Instytut Fizyki Molekularnej
Polskiej Akademii Nauk
Mariana Smoluchowskiego 17, 60-179 Poznań
tel. 61 8695 100, 234, faks 61 8684 524
www.ifmpan.poznan.pl

Recruitment for the Poznan Doctoral School of the Institutes of the Polish Academy of Sciences at the Institute of Molecular Physics, PAS in Poznan
Procedure No. 1/2019/IFM PAN/PSD

Institution:	Institute of Molecular Physics Polish Academy of Sciences
City:	Poznan
Position:	PhD student
Positions available:	1
Scientific discipline:	physical sciences
Publication date:	06.11.2019 r.
Application deadline:	06.12.2019 r.
IMP PAS website:	https://www.ifmpan.poznan.pl/pl/
PDS IPAS website:	https://www.ifmpan.poznan.pl/BIP/index.php/edukacja/psd-ipan

RESEARCH PROJECT OFFER:

I. COMPUTER SIMULATIONS OF SELECTED NANOCOMPOSITE MODELS

Keywords: nanocomposite models, physical properties computer simulations

Research group: Department of Computational Physics of Complex Systems, Division of Soft Matter Physics and Functional Materials

Principal Investigator: dr hab. inż. Konstantin V. Tretiakov *prof. IMP PAS*

Project description:

Materials consisting of periodically repeating sequences of two or more layers of different substances often have physical properties that differ significantly from the same properties of their components and are called composite materials. The recent development of nanotechnology has intensified research on various physical and chemical phenomena at the nanoscale in many fields of science and technology. An interesting issue is the attempt to consider composites at the nanoscale. The proposed topic of the doctoral dissertation concerns the construction of nanocomposite models and the study of their basic physical properties (e.g., transport coefficients or elastic properties).

Aim of the project:

The aim of the study is to investigate the basic physical properties of selected nanocomposite models using computer simulation methods.

II. QUANTUM COMMUNICATION BY ELECTRON SPINS IN QUANTUM DOT – SUPERCONDUCTOR SYSTEM

Keywords: quantum computers; quantum communication; superconductors; quantum dots

Research group: Department of Superconductivity and Phase Transitions, Division of Physics of Dielectrics and Molecular Spectroscopy

Principal Investigator: prof. Dr hab. Jan Martinek

Project description:

In quantum computers, one can use of quantum-mechanical phenomena such as superposition and entanglement to perform computation. In the nineties, there were published first algorithms that are able to efficiently solve some important problems that are considered hard for classical computers. Since that for last three decades there are steady studies on theoretical background (quantum information theory) as well as on experimental realization of quantum computers. Academic and industrial research is concentrated on near-term intermediate-scale device and the demonstration of "quantum supremacy", while large-scale universal quantum computers are likely decades away. The main applications are expected to be: quantum communication, quantum machine learning, and quantum chemistry simulation.

Aim of the project: The important step required for the construction of a solid-state quantum computer is to get an entangled state of electrons. One of the proposals to obtain entangled pair of electrons is use of superconductors, which is a natural source of such pairs, so-called Cooper pairs, and separating them in a double quantum dot system. This type of system can be used in the manufacture of logic gates and spin quantum electronics.

III. MODIFICATION OF MAGNETIC PROPERTIES OF FERRIMAGNETIC THIN FILMS FOR SPINTRONIC APPLICATIONS

Keywords: spintronic, ferrimagnets, magnetic anisotropy, thin films

Research group: Department of Thin Films, Division of Physics of Magnetics and Cooperative Phenomena

Principal Investigator: dr hab. inż. Piotr Kuświk

Project description:

The possibility of wide-range modifications of magnetic properties of ferrimagnetic systems generate great interest Properties that can be tuned by controlled changes of composition include magnetic anisotropy, saturation magnetization, type of interlayer interaction, and compensation point. Thanks to that, ferrimagnetic layers strongly compete with ferromagnetic layers in spintronics, the field in which the electron transport is controlled by their charge and spin. In recent years, it has been shown that it is possible to switch the magnetization direction of ferrimagnetic layers using light pulses or spin-polarized currents. Moreover, in such layers, skyrmions (chiral magnetic texture) have also been observed. This magnetic structure can be created, and its motion controlled using currents only, this important property opens the possibility to develop a new generation of magnetic memories.

Aim of the project:

Our goal is to develop a method to control the magnetic properties of ferrimagnetic layers that are critical for applications in spintronic devices. These studies will focus on experimental work supported by micromagnetic simulations.

IV. INVESTIGATIONS OF MAGNETIC EFFECTS SUPPORTING THE SEPARATION OF HELIUM ISOTOPES

Keywords: ^{3}He isotope, quantum separation of isotopes, superconductivity, magnetism

Research group: Department of Low temperature, Division of Physics of Dielectrics and Molecular Spectroscopy

Principal Investigator: dr hab. Wojciech Kempiński *prof. IMP PAS*

Project description:

The world market is experiencing severe shortages in the supply of helium isotope - ^{3}He. In the future, this isotope can play an important role in solving the energy problems of our planet - its use in the phenomenon of nuclear fusion gives the greatest energy gain in the area of clean energy. The search for this rare isotope on Earth has already begun on the Moon. Also planets of our system, which do not have a shielding magnetic field, are taken into account. ^{3}He in the USA, as well as in Europe is treated as a strategic material.

The ^{3}He isotope deficiency may be remedied by an attempt to separate ^{3}He from liquid helium using the quantum filtration effect. The effects of this filtration can be magnified by using the magnetic properties of ^{3}He.

Planned tasks will be focused on the study of the possibility of using modern magnetic and superconducting nano-materials in order to obtain high ^{3}He concentration in ^{4}He.

Aim of the project:

This project aims to clarify whether magnetic effects studied in modern magnetic and superconducting nano-materials can play a significant role in obtaining high concentrations of the ^{3}He isotope in the ^{4}He/^{3}He mixture.

V. NEW MULTIFERROICS MATERIALS

Keywords: multiferroics, magnetoelectrics, brownmillerites

Research group: Department of Ferroelectrics, Division of Physics of Dielectrics and Molecular Spectroscopy

Principal Investigator: dr hab. Bartłomiej Andrzejewski, *prof. IMP PAS*

Project description:

Multiferroics are single-phase materials that can simultaneously exhibit at least two of the properties (arrangements) such as ferromagnetism, ferroelectricity, ferroelasticity or ferrotoroidicity. The most important multiferroics are magnetoelectric materials in which the external magnetic field allows changing the electric polarization and vice versa applied voltage changes magnetization. An example is $BiFeO_3$ bismuth iron ferrite exhibiting multiferroic properties even at room temperature. $Ca_2Fe_{2-x}Al_xO_5$ brownmillerites are also promising compounds because they are ionic conductors, magnetoresistive materials, and magnetoelectrics. Moreover their direction of magnetization can change rapidly under the magnetic field. The project involves the synthesis and investigations of various bismuth-doped brownmillerite $Ca_{2-x}Bi_xFe_{2-y}Al_yO_3$, which would combine the advantages and properties of the two materials mentioned above.

Aim of the project:

The development of methods for the synthesis of bismuth-doped brownmillerites, investigating of their structure and magnetic and electrical properties.

VI. SYNTHESIS AND PHYSICAL PROPERTIES OF NEW PROTON-CONDUCTING ELECTROLYTES BY DISPERSING HETEROCYCLIC MOLECULES IN LIGHT-CURED POLYMER MATRICES

Keywords: proton conductivity, molecular dynamics, molecular structure, photopolymerization, heterocyclic molecules, light-cured polymers

Research group: Department of Nuclear Magnetic Resonance, Division of Physics of Dielectrics and Molecular Spectroscopy

Principal Investigator: dr hab. Adam Rachocki

Project description:

The need to increase the functionality and efficiency of power sources results from the intensity of development of many areas of our lives, including electromobility. Fuel cells have the opportunity to compete in the automotive market as low-voltage electric sources converting directly chemical energy into electrical one without unnecessary pollution – most often as a result of a hydrogen oxidation reaction. Anhydrous proton-conducting materials with possibly wide temperature range of application (above 100°C) play a key role in the rapid development of these environmentally-friendly electrochemical devices. Incorporation of dispersed heterocyclic molecules as imidazole within appropriate polymer matrices by photopolymerization technique is an innovative approach for searching for new polymer electrolytes for fuel cells and can create a long-range pathway in the material for proton conduction.

Aim of the project:

The main goal of the proposed investigations is to develop a preparation of the new proton-conducting materials by dispersing heterocyclic molecules (e.g., imidazole) in light-cured polymer matrices. The specific purpose of the study is characterization of the obtained materials and modification their physical properties to choose the system, which in anhydrous conditions will show electrical conductivity at a level similar to that observed in solid electrolytes important for applications.

Additional information:

1. Ph.D. students shall receive a stipend in the amount of 2 380 PLN – till the month of mid-term assessment, and in the amount of 3 660 PLN – after the month when the mid-term assessment will be performed.
2. Ph.D. students shall be subject to social insurance, pursuant to article. 6 section 1 passage 7b of the act of October 13th, 1998 on the social insurance system (Journal of Laws of 2019, item 300, 303 and 730).

Requirements for the candidates:

1. MSc degree in physics or related sciences, or fulfilling the conditions stipulated in article 186, section 2 of the act of July 20th, 2018 Law on Higher Education and Science (journal of Laws of 2018, item 1668, as amended).
2. Knowledge in the field of dielectric, magnetic, soft matter, and molecular physics.
3. Commitment, critical thinking skills, and problem-solving abilities.
4. Manual skills and enthusiasm in performing experiments.
5. High motivation for further development, communication skills, and ability to work in a team.
6. Fluency in English (both in speech and writing).
7. Skills which will be an advantage of the applicant:
   - Experience in working with type of samples, experimental and theoretical techniques relevant to the specified project
   - Scientific achievements: co-authorship of publications, internships, and trainings

Required documents:

1. Application for admission to PDS IPAS along with the consent for processing personal data upon the recruitment procedure and a statement on having acknowledged the regulations of recruitment for PDS IPAS, using form downloaded from: https://www.ifmpan.poznan.pl/BIP/index.php/edukacja/psd-ipan
2. Certified copy of the diploma confirming graduation or a certificate confirming graduation (in the case of diplomas issued by foreign higher education schools, diploma stipulated in article 326, section 2, passage 2 or article 327, passage 2 of the act of July 20th, 2018 – Law on Higher Education and Science (Journal of Laws of 2018, item 1668, as amended), entitling to apply for conferment of a doctoral degree in the state in where such a certificate was issued by the relevant higher education school. In the event when the candidate does not have the aforementioned documents, he/she is obliged to submit them before admission to PDS IPAS. Additional information on foreign school diplomas is available at: https://nawa.gov.pl/en/recognition/recognition-for-academic-purposes/applying-for-admission-to-doctoralstudies.
3. Scientific CV encompassing track record of previous education and employment.
4. A cover letter featuring a short description of research interests, scientific accomplishments, a list of publications, information on involvement in scientific activity (membership of student scientific groups, participation in scientific conferences, completed internships and training courses, prizes and distinctions received) and reasons for wishing to study at the doctoral school.
5. Certificates or other documents confirming the degree of proficiency in English, if the candidate owns such materials.
6. Contact details of at least one previous scientific supervisor or another researcher who is entitled to issue an opinion on the candidate.

Applications should be submitted electronically on e-mail address office@ifmpan.poznan.pl with the subject of the message "*Competition for the Ph.D. position No. 1/2019/IFM PAN/PSD*" as the attachment in the pdf file format.

Alternatively, if the electronic delivery is not possible, applications can be sent to the postal address of the Secretariat of the Institute of Molecular Physics, Polish Academy of Sciences - ul. Mariana Smoluchowskiego 17,

60-179 Poznan, Poland with an annotation on the envelope: "*Competition for the Ph.D. position No. 1/2019/IFM PAN/PSD*".
Please do not send the originals of the documents.

Submission deadline is December 6, 2019 (The date of the document receipt shall be decisive).

Criteria for evaluation of candidates:

1. Candidate's research achievements, according to the grades obtained in the course of studies, scientific publications, awarded scholarships, and distinctions resulting from conducting scientific research or student activities or other achievements.
2. Candidate's scientific and professional experience, according to participation in conferences, workshops, training sessions and internships, implementation of research and commercial projects, involvement in scientific trusts and societies, international and professional mobility, experience in other sectors, including industry.
3. Candidate's knowledge of the following discipline: physical sciences.
4. Knowledge of the subject matter described in the recruitment advertisement.

The recruitment procedure shall be concluded until December 20, 2019

The description of the recruitment process is stipulated in the Regulations of Recruitment for PDS IPAS. Following the recruitment procedure, the unadmitted candidates shall be informed on the strong and weak sides of their applications. The recruitment results are public.

For additional information, please contact the Principal Investigator:

Project No. I:	dr hab. inż. Konstantin V. Tretiakov *prof. IFM PAN*; e-mail: konstantin.tretiakov@ifmpan.poznan.pl
Project No. II:	prof. dr hab. Jan Martinek e-mail: jan.martinek@ifmpan.poznan.pl
Project No. III:	dr hab. inż. Piotr Kuświk e-mail: piotr.kuswik@ifmpan.poznan.pl
Project No. IV:	dr hab. Wojciech Kempiński *prof. IFM PAN* e-mail: wojciech.kempinski@ifmpan.poznan.pl
Project No. V:	dr hab. Bartłomiej Andrzejewski *prof. IFM PAN* e-mail: bartlomiej.andrzejewski@ifmpan.poznan.pl
Project No. VI:	dr hab. Adam Rachocki e-mail: adam.rachocki@ifmpan.poznan.pl

Information clause:

According to the content of art. 13 of Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46 / EC (General Data Protection Regulation), hereinafter referred to as GDPR, we inform that:

1. The administrator of the collected personal data is Institute of Molecular Physics of the Polish Academy of Sciences, Mariana Smoluchowskiego 17, 60-179 Poznań, Poland, VAT No. PL-777-00-20-870 (hereinafter referred to as the Institute).
2. The administrator has appointed a Data Protection Inspector who can be contacted in writing, by traditional mail, writing to the Institute's address: Data Protection Inspector, Institute of Molecular Physics of the Polish Academy of Sciences, Mariana Smoluchowskiego 17, 60-179 Poznań, Poland or by sending an e-mail to: iod@ifmpan.poznan.pl.

3. Personal data are processed in order to implement the administrator's tasks related to the recruitment to the Poznań Doctoral School of the Institutes of the Polish Academy of Sciences.
4. The legal basis for data processing is the Act of 26 June 1974 - Labor Code, the Act of 30 April 2010 on the Polish Academy of Sciences, the Act of 20 July 2018 Law on Higher Education and Science and consent of the data subject.
5. Personal data collected in the current recruitment process will be stored for a period of 3 months from the conclusion of the recruitment process for candidates who were not accepted to the PDS IPAS. After this period, personal data will be effectively destroyed. In case of submission of a request for a re-examination of the application to the Director of the Institute, personal data will be stored for a period of 3 months from the moment of a delivery of the new decision to the declined candidate as a result of re-examination of the aforementioned application. After this period, personal data will be effectively destroyed.
In the case of candidates accepted to the PDS IPAS, personal data collected in the recruitment process will be stored along with documentation related to further education process and archived in accordance with the applicable regulations.
6. Personal data will not be conveyed to a third country.
7. Personal data of the candidate selected in the competition may be made available to third parties authorized under the law and the co-administrator - the Institute of Bioorganic Chemistry of the Polish Academy of Sciences - on the basis of an agreement.
8. The person whose data is processed has the right to:
- access to the content of your personal data, demand their correction or deletion, on the terms set out in art. 15-17 GDPR;
- set restrictions on data processing, in cases specified in art. 18 GDPR;
- data transfer, on the principles set out in art. 20 GDPR;
- withdrawal of consent at any time without affecting the lawfulness of the processing that was carried out on the basis of consent before its withdrawal;
- lodging a complaint to the President of the Office for Personal Data Protection.
Providing personal data in the scope resulting from art. 22 (1) of the Act of 26 June 1974 - Labor Code, is mandatory, providing data in a broader scope is voluntary and requires consent to their processing. Refusal to provide personal data prevents the application from being considered.

DYREKTOR
Instytutu Fizyki Molekularnej
Polskiej Akademii Nauk
prof. dr hab. Zbigniew Trybuła