanoscopic wires
NanoSMat 2011 - 6th International Conference on Surfaces, Coatings & Nanostructured Materials ,
Polska/Kraków, 2011-10-17 2011-10-20
ORAL

154. M. RYBAK, K. KUŁAKOWSKI
Competing contact processes on the Erdos-Renyi Network with tunable clusterization
24 Marian Smoluchowski Symposium on Statistical Physics,
Polska/Zakopane, 2011-09-17 2011-09-22
POSTER

155. W. SIKORA, J. MALINOWSKI, A. KUPCZAK
Model of skyscraper evacuation with the use of space symmetry and fluid dynamic approximation.
Parallel Processing and Applied Mathematics,
Polska/Toruń 2011-09-11 2011-09-14
ORAL

156. K. SURMACZ, K. SAEED
Robust Algorithm for Fingerprint Identification with a Simple Image Descriptor.
International Conference on Computer Information Systems and Industrial Management Applications
India/Kolkata 2011-12-14 2011-12-16
ORAL

157. J. KARWAN, K. SAEED
A New Algorithm for Speech and Gender Recognition on the Basis of Voiced Parts of Speech.
International Conference on Computer Information Systems and Industrial Management Applications
India/Kolkata 2011-12-14 2011-12-16
ORAL

158. A.SZCZEPAŃSKI, K. SAEED, A. RIENER, A. FERSCHA
Wearable Computers:A Study on ECG Signal Changes During Everyday Activities.
Takamatsu, Japan, 2011-09-19 2011-09-21
ORAL

159. K. SAEED
Töeplitz Minimal Eigenvalues in Signal and Image Processing
10th IMACS Conference,
Morocco 2011-05-18 2011-05-21
ORAL

160. I. GRABOWSKA-BOLD
Heavy ion triggers
ATLAS Meeting, CERN, Geneva, Switzerland, November 2011

161. A. ZIELIŃSKA, W. DĄBROWSKI, T. FIUTOWSKI, B. MINDUR, P. WIĄCEK
Development of an ASIC for 2-D readout of Gas Electron Multiplier detectors.
18th International Conference Mixed Design of Integrated Circuits and Systems (MIXDES),
Gliwice, 16-18 June
2011.
ORAL

162. P. WIĄCEK, W. DĄBROWSKI, T. FIUTOWSKI, B. MINDUR, A. ZIELIŃSKA
Design and performance of a system for two-dimensional readout of gas electron multiplier detectors for proton range
radiography.
NUTECH 2011 International Conference on Development and Applications of Nuclear Technologies
Kraków, 11–14 September 2011.
ORAL

163. T. FIUTOWSKI, W. DĄBROWSKI, B. MINDUR, P. WIĄCEK, A. ZIELIŃSKA
Design and Performance of the GEMROC ASIC for 2-D Readout of Gas Electron Multiplier Detectors.
2011 IEEE Nuclear Science Symposium and Medical Imaging Conference, Valencia, 23-29 October 2011.
ORAL

164. B. MINDUR, Ł. JACHYMCZYK
A General Purpose Ethernet Based Readout Data Acquisition System.
2011 IEEE Nuclear Science Symposium and Medical Imaging Conference,
Valencia, 23-29 October 2011.
Poster

165. W. DĄBROWSKI, J. FINK, T. FIUTOWSKI, H.-G. KRANE, P. WIĄCEK
One dimensional detector for X-ray diffraction with superior energy resolution based on silicon strip detector
technology.
9th International Conference on Position Sensitive Detectors (PSD9),
Aberystwyth, 12-16 September 2011.
ORAL

166. D. PRZYBOROWSKI, M. IDZIK
Development of Low-Power Small-Area L-2L CMOS DACs for Multichannel Readout Systems.
Topical Workshop on Electronics for Particle Physics TWEPP 2011,
Vienna, 26-30 September 2011.
Poster

167. J. MOROŃ, M. IDZIK, M. FIRLEJ
Development of low power Phase-Locked Loop (PLL) and PLL-based serial transceiver.
Topical Workshop on Electronics for Particle Physics TWEPP 2011,
Vienna, 26-30 September 2011.
ORAL

168. S. KULIS
Development of readout electronic and test-beam results of FCAL detector prototype.
International Workshop on Future Linear Colliders (LCWS11),
Granada, 26-30 September 2011.
ORAL

169. S. KULIS
ILD Forward Region
International Workshop on Future Linear Colliders (LCWS11),
Granada, 26-30 September 2011.
ORAL

170. S. KULIS
Report on FCAL test-beam.
Workshop on Forward Calorimetry at Future Linear Collider,
Belgrad, 13-15 September 2011.
ORAL

171. S. KULIS
Progress on signal deconvolution with continuously sampling ADC.
FCAL Collaboration Workshop,
Predeal, 30 May – 1 June 2011.
ORAL

172. M. IDZIK
Development of ASICs for LumiCal readout within FCAL and Power pulsing issues
Linear Collider Power Distribution and Pulsing Workshop, LAL,
Paris, 9-10 May 2011
ORAL

173. M. IDZIK
Development of front-end electronics for STT readout
PANDA XXXIX Collaboration meeting , GSI,
Darmstadt, 12-16 December 2011
ORAL

174. M. IDZIK
Status of LumiCal Readout Electronics
Workshop on Forward Calorimetry at Future Linear Collider,
Belgrad 13-15 September 2011
ORAL

175. J. AGUILAR
Luminometer for the future International Collider simulation and beam test
Technology and Instrumentation in Particle Physics TIPP 2011,
Chicago, 9-14 June 2011
ORAL

176. T. SZUMLAK
Selected results from the LHCb experiment
LHC Krakow-Warsaw Workshop,
Kraków, 1 December 2011
ORAL

177. T. SZUMLAK
Full participation and plans of the AGH - Krakow group in VELO project,
VELO Project Steering Board Meeting - LHCb Week, CERN
Geneva, 28 November, 2011
ORAL

178. T. SZUMLAK
Front-end R/O chip - the silicon strip option for the LHCb upgrade
LHCb Upgrade Workshop on VELO, CERN
Geneva, 9.November, 2011
ORAL

179. T. SZUMLAK
Preliminary plans and schedule for the front-end R/O strip chip design
LHCb Upgrade Worshop on VELO, CERN
Geneva, 9 November..2011
ORAL

180. T. SZUMLAK
Design of a new R/O chip for the silicon strip option (VELO + ST).
LHCb Upgrade Workshop on Tracker, CERN
Geneva, 16 November,.2011
ORAL

181. T. SZUMLAK
VELO resolution tuning for the 2012 collision data taking.
VELO Project Meeting, CERN
Geneva, 18 November, 2011
ORAL

182. T. SZUMLAK
Error parametrisation for the VELO pattern recognition algorithms.
VELO Project Meeting, CERN
Geneva, 12 August, 2011
ORAL

183. T. SZUMLAK
VELO Performance Paper: calibration, simulation and monitoring.
VELO Project Steering Board Meeting, CERN
Geneva, 15 June, 2011
ORAL

184. T. SZUMLAK
Single hit resolution dependence on the error parametrisation.
VELO Project Meeting, CERN
Geneva, 20 May, 2011

185. J. NĘCKI, Ł.CHMURA, A. KORUS, M. ZIMNOCH, J. ROSIEK, M. GALKOWSKI, K. ROZANSKI
Impact of coal mining on elevated CH_4 levels in near-ground regional atmosphere over Southern Poland.
European Geophysical Union, General Assembly, Vienna, April 4-8, 2011
ORAL

186. M. ZIMNOCH, P. WACH, K. ROZANSKI, J. GODKOWSKA, J. MAZUR, K. KOZAK
Determination of 222-Rn exhalation rates in an urban area – comparison of top-down and bottom-up approach.
European Geophysical Union, General Assembly, Vienna, April 4-8, 2011
POSTER

187. A. JASEK, M. ZIMNOCH, Z. GORCZYCA, K. ROZANSKI
Seasonal variability of CO_2 flux and its stable isotope composition in an urban area
European Geophysical Union, General Assembly, Vienna, April 4-8, 2011
POSTER

188. P. WACHNIEW, E. ŁOKAS, P. WACH, M. BONCZYK, E. JENCH, M. GASIOREK, J. SZMANDA
Vertical Distribution of ^{210}Pb in soils.
ICRER-2011 International Conference on Radioecology & Environmental Radioactivity, Hamilton, Canada, June 19-24, 2011.
POSTER

189. E. ŁOKAS, P. WACHNIEW, J. W. MIETELSKI, M. GASIOREK, P. BARTMIŃSKI, Z. ZWOLIŃSKI, I. SOBOTA
Distribution of ^{137}Cs, $^{238,\ 239+240}Pu$ and ^{241}Am in soil profiles from the western and central Spitsbergen.
ICRER-2011 International Conference on Radioecology & Environmental Radioactivity, Hamilton, Canada, June 19-24, 2011.
POSTER

190. J. BARTYZEL, J. ROSIEK, K. ROZANSKI
Kriogeniczne wzbogacanie próbek w pomiarach stężenia SF_5CF_3 i SF_6 w atmosferze.
IX Konferencja Chromatograficzna, Poznań, 26-29 czerwca 2011
ORAL

191. J. NECKI, Ł. CHMURA
Określenie zmienności atmosferycznego stężenia wodoru na terenie Europy Środkowej – pierwsze wyniki ciągłych pomiarów chromatograficznych prowadzonych na Kasprowym Wierchu.
IX Konferencja Chromatograficzna, Poznań, 26-29 czerwca 2011
POSTER

192. M. DULIŃSKI, L. RAJCHEL, J. RAJCHEL
Stable isotope composition of karbon dioxide and TDIC reservoir associated with mineral waters of the Polish Flysch Carpathians.
Isotope Workshop XI, Budapest, July 4-8, 2011
ORAL

193. M. GALKOWSKI, D. JELEŃ, M. ZIMNOCH, T. KUC, J. NECKI, Ł. CHMURA, Z. GORCZYCA, A. JASEK, K. ROZANSKI
Apportionment of carbon dioxide over central Europe: insights from combined measurements of atmospheric CO_2 mixing ratios and carbon isotope composition.
Isotope Workshop XI, Budapest, July 4-8, 2011
ORAL

194. N.D. CHAU, J. NOWAK, P. JODLOWSKI
Uranium, radium and ^{222}Rn isotopes in thermal waters from Podhale Trough (Polish Inner Carpathians).
Isotope Workshop XI, Budapest, July 4-8, 2011
POSTER

195. M. DULINSKI, N.D. CHAU, P. JODLOWSKI, J. NOWAK, K. ROZANSKI, M. SLEZIAK, P. WACHNIEW
Natural radioactivity in groundwater.
International Conference on Development and Applications of Nuclear Technologies,
NUTECH-2011, Kraków, September 11-14, 2011
ORAL

196. N.D. CHAU, J. NOWAK
Uranium and radium isotopes in geothermal systems.
International Conference on Development and Applications of Nuclear Technologies,
NUTECH-2011, Kraków, September 11-14, 2011
POSTER

197. A. BOLEWSKI, M. CIECHANOWSKI, A. KREFT
Determining the content of ^{10}B in boric acid by means of the thermal neutron absorption technique.
International Conference on Development and Applications of Nuclear Technologies,
NUTECH-2011, Kraków, September 11-14, 2011
ORAL

198. N. D. CHAU, J. NOWAK, M. BIALIC, L. RAJCHEL, M. CZOP, J. WRÓBLEWSKI
Nowe wyniki badań zawartości naturalnych pierwiastków promieniotwórczych w środowisku wodnym w rejonie Kowar.
XV Sympozjum Współczesne Problemy Hydrogeologii,
Poznań, wrzesień 14-16, 2011
ORAL

199. N. D. CHAU, J. NOWAK, M. BIALIC, L. RAJCHEL, M. CZOP, J. WRÓBLEWSKI
Radiological hazard of mine water from polymetallic and uranium deposits in the Karkonosze Mountains south-west Poland.
International Conference 2011: Uranium Mining and Hydrogeology VI,
Freiberg, Germany, September11-18,.2011.
ORAL

200. M. SZKLARSKA-ŁUKASIK, J. AUGUISTYN-PIENIAŻEK, J. CHMIST, W. BODNAR, J. PSZCZOŁA
Właściwości elektryczne i magnetyczne związku międzymetalicznego $Tb_{0.27}Dy_{0.73}(Fe_{0.7}Co_{0.3})_2$. XXXIX Szkoła Inżynierii Materiałowej,
Kraków-Krynica, wrzesień 27-30, 2011
ORAL

201. M. SZKLARSKA-ŁUKASIK, A. PAWLACZYK, M. DUDEK, J. CHMIST, M. BEDNARSKI, A. ZWOŹNIAK, A. KRAWCZYK, J. PSZCZOŁA
Badania strukturalne i efekt magnetoelektryczny związków międzymetalicznych.
VI Krakowska Konferencja Młodych Uczonych,
Kraków, wrzesień 29 – październik 1, 2011
ORAL

202. Ł. CHMURA, J. NECKI, M. ZIMNOCH, K. ROZANSKI, A. KORUS
16 lat monitoringu stężenia dwutlenku węgla i metanu w atmosferze Kasprowego Wierchu.
VI Krakowska Konferencja Młodych Uczonych,
Kraków, wrzesień 29 – październik 1, 2011
ORAL

203. J. BARTYZEL, J. ROSIEK, I. ŚLIWKA, K. ROZANSKI
Use of selected non-CO_2 greenhouse gases (SF_6, SF_5CF_3) as a dating tool for groundwater.
Sixth International Symposium on Non-CO2 Greenhouse gases (NCGG-6),
Amsterdam, November 2-4, 2011.
POSTER

204. J. NECKI, M. ZIMNOCH L. CHMURA, A. KORUS, J. ROSIEK, M. GALKOWSKI, K. ROZANSKI
Elevated CH_4 levels in regional atmosphere over Silesia, southern Poland.
Sixth International Symposium on Non-CO2 Greenhouse gases (NCGG-6),
Amsterdam, November 2-4, 2011.
ORAL

205. J. NECKI, J. BIELECKI, J. BARTYZEL, M. PYCIA, P. RUMIAN, I. ŚLIWKA, K. ROZANSKI
Loads of hydrogen in urban atmosphere: case study from Krakow, southern Poland.
Sixth International Symposium on Non-CO2 Greenhouse gases (NCGG-6),
Amsterdam, November 2-4, 2011.
POSTER

Scientific events

Titles, positions, etc.

FULL PROFESSOR POSITION

Wiesława Sikora
1.05.2011

FULL PROFESSOR

Janusz Toboła
12.05.2011

ASSOCIATE PROFESSOR POSITION

Marek Idzik
1.2.2011

Ryszard Radwański
7.10.2010 (Uniwersytet Pedagogiczny w Krakowie)

Habilitations and PhD Defenses

HABILITATIONS

Janusz Przewoźnik
21.3.2011r

Wiesław marek Woch
9.5.2011r

Łukasz Gondek
6.6.2011r

Zdzisław Stęgowski
17.10.2011r

Marek Duliński
18.4.2011

Nguyen Dinh Chau
21.11.2011

PHD DEFENSES

Grzegorz Król
Wpływ pola magnetycznego na strukturę magnetyczną i krystaliczną magnetytu
- dr hab. Andrzej Kozłowski
– obrona – 24.01.2011r

Dominik Kawalec
Fizyczne i numeryczne modelowanie procesów wymiany ciepła i masy w układzie upust ciepła _otoczenie
- promotor – dr hab. inż. Witold Krajewski WO AGH
- obrona – 24.01.2011r

Michał Duda
Struktura układów o gigantycznej komórce elementarnej na przykładzie stopu Mg-Al.
- promotor – prof. dr hab. Janusz Wolny
- obrona – 24.01.2011r

Wiktor Bodnar
Właściwości elektryczne i magnetyczne materiałów funkcjonalnych typu ziemia rzadka – metal przejściowy
- promotor prof. dr hab. Jarosław Pszczoła
– obrona – 24.01.2011r

Stefan Koperny
Gazowe detektory w eksperymentach wysokich energii na przykładzie kalorymetru uzupełniającego eksperymentu ZEUS
- promotor prof. dr hab. Kazimierz Jeleń
– obrona – 24.01.2011r

Łukasz Lasyk
Interferometria plamkowa i inne metody optyczne w analizie uszkodzeń obiektów zabytkowych
- promotor – doc.dr hab. Roman Kozłowski IKkiFP PAN
- obrona – 28.02.2011r

Beata Ostachowicz
Zastosowanie zjawiska całkowitego odbicia promieniowania X w rentgenowskiej analizie fluoroscencyjnej
- promotor – prof. dr hab. inż. Marek Lankosz
- obrona – 28.02.2011r

Anna Mańka-Krasoń
Wpływ frustracji na własności sieci Erdosa-Renyi z oddziaływaniem antyferromagnetycznym w modelu Isinga
- promotor – prof. dr hab. Krzysztof Kułskowski
- obrona – 28.03.2011r

Kamil Kisielewicz
Optymalizacja ochrony radiologicznej w adiologii zabiegowej
- promotor – dr hab. Marta Wasilewska-Radwańska
- obrona – 26.09.2011r

Maurycy Ornat
Stabilny kwantowy model [rzewodnictwa elektrycznego dwu i wieloskładnikowych układów nieuporządkowanych
- promotor – dr hab. Antoni Paja
- obrona – 26.09.2011r

Nivas babu Selvaraj
Thermal analysis and neutron imaging studies fo the metal hydride storage tank
- promotor – prof dr hab. Henryk Figiel
- obrona – 24.10.2011r

Bartłomiej Łabno
Symulacje komputerowe stabilności atomowych klastrów metalicznych
- promotor – prof. dr hab. Janusz Adamowski
- obrona – 26.09.2011r

Antoni Żywczak
Wlasności fizyczne stopów $Ti_{45}Zu_{38}Ni_{17-x}$ M_x (M=Co,Fe,Nu) i Ti_{48} Zr_7 Fe_{18} oraz ich wodorków
- promotor – prof. dr hab. Henryk Figiel
- obrona – 21.11.2011r

Organized Conferences

NUTECH-2011 INTERNATIONAL CONFERENCE ON DEVELOPMENT AND APPLICATIONS OF NUCLEAR TECHNOLOGIES
Cracow, September 11 - 14, 2011

Faculty Seminars

2011/06/17
First results from LHCb, dr Chris Parkes (CERN)

2011/05/27
Emergentny charakter praw fizycznych i hierarchiczna struktura nauki, prof. dr hab. Józef Spałek (IF UJ i WFiIS AGH)

2011/05/20
Zachowanie krytyczne oraz efekt magnetokaloryczny w wybranych układach związków miedzymetalicznych, dr hab. Ryszard Zach, prof. PK (Instytut Fizyki, WFMiI, Politechnika Krakowska)

2011/05/13
Plazma - czwarty stan materii, dr Dariusz Twaróg (ZFTP IFJ PAN)

2011/05/06
Frustracja i współzawodnictwo oddziaływań magnetycznych w związkach międzymetalicznych ziem rzadkich, dr Łukasz Gondek (KFCS WFiIS AGH)

2011/04/15

Spektrometria mas jonów wtórnych (SIMS): nowe możliwości badawcze, dr hab. inż. Andrzej Bernasik (KFMS WFiIS AGH)

2011/04/08

100-lecie nadprzewodnictwa, prof. dr hab. Andrzej Kołodziejczyk (Katedra Fizyki Ciała Stałego WFiIS AGH)

2011/04/01

Spintronika - co nowego? prof. dr hab. Tomasz Stobiecki (Katedra Elektroniki WEAIiE AGH)

2011/03/25

Efekt magnetoelektryczny, prof. dr hab. Jarosław Pszczoła (KZFJ WFiIS AGH)

2011/03/18

Modelowanie kompartmentowe w pozaustrojowej terapii wątroby, dr inż. Aleksandra Jung (KFMiB WFiIS AGH)

2011/03/11

Dyskretna struktura elektronowa i orbitalny magnetyzm w związkach d-elektronowych (NiO, LaCoO3, FeO, CoO), prof. dr hab. Ryszard J. Radwański (Centrum Fizyki Ciała Stałego, Kraków i Instytut Fizyki, Uniwersytet Pedagogiczny, Kraków)

2011/03/04

The LHCb - Flavour Physics Experiment, dr Eduardo Rodrigues (CERN EP group/University of Glasgow)

2011/01/28

Modelowanie układów przepływowych z zastosowaniem numerycznej mechaniki płynów, dr inż. Zdzisław Stęgowski (Katedry Fizyki Medycznej i Biofizyki WFiIS AGH)

2010/01/21

Pluton w środowisku - badania prowadzone w IFJ PAN, dr hab. Jerzy Mietelski (Zakład Fizykochemii Jądrowej IFJ PAN)

2011/01/14

100 rocznica Nagrody Nobla z Chemii dla Marii Skłodowskiej-Curie, dr hab. Dariusz Węgrzynek (Katedra Fizyki Medycznej i Biofizyki WFiIS AGH)