Annual Report 2010/2011

German-Russian Interdisciplinary Science Center

Freie Universität Berlin

G-RISC
German-Russian Interdisciplinary Science Center

Санкт-Петербургский государственный университет

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Editorial from the Scientific Coordinators

The **G**erman-**R**ussian **I**nterdisciplinary **S**cience **C**enter (**G-RISC**) is the first Center of Excellence in the northern hemisphere funded by the German Academic Exchange Service (DAAD) with financial support from the Federal Foreign Office (Auswärtiges Amt) of Germany. Substantial support for G-RISC is also provided by the hosting institutions St. Petersburg State University and Freie Universität Berlin.

G-RISC is built on long-standing collaborations between German and Russian scientists. G-RISC aims to bring together the available expertise in physics, geophysics, physical chemistry, and mathematics with the aim of reaching new horizons in interdisciplinary research and education between Russia and Germany.

G-RISC was formally opened on March 22, 2010. Since then, numerous projects have been realized. These are gathered in this first Annual Report. G-RISC consists of an open and federal decentralized structure which permits researchers from Russia and Germany to put their ideas involving collaborative and interdisciplinary work into reality without substantial delay. No research site in both countries is excluded; the only selection criterion is the competition for the best projects to be funded by G-RISC. This large operation requires a minimum of administration. It consists of a small, but efficient coordination unit in each country. The main office is based at St. Petersburg State University. The strong ties of G-RISC with Germany are maintained by Freie Universität Berlin, which acts as the German coordinating partner of G-RISC.

G-RISC focuses on young researchers from Germany and Russia and their education. G-RISC welcomes the younger generation to gain experience in working in laboratories of the partner country. Formal barriers are lowered as much as possible to enable excellent science to be the highest priority for support by G-RISC. Research stays of up to three months are funded, whereby formal language skills in the local languages are not required. G-RISC makes successful use of English as the lingua franca of science.

We are impressed by how well G-RISC has been accepted by the community in both countries since the opening. During the first two rounds of proposals more than 80 young scholars and scientists have been supported by G-RISC in the fields of research and education, and three major workshops were held. We hope that this excellent start will carry on in the future, permitting the realization of G-RISC's ambitious goals of becoming a new dimension in intense scientific interactions between Russia and Germany.

We are grateful to all the experienced and the young researchers from Russia and Germany who took the initiative after G-RISC's opening to participate in the activities of the Center of Excellence. This Annual Report aims to bring the funded activities at the frontier of science to a larger public to motivate more researchers from both countries to participate in the broad and challenging activities of G-RISC.

Of course, the work that is included in this Annual Report would not have been possible without funding by DAAD and the Federal Foreign Office of Germany, generous support from the involved institutions, St. Petersburg State University and Freie Universität Berlin, as well as the colleagues serving in the Steering Committee for the benefit and development of G-RISC. We are most grateful for this tremendous support which motivates us to develop the aims of G-RISC even beyond the scope envisioned when we started to plan the Center of Excellence not too long ago.

Alexander M. Shikin
St. Petersburg, June 2011

Eckart Rühl
Berlin, June 2011

Mission – Visions – Aims

Mission

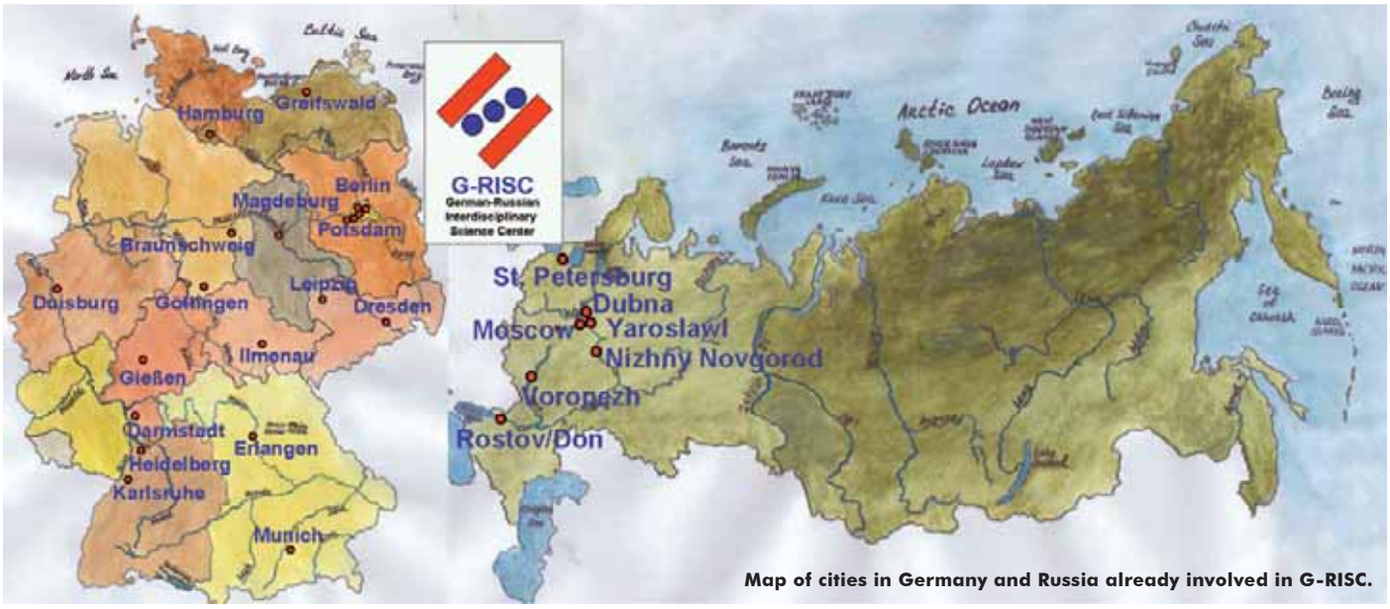
- **G-RISC** is the **G**erman-**R**ussian **I**nterdisciplinary **S**cience **C**enter. It is a Center of Excellence, funded by the German Academic Exchange Service (DAAD) with financial support of the Federal Foreign Office of Germany.
- **G-RISC** is a multidisciplinary platform for modern research and education. It covers the important areas of the natural sciences, giving preference to physics, geophysics, physical chemistry, and mathematics.
- **G-RISC** brings together key competences from leading universities and research laboratories from Russia and Germany. The scope of G-RISC underlines a modern interdisciplinary concept of research and education.

Visions

- To solve important scientific and interdisciplinary problems of science by experimental and theoretical approaches in close collaboration between scientists from Russia and Germany.
- To educate students in an international and interdisciplinary environment and training of their mobility including the use of electronic media.
- To achieve a new dimension of collaboration between Russian and German scientist, teachers, and students by overcoming barriers between disciplines, cultures, and languages.

Aims

- Creation of stable science platforms in physics, geophysics, physical chemistry, and mathematics including interdisciplinary work for tackling current problems in nanoscience, intermolecular interactions, waves in geophysics, and control of wave patterns.
- Creation of stimulating educational programs by exchanges of professors and students
- Exploring new avenues in teaching by using electronic media
- Holding conferences and workshops in Russia and in Germany to enhance interdisciplinary and international research environments
- Establishing criteria of excellence for research and education in order to attract the best researchers and students in the fields covered by G-RISC.



Map of cities in Germany and Russia already involved in G-RISC.

How does G-RISC work? - A New Idea is Born!

The way to contribute to G-RISC is made as simple as possible so as to support both young and experienced scientists who are interested in putting their new and brilliant ideas into reality. Certainly, not all ideas developed in Germany and Russia can be put into the framework of G-RISC. Therefore there are important criteria to be considered before writing a proposal:

Scope of G-RISC

The Center of Excellence has a clear focus by covering the core disciplines of physics, geophysics, physical chemistry, and mathematics. This is already a quite broad scope, given the many possible subjects and the limited resources for support. Researchers from outside these disciplines need to find a clear link to the core activities of G-RISC in order to be considered.

Interdisciplinary Research

G-RISC is convinced that research within a discipline is important for the development of each single field. However, new ideas often come from the borders between different disciplines, where the required expertise is limited and single research groups cannot easily advance. Collaborations are the usual way to overcome this limitation. G-RISC supports collaborative research beyond inner-disciplinary research involving research groups from Russia and Germany.

Cutting-Edge Research

Frontiers of science are being pushed back by G-RISC, which clearly goes beyond routine work. This implies that projects have a given risk of failure or may need to undergo optimization until they become successful. However, clear results and perspectives are required to be delivered by funded projects.

Scientific Excellence

G-RISC encourages the best and most experienced groups from Russia and Germany to contribute to G-RISC. Experienced researchers are encouraged to submit their best proposals to G-RISC for evaluation.

Russian-German Collaborations

Local research projects cannot be funded by G-RISC. The obligator requirement is to always involve a partner group from the other country.

Young Researchers

The younger generation from Russia and Germany should benefit most from funding by G-RISC. Their contributions to the success of each project are of crucial importance and should be made clear from the beginning. Of course, experienced researchers are never excluded. Their expertise is essential for the success of each project. The best way is for both young and experienced researchers from Russia and Germany to work together closely for the benefit of each project.

Education

G-RISC is much more than just research. Educational programs are offered by excellent and distinguished teachers. G-RISC supports initiatives for lectures and lecture series supporting interdisciplinary research. Systematic use of new electronic media is encouraged for teaching and education.

Conferences and Workshops

Meeting other scientists is essential for the success of G-RISC. The Center of Excellence funds conferences and workshops in support of interdisciplinary research in science.

12 Frequently Asked Questions about G-RISC

1. What is G-RISC?
G-RISC is a research and education platform for collaborative work between Russia and Germany. Natural sciences (physics, geophysics, physical chemistry, and mathematics) are the focus of G-RISC.

2. Why should I apply for a G-RISC project?
A G-RISC project is first of all a distinction, if it is selected for funding. These projects become a visible contribution to the development of German-Russian collaborations in science. Each single project is important in helping to tie together researchers and research interests and to develop novel, interdisciplinary research between Russia and Germany.

3. Who can apply for G-RISC?
Only researchers based in Russia or Germany can apply. Their nationality or citizenship is of no importance, only the location of their affiliation. Submitters are outstanding researchers supporting young people, interdisciplinary research, and collaborations between Russia and Germany.

4. What is funded by G-RISC?
G-RISC primarily funds mobility of young researchers between Russia and Germany. First of all this concerns research stays in laboratories of the partner groups in the other country. It is anticipated that this mobility will function equally in both directions, increasing the chances for stable long-term Russian-German collaborations. G-RISC can neither fund expensive equipment nor positions for scientists. Therefore, projects funded by G-RISC can only fill the need for scientific and educational exchange.

5. Where and how often are calls for proposal issued?
Calls for proposals are issued every six months. They are publicly accessible, as they are officially advertised via the internet at the official web-site of G-RISC www.g-risc.org. The information is spread to the involved institutions in order to guarantee that a broad audience knows about calls for proposals. Typically, there is a four week time period for submitting proposals before the deadline is reached. The most recent call for proposals was in April, 2011 and the next one is scheduled for Fall October 2011.

6. Can partner groups be found?
Often partner groups from Russia and Germany know each other from long-standing collaborations. New groups to this field are encouraged to seek advice on where to find suitable partners from the G-RISC coordination units.

7. Is there funding of long-term projects?
Long-term funding is not foreseen by G-RISC. There are good reasons for this: The highest degree of flexibility, access to the scientific communities, and scientific productivity is achieved by short term proposals of six months. In reality it is not impossible to build a long-term project by regularly submitting proposals for evaluation. But there is no guarantee of funding, which gives all groups the same chance to compete for the best ideas in a time that is quickly developing.

8. Who evaluates a proposal?
G-RISC is directed by a Steering Committee, where experts from Russia and Germany are assembled. They read and evaluate all proposals and decide which project is to be the subject of funding.

9. What are the administrative structures of G-RISC?
The coordinating units in St. Petersburg (main office) and in Berlin (German office) take care of all administrative duties that are required for the operation of G-RISC. There you can ask any questions and there all processing of the proposals, project handling, letters of invitation, and correspondence is done. Note that accommodation of guests is done by the local hosts.

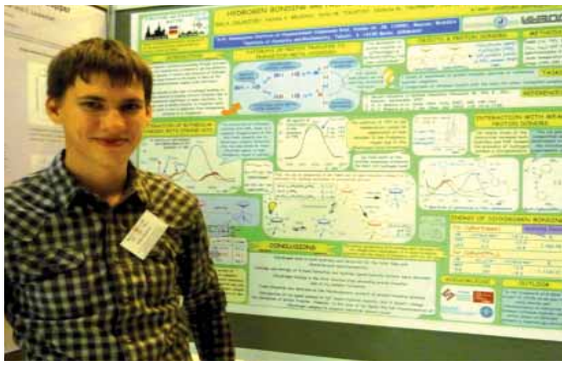
10. Who can help in case of problems?
There is no project without problems. G-RISC does everything for the community to avoid any foreseeable problems. But nobody is perfect and if problems really occur everybody is asked to contribute to a solution. In most cases it is sufficient to ask the administrative coordinators. All problems beyond that are resolved together with the scientific coordinators and the Steering Committee.

11. What does a G-RISC proposal look like?
Clear instructions are published with the calls for proposals. Experience made after the opening of G-RISC indicted that optimization of this process was required. Therefore, you are advised to make use of the latest version of instructions. In general, there is a strict two page limit for proposals. This helps to limit the work required for the submitters as well as the reviewers, and it is not too difficult to communicate the project ideas in limited space.

12. What does a proposal report look like?
Each G-RISC proposal that is admitted requires a report, which is due four weeks after the end of funding. Details on this report are documented on the web page of G-RISC.

G-RISC in Reality – Experiences of Funded Participants

Gleb Silantiev – A research stay in Berlin and Greifswald

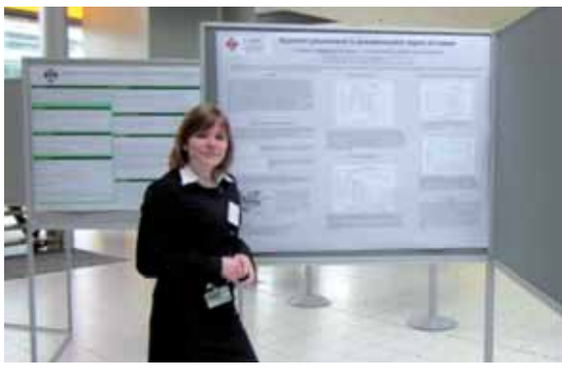


"I was given an excellent opportunity to work in two groups: In the group of Dr. P. Tolstoy at Freie Universität Berlin and in the group of Prof. Dr. K. Weisz at the University of Greifswald. This was my first visit to Germany. It was very interesting for me to make an acquaintance with German culture, traditions, the way of life, and of course to participate in joint scientific research between Russia and Germany.
The hospitality both in Berlin and Greifswald, friendly work atmosphere, interest and active participation of parties in the joint work favored the quick removal of a language barrier and facilitated my training. I am looking forward to continuing this line of investigation and hope this project will become the base for a well-established fruitful collaboration."

Shushu Kong – A research stay in Moscow

„In my point of view it is valuable to take part in the G-RISC Project. There are three points of advantages. Firstly, the project acts as a function like bridge, which can connect science between Germany and Russia. It helps PhD students open their scientific view. Secondly, working with different people is always interesting. Finally, Russia is also a beautiful country. It is valuable to go there in life."

Anna Makarova – A research stay in Dresden



"As for me, participation in G-RISC student exchange program gave me the exclusive chance to visit Germany and to be exposed by German culture and German everyday life. I have broken my language barrier during my visit. I think that it is real achievement. It was a chance to carry out experiments by means of up-to-date equipment in modern laboratories and to work in collaboration with German leading scientists in the field of Solid State Physics.
Also, it was so exciting for me to acquire knowledge, adopt practices and at the same time share experience with other students. Research in work group of Professor Laubschat (our collaboration partners) produced only good impressions on me."

Ksenia Brykalova – A research stay in Berlin

"It was not my first visit of Berlin, two years earlier I have been here in framework of the Leonhard-Euler Program.
Both visits gave me only good impressions and pleasant memories. Berlin is a very interesting and unique city, especially its south-west part where Freie University is located. The south-west of Berlin is a region of lakes and small beautiful houses in traditional German style.
Such walks helped me to relax and concentrate on further work."

Egill Antonsson – Visit of the Student Conference on Science and Progress in St. Petersburg

"My participation in the conference and stay in Russia was a very enjoyable one. In terms of science, the topics covered were quite varied and among them very many that overlap with my interests. I very much enjoyed visiting and getting to know Russia for the first time, a country which for me felt somewhat far away despite the geographic proximity. I liked living on campus to get a chance to get a feeling for everyday life of university students."

Kathrin Lange - Visit of the G-RISC Conference Rostov/Don

"The workshop was well organized and everybody was very helpful to the foreign guests. The technical equipment was excellent so that all oral presentations were accessible on the Internet.
The spectrum of presentations was broad and interesting. Some students were evidently giving their presentations in the English language for the first time.
I was surprised that I was the only younger student from Germany attending this workshop and I would encourage more young people from Germany to consider a visit to such workshops."

Yulia Rozhkova – A research stay in Berlin

"If somebody offers you a chance to take part in G-RISC project, you should do it because there are no disadvantages at all. First, you will have experience in work abroad. It differs from work in Russian laboratories.
I worked in very good group. Everybody was very responsive and friendly. I could carry out different experiments in a short period of time, because there were all the equipment and reagents I needed.
So I had very good conditions for productive work. As a consequence, my master's thesis was based on results which I obtained in Germany. So it was very useful and interesting for me."

Alexey Osipov – A research stay in Berlin

"I spent 2.5 months in the research group of Prof. Fiedler at Freie Universität Berlin. This visit was very fruitful from a scientific point of view. I talked with many mathematicians from various scientific schools, studied such new (for me) areas of mathematics as centralisers of diffeomorphisms, blow-up, cosmology. Probably, my strongest experience was an unofficial barbecue of the group on the 9th of May (in Russia it is considered to be the date of the end of the Second World War). Our company was rather international, it included Russians, Germans, Israelis. Unfortunately, such a barbecue was impossible 70 years ago. I believe that G-RISC is one of the forces that help science to remain international, and, as a consequence, it helps to prevent such sad events as a new iron curtain or new global war."

Ekaterina Klyushina – A research stay in Berlin

"It was a great experience for my scientific activities and my communications skills. The persons from the group were very hospitable and friendly.
They were interested not only in the topic of my research but also in the culture of Russia. Sometimes on weekends we met in a café and discussed various topics about the features of life in Russia and in Germany.
I was interested to know more about "bio" products, houses with coal-burning stoves, popular directions in education for young person and information, which you could not find in the typical guidebook."

Ilya Ermakov – Visit of the Student Conference on Science and Progress in St. Petersburg

"…I was impressed by the conference "Science and Progress". In my opinion, it was organized on a high level. A drawback is that papers for conference proceedings are not accepted in TeX format."

Yuri Kapitonov – A research stay in Göttingen

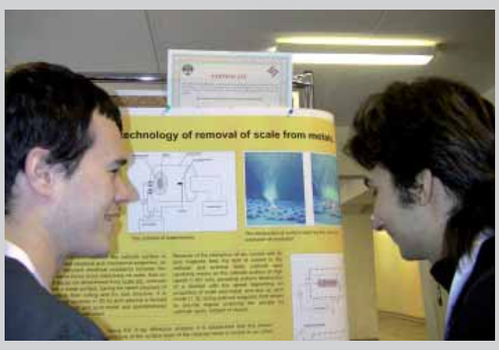
"I really enjoyed my stay in Göttingen and I want to thank the working group of Prof. Dr. Michael Seibt. I was really impressed by the working style and encouraging atmosphere of the group. Also I was glad to have an opportunity to participate in the conference "Understanding materials using in-situ microscopy" that was held in Universität Göttingen on 10-12 November 2010."

Ekaterina Tereshchenko – A research stay in Erlangen

„Max Planck Institute its highly skilled and friendly employees, high quality equipment, a wide field of activity for the student-chemist, a fresh look at scientific work, working skills using modern equipment, and also the magnificent possibility to apply the knowledge."

Yury Kalinin – Awardee of a Sur-Place Stipend in St. Petersburg

"I really like the idea of interdisciplinary international collaboration. This is a good opportunity for young specialists from Russia and Germany to get support in their research and to get an overview of research in neighboring areas.
This program is especially relevant for specialists focusing on theoretical areas who frequently have problems with applying their skills in practice. I think that the idea of interdisciplinary German-Russian collaboration will be very useful for them."



Structure of G-RISC

The G-RISC Coordination Unit in St. Petersburg

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Website: www.g-risc.org

The G-RISC Team in St. Petersburg: Elena Serova and Prof. Dr. Alexander M. Shikin at the opening ceremony of G-RISC (left); Anna Popova, Prof. Dr. Alexander M. Shikin and Artem Rybkin at the Russian-German Laboratory at BESSY II (right).

The G-RISC office is located in the Department of Physics of St. Petersburg State University in Peterhof. The scientific coordinator, Prof. Dr. Alexander M. Shikin, and three administrative coordinators, Anna Popova, Elena Serova, and Artem Rybkin are based there. They are responsible for all duties concerning Russia. This comprises handling the visits of guests coming to Russia including letters of invitation, organization of workshops in St. Petersburg, and all financial and administrative issues related to Russia.

The G-RISC Coordination Unit at Freie Universität Berlin

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The G-RISC Team at Freie Universität Berlin: Prof. Dr. Eckart Rühl and Natalia Kolanovska.

The German counterpart of the main G-RISC office is located at Freie Universität Berlin, where the scientific coordinator, Prof. Dr. Eckart Rühl, and the administrative coordinator, Natalia Kolanovska, are based. They handle all visits of Russian scientists to Germany including invitations to Germany, organization of workshops held in Berlin, all project management and calls for proposals, and management of the project with regard to the funding organization DAAD.

The G-RISC Steering Committee

G-RISC Steering Committee at work during its first meeting on March 23, 2010.

A Steering Committee is needed to supervise all scientific activities of G-RISC. This includes evaluation of all proposals and selecting the best of them. Further, the Steering Committee takes care of defining the general goals for the development of G-RISC.

Russian Members of the Steering Committee

Prof. Dr. A. M. Shikin (Physics and scientific coordinator from Russia, St. Petersburg State University).
Prof. Dr. V. N. Troyan (Geophysics, St. Petersburg State University)
Prof. Dr. G. A. Leonov (Mathematics, St. Petersburg State University)
Prof. Dr. Yu. S. Tver'yanovich (Physical Chemistry, St. Petersburg State University)

German Members of the Steering Committee

Prof. Dr. E. Rühl (Physical Chemistry and scientific coordinator from Germany, Freie Universität Berlin)
Prof. Dr. S. Shapiro (Geophysics, Freie Universität Berlin)
Prof. Dr. B. Fiedler (Mathematics, Freie Universität Berlin)
Prof. Dr. C. Laubschat (Physics, Technische Universität Dresden)

Member of the Steering Committee from the German Academic Exchange Service (DAAD)

B. Brisch (Head of Division 32 / Eastern Europe and CIS of DAAD, Bonn). His task is to supervise G-RISC from the funding organization point of view.

Intense discussions and difficult decisions during the meeting of Steering Committee on November 15, 2010: The coordinators Prof. Dr. A. M. Shikin and Prof. Dr. E. Rühl (left); Prof. Dr. C. Laubschat (TU Dresden) and M. Stüdemann (Head of Liaison Office of Freie Universität Berlin in Moscow) (right).

G-RISC Opening Ceremony

The opening ceremony of the German-Russian Interdisciplinary Science Center (G-RISC) was held on March, 22, 2010, in Petrovsky Hall of Saint Petersburg State University. Distinguished members from St. Petersburg State University, a delegation from Germany, invited guests, and last but not least students participated in this outstanding celebration.

The hosting institution was represented by its president Prof. Dr. Lyudmila A. Verbitskaya and the senior vice-president for academic affairs and research Prof. Dr. Igor A. Gorlinsky. The dean of the faculty of Physics of St. Petersburg State University Dr. Alexander S. Chirtsov also participated.

The scientific coordinator of G-RISC in Russia Prof. Dr. Alexander M. Shikin as well as other distinguished faculty members from St. Petersburg State University were present. Also in attendance in St. Petersburg was Dr. Gregor Berghorn, head of Moscow office of the DAAD, Mr. Benedikt Brisch, head of the division "Eastern Europe and CIS" of DAAD, Dr. Martin Krispin, deputy head of the Department "Russia/Belarus" of DAAD, Mr. Markus Mathyl, head of the DAAD Information Center in St. Petersburg, Prof. Dr. Ursula Lehmkuhl, the acting president of Freie Universität Berlin, Prof. Dr. Eckart Rühl, scientific coordinator of G-RISC in Germany, Gottfried Gügold, vice-head of International Office of Freie Universität Berlin, and Prof. Dr. Clemens Laubschat, director of Institute for Surface Physics and Microstructure Physics of Technical University Dresden.

Prof. Dr. Lyudmila A. Verbitskaya, the president of St. Petersburg State University, and Prof. Dr. Igor A. Gorlinsky, senior vice-rector for academic affairs and research of St. Petersburg State University, opened the ceremony with a warm welcome. In her speech, the acting president of Freie Universität Berlin, Prof. Dr. Ursula Lehmkuhl, pointed out that this project has become the natural continuation of 40 years of partnership of Freie Universität Berlin and St. Petersburg State University. Prof. Lehmkuhl emphasized that the Center of Excellence is the only one in the northern hemisphere funded by DAAD and the Federal Foreign Office of Germany. There are three other centers that will be founded soon – in Chile, Colombia, and Thailand.

"The University of the Northern Capital – our old partner," declared the acting president of the DAAD, Prof. Dr. Max Huber. Interests of foreign cultural policy were behind the idea of elite centers: The center had to be established in a region of Russia with a specific interest for collaborations with Germany along with sufficient scientific capacities. We are aiming for important contributions to international dialogue by means of scientific collaborations in the form of Centers of Excellence. Not only the interdisciplinary orientation of G-RISC, its efforts to develop new methods of education including the use of the newest vehicles for communication played its own role for support, but so did the scientific reputation of both partners whose collaborations effectively began in the year 1968.

Dr. Peter Schaller, Consul General of the Federal Republic of Germany in St. Petersburg, emphasized during his speech: "With great pleasure, I congratulate St. Petersburg University on this significant event. Our countries have the highest potential for scientific and technical ideas."

"The Center of Excellence G-RISC opens up for us new possibilities of scientific and educational cooperation in the field of natural science" emphasized the German scientific coordinator of G-RISC, Prof. Dr. Eckart Rühl. In total, more than 40 institutions and

Key Ceremony during the opening of G-RISC: Prof. L. A. Verbitskaya, Dr. A. S. Chirtsov, Prof. I.A. Gorlinsky, Prof. A. M. Shikin, Prof. E. Rühl, Prof. U. Lehmkuhl, Prof. M. Huber (from left to right).

Opening ceremony of G-RISC: Dr. A. S. Chirtsov, Prof. I. A. Gorlinsky, Prof. L. A. Verbitskaya, Prof. M. Huber, Prof. U. Lehmkuhl, M. Goiny, Dr. P. Schaller, Dr. G. Berghorn (from left to right).

more than 100 groups from Russia and Germany will conduct research and teach at the center. It opens up new opportunities for interdisciplinary training of young scientists, and is the basis for an internationally visible and long-term collaboration between leading scientists from both countries. Major scientific challenges are tackled, such as research on nanoscopic materials, intermolecular interactions, and ultrafast processes. The first call for proposals was announced recently. It received publicity, and a considerable number of proposals were submitted. This is clear evidence that G-RISC is fully accepted by the scientific community. A Key Ceremony followed, symbolizing the formal opening of G-RISC. These keys symbolize a new step in Russian-German collaborations which has only been possible due to the generous financial support given by the German Academic Exchange Service (DAAD), the German Foreign Office, and the support of the participating institutions, as well as the scientific communities in both countries. In honor of this outstanding occasion the chamber orchestra of St. Petersburg State University arranged a small concert.The official launch of the Center of Excellence was preceded by a first competition for the best project proposals with 23 projects being awarded funding. Leading scientists who were successful in this competition, Prof. Dr. Gennadiy A. Leonov, Prof. Dr. Alexander Yu. Bilibin, and students and PhD students of physical, mathematical, and chemical faculties gave short scientific contributions from different scientific directions of G-RISC.

This part of the opening underlined the fact that G-RISC is a Center of Excellence which focuses on the younger generation and its scientific development.

Presentation by the young scientist Sergey Safonov (right) at the opening of G-RISC.

G-RISC Annual Meeting



Audience (left) and podium (middle), and Anna Markarova giving a presentation at the first G-RISC Annual Meeting (right).

Another highlight during the first year of G-RISC was the Annual Meeting which was held on November 16, 2010, where "First Results and Perspectives" were discussed.

More than 45 projects were supported in 2010 year and it was decided to fund another 15 projects in the first semester of 2011. Top-level universities and scientific-research organizations of Germany have already been incorporated into this activity (among them Freie Universität Berlin, Technische Universität Dresden, Leipzig University, the Max Planck Institute for the Science of Light in Erlangen, the Universities of Potsdam and Rostock, Helmholtz Center Berlin, and others).

The majority of projects from the Russian side were submitted from St. Petersburg State University, Ioffe Physical Technical Institute, Peoples' Friendship University of Russia, Yaroslavl State University, Southern Federal University, and Lobachevsky State University of Nizhny Novgorod.

More and more people are getting to know about G-RISC and the affiliations of the participants are spreading substantially, reported Prof. Dr. Alexander M. Shikin: "I strongly encourage all participants working on joint Russian-German projects to submit a competitive proposal to G-RISC." Selected students who came back from research visits to Germany also gave presentations on their projects in physics, biophysics, chemistry, and mathematics. These were Anna Popova, Anna Makarova, Liudmila Lysyakova, Julia Rozhkova and Ilya Ermakov. The experts who were present at the meeting convinced themselves on the high the level of student reports.

The head of the Department of Physics of Earth and member of the Steering Committee of G-RISC, Prof. Dr. Vladimir Troyan, congratulated everyone for their successful work, where he said: "It is more than visible how the level of our students improved. They made top-level investigations and gave excellent reports."



Dr. M. Krispin (DAAD, Bonn), Dr. M. Kleineberg (DAAD, St. Petersburg), Prof. V. N. Troyan (St. Petersburg State University), and Prof. A. M. Shikin (St. Petersburg State University) at the first Annual Meeting of G-RISC.

First Interdisciplinary G-RISC Workshop on "Structure and Dynamics of Matter"

The first G-RISC Workshop "First German-Russian Interdisciplinary Workshop on the Structure and Dynamics of Matter" held at the BESSY II facility at the Helmholtz Center in Berlin-Adlershof (October 18-20, 2010). 70 participants joined, with about 50% of the participants coming from various places in Russia. They attended a truly interdisciplinary program including contributions from physics, chemistry, and mathematics. The scientific sessions of the workshop included important topics in nanoscience, fundamental properties of matter, and surface science, to which speakers from all disciplines contributed.

Impressions from the poster session at the G-RISC workshop in Berlin.

The workshop was opened by Prof. Dr. A. R. Kaysser-Pyzalla, the head of the Helmholtz Center Berlin. The opening of the workshop was completed by a presentation by the scientific and administrative coordinators of G-RISC.

The scope of the conference was designed in the spirit of G-RISC, where cutting-edge research of all disciplines were discussed by specialists and students from Russia and Germany. It is not so common for even experienced scientists to expose themselves to such a diverse environment, since most of the scientific meetings take place in communities of specialists from more or less the same field. The unique feature of this interdisciplinary workshop was the time to talk to colleagues from different fields, whereby it was necessary to find a common language for the appreciation of the scientific problems that were discussed. This demanded from all participants thoughtful preparations of the contributions so that non-specialists were able to understand the lectures. The result of these efforts was impressive: The participants agreed in an anonymous evaluation at the end of the workshop that the format of such workshops is very useful and should be continued in the future. This is needed to build trust and understanding, and G-RISC certainly provides the best environment. There are surely not many such opportunities to get presentations from high level scientists who take care that non-specialists understand the problems. The audience was able to successfully contribute to the discussions and to build a common understanding. Young researchers also had their place at the workshop, where they presented their research in front of a distinguished audience, either in oral contributions or in posters. For some of them from Germany and Russia it was the first time that they were presenting their results to an international audience. They felt that this was good experience, which was supported by the friendly atmosphere during the workshop.

Guided tour to the BESSY II storage ring facility and the Russian-German Laboratory during the G-RISC workshop in Berlin.

A true highlight was the site of the conference. The BESSY II facility is one of the leading synchrotron radiation facilities in the world for soft X-rays. It was presented in an introductory talk followed by a visit to the numerous experimental stations including the Russian-German Laboratory at BESSY II. For most of the participants it was the first time that they had visited such a large scale facility. It was greatly appreciated by the participants that such an exciting environment is a core aspect of G-RISC.

The workshop was fully made accessible using the video equipment acquired for G-RISC activities. The workshop was possible to follow at the same time at the Department of Physics in St. Petersburg.

The conclusion of the workshop was: Interdisciplinary understanding needs open minds and time. More workshops need to follow the first one. G-RISC is an excellent platform for building an interdisciplinary culture between scientists from Russia and Germany.

G-RISC Student Conference "Science and Progress"

Posters and conversations at the Student Conference in St. Petersburg.

The aim of this student conference was to develop deep collaboration between students and young researchers from Russia and Germany and raise the level of the student scientific investigations by intense discussion between young researchers and professors from both countries including presentations of overview lectures by professors from Russia and Germany in the most topical and interesting fields of science. The idea of the conference was a union of investigations in physics, geophysics, chemistry, and mathematics and to identify the most pressing and modern problems and directions of interdisciplinary investigations.

The conference took place on November 15-19, 2010 at the Faculty of Physics at St. Petersburg State University. The results were presented in overview lectures, oral talks, and posters. The official language of the conference was English. Students, Ph.D. students and young scientists were invited to join the conference. The number of participants exceeded 160 people; among them were 15 people from Germany (mostly from Freie Universität Berlin). Six invited lectures were presented by participants from Germany. All the abstracts of the reports were included in a book of abstracts and distributed to each participant on registration. After the conference all the accepted papers of participants were also published in the conference proceedings. Online video conferencing gave scientists in Germany a chance to participate in the conference.

The conference was attended by the heads and members of the Departments of St. Petersburg State University. Representatives from Germany who joined as well were Dr. Martin Krispin, the deputy head of Department 325 "Russia/Belarus" of the DAAD, Mr. Tobias Stüdemann, the representative of Freie Universität Berlin in Moscow, and the head of DAAD Information Center in St. Petersburg Dr. Michael Kleineberg.

The conference covered eight major topics in total: chemistry, geo- and astrophysics, mathematics and mechanics, solid state physics, applied physics, optics and spectroscopy, theoretical, mathematical and computational physics, and biophysics. Honor prizes were awarded for the best oral report and the best poster report of each topic.

Prof. Dr. Alexander M. Shikin, coordinator of G-RISC at SPbSU pointed out that the main idea of G-RISC is the unification of efforts of different scientific disciplines in different sciences including physics, geophysics, physical chemistry, and mathematics. This is of importance since most important scientific discoveries are made at the edge of different disciplines. Such conferences are mostly important for people to get know about progress of colleagues and to decide with them how their work can be useful in adjacent fields of science. It is a good possibility for inclusion of our students to the European scientific community. They should become used to speak English fluently and to present their reports on a high level.

Other attractions during the conference were two excursions, which went to Pushkin (Tsarskoye Selo - Catherine Palace, with the famous Amber Room) and to Petersburg at night.

Valerie Mondes from Berlin is practising teaching at the blackboard during the Student Conference.

Arrival of Shi-Hao Kung (Berlin) at Peterhof (left); Participants from Germany and Russia at the Student Conference in St. Petersburg-Peterhof (right).

G-RISC Workshop on "Nanodesign: Physics, Chemistry, Computer Modeling"

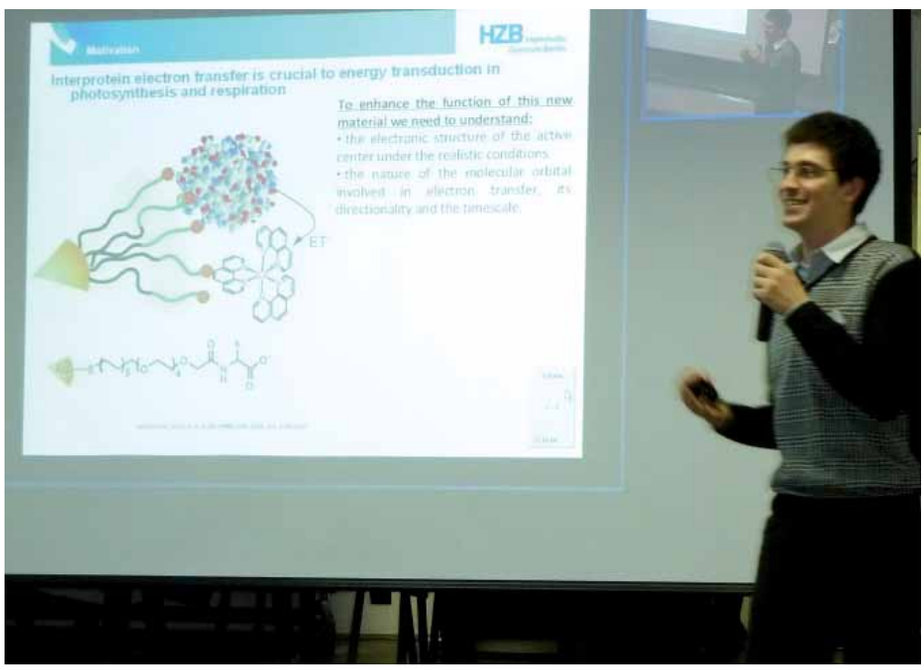
Southern Federal University of Russia in Rostov/Don hosted the third G-RISC workshop that was held in the first year of operation. This workshop documented the open and decentralized character of G-RISC, where different places in both countries can contribute to G-RISC activities. The workshop was organized by Prof. Dr. A. V. Soldatov from the Department of Physics.

The scope of the workshop focused on nanoscience, with contributions from physics, chemistry, and informatics. The workshop was opened by the vice rector for research of Southern Federal University, Prof. Dr. E. K. Aydarkin. Prof. Dr. A. V. Soldatov explained in the opening session his concept of the Interdisciplinary Russian-German Network Laboratory. It allows students from Rostov to participate directly in scientific activities abroad and outside their university where the expertise of other participating G-RISC laboratories is used. The involvement of supervisors is not required, and inconvenient indirect communication is replaced by direct communication between the actively involved young researchers. The majority of the roughly 35 participants came from Rostov, but they were joined by a number of people from several German institutions who came to Rostov for the first time.

In the spirit of G-RISC conferences, there was a mixture of contributions from experienced and young researchers. Clusters, nanoparticles, and nanowires studied by theory and experiments were discussed. Results were presented on unique optical, dynamical, magnetic, and electronic properties of nanoscopic matter. Molecular dynamics of nanostructures and multiscale modeling were among the subjects of presentations, as well as catalytic, solar cell, and laser applications. All participants had the chance to conduct intense discussions due to the friendly and open atmosphere. An extensive laboratory visit impressed the visitors by demonstrating the available resources for structural research at Southern Federal University.

The chairman, Prof. A. V. Soldatov, at the opening of the G-RISC workshop in Rostov/Don.

The workshop was made accessible on the internet. Up to 10 people were monitored following the lectures abroad. This is fully in line with the goals of G-RISC to make use of electronic media for letting people participate in G-RISC activities without traveling. However, it is also clear that nothing is better than personal contacts between researchers, especially if language or cultural barriers are to be overcome.



Mikhail Soldatov shows that it is fun to present science.

G-RISC in the Media

G-RISC has received attention in newspapers and television interviews in Russia and in Germany. Some of these articles are shown below.

129 / SONNABEND, 13. FEBRUAR 2010

IM INTERVIEW

„Die Lehre wird künftig grenzüberschreitend"

Herr Professor Rühl, welche Erwartungen verbinden Sie mit der Gründung des Exzellenzzentrums in Forschung und Lehre in St. Petersburg?

Das Exzellenzzentrum wird einen wichtigen Beitrag zur Vernetzung russischer und deutscher Wissenschaftler leisten. Es wird auch die

Eckart Rühl koordiniert den Aufbau des Exzellenzzentrums. Er ist Professor für Physikalische und Theoretische Chemie an der Freien Universität.

Ausbildung der Studierenden durch Lehrveranstaltungen von Wissenschaftlern aus dem jeweiligen Partnerland bereichern. Das wird dazu führen, dass die junge Generation von Studierenden und Wissenschaftlern sich offener gegenüber dem Partnerland verhalten wird.

Wie wird die Förderung durch das Exzellenzzentrum in St. Petersburg nau aussehen?

Jedes Jahr werden im Wettbe Mobilitätsmittel an mehr als 4 vorragende Studierende und wuchswissenschaftler aus Russland und Deutschland für Forschungsau enthalte im jeweils anderen Land ve geben. Das erlaubt, im Partnerla zu forschen, die andere Sprache erlernen und Lehrveranstaltun zu besuchen. Hinzu kommen bis zehn Kurzzeit-Stipendien zur Fö rung der besten Nachwuchswis schaftler, die vor allem Persone Russland zugute kommen. Da hinaus sollen bereits vorhande operationen koordiniert und in ziplinäre Workshops, Konfe sowie Winter- und Sommers organisiert werden. Das Ex zentrum wird auch Mobilit für Lehrende zur Verfügun was eine neue Dimension nationalisierung der uni Lehre eröffnet. Damit sind innovative Formen v anstaltungen, in denen mit übertragung gearbeitet grenzüberschreitende ermöglicht werden. V gungen fördern zudem kation zwischen Wis beider Länder.

— Die Fragen stellte Jan Hamb

FREIE UNIVERSITÄT BERLIN

NR. 20

Eine neue Dimension

Naturwissenschaftler der Freien Universität Berlin und der Universität St. Petersburg gründen erstes deutsch-russisches Exzellenzzentrum – Wettbewerb um Beiträge läuft

VON JAN HAMBURA

Interdisziplinäre und grenzüberschreitende Forschung: Das sind die Ziele des ersten Exzellenzzentrums in Forschung und Lehre in Russland. Es wird von Wissenschaftlern der Fächer Physik, Geophysik, Physikalische Chemie und Mathematik der Freien Universität Berlin gemeinsam mit Kollegen der Staatlichen Universität St. Petersburg aufgebaut. Das Projekt beider Institutionen ist erfolgreich aus einem Wettbewerb des Deutschen Akademischen Austauschdienstes hervorgegangen. Damit ist die Freie Universität am Aufbau eines von weltweit vier neu eingerichteten „Exzellenzzen-

ОБРАЗОВАНИЕ И КАРЬЕРА

НАУКА ВО ГЛАВЕ

В Петербурге открылся первый элитарный российско-немецкий научно-исследовательский центр

МК-СПРАВКА

МК-ФАКТ

Молодые ученые получат новые возможности

Russian-German Laboratory at BESSY II

The Russian-German Laboratory is located at the synchrotron radiation facility BESSY II in Berlin-Adlershof. It is operated by the Helmholtz Center Berlin (HZB). This laboratory was opened in 2001, so that we can look back at 10 years of successful user operation. It has established itself as a core facility for Russian-German collaborations, where it is tightly integrated into the German-Russian Interdisciplinary Science Center (G-RISC).

The Russian-German Laboratory at BESSY II has a long-standing history, which dates back to 1994, when the physicists Prof. Dr. G. Kaindl (Freie Universität Berlin) and Prof. Dr. V. K. Adamchuk (St. Petersburg) planned far ahead into the future, by designing a joint laboratory for structural research using soft X-rays. Their plans were based on their long-standing collaborations and found full support by the scientific director of BESSY II, Prof. Dr. W. Gudat.

A scientific case was made, based on Russian-German Workshops, which were held in 1995 in Berlin and 1997 in St. Petersburg. At that time about 40 Russian scientific groups and institutions contributed to this project by proposing tentative experiments. This resulted in the decision that a user facility should be established, with the proposed core installation consisting of a high resolution bending-magnet beamline covering the entire soft X–ray regime from 30 eV to 1500 eV. It was decided that the endstation would consist of a high resolution photoelectron spectrometer for photoemission and photoabsorption studies of structural research on solids, interfaces, and gases.

This ambitious project turned out to be fully compatible with the needs of the newly established BESSY II storage ring facility, which was aiming to attract the strongest user groups for their work utilizing soft X-rays. A plane grating monochromator began to be constructed in 1997 under the responsibility of Freie Universität Berlin, with substantial funds donated by "Stiftung Deutsche Klassenlotterie Berlin" and the German Federal Ministry of Education and Research (BMBF). The required installations were designed and manufactured in Russia as well as in Germany.

The official inauguration ceremony took place on November 20, 2001 and in 2002 the photoemission endstation was given over to user operation after being developed by Technische Universität Dresden.

Successful operation of the Russian-German Laboratory at BESSY II is provided by a broad and constantly developing user community from both countries. Highest scientific standards are provided by a Steering Committee, representing the responsible institutions taking care of the development of this unique laboratory. From the Russian side St. Petersburg State University, Ioffe Physico-Technical Institute (RAS, St. Petersburg), National Research Center "Kurchatov Institute" (Moscow), and Shubnikov Institute for Crystallography (RAS, Moscow) are responsible for the operation of the Russian-German Laboratory.

Contributors from the German side are Helmholtz Center Berlin, Freie Universität Berlin, and Technische Universität Dresden. Every six months, beam time proposals are submitted by the users and they are evaluated by the Steering Committee, whereby the tough competition for the limited beam time leads to realization of only the best proposals.

Every year about 40 research groups from various places all over Russia and Germany are using the Russian-German Laboratory at BESSY II for their experiments, partially for joint work. They are hosted by a team of beamline scientists

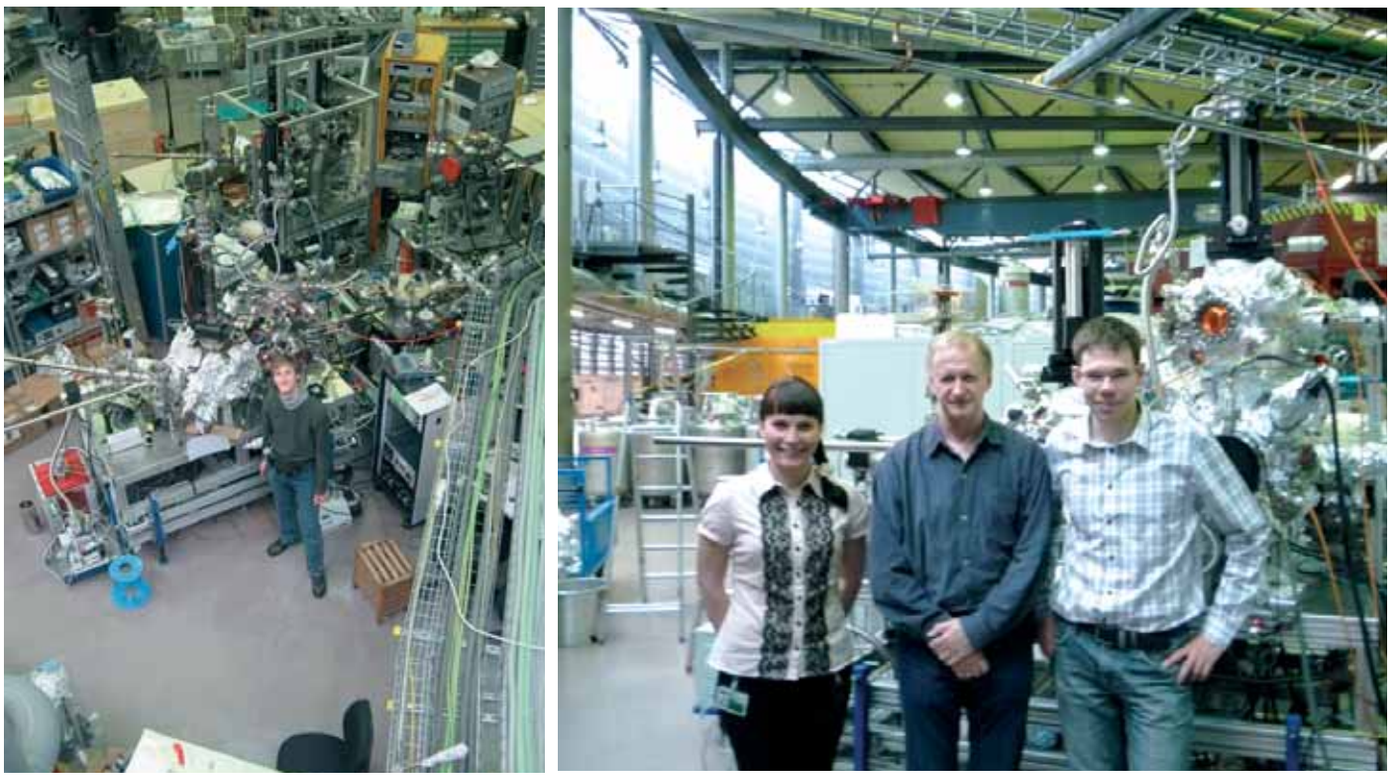
and a senior scientist. The scientific output is quite remarkable, with more than 250 publications published in peer reviewed journals including high impact journals, such as Nature, Physical Review Letters, and Nano Letters.

Currently, the Russian-German Laboratory is in the process of being significantly extended by a new undulator beamline by Helmholtz Center Berlin, funded by the German Federal Ministry of Education and Research (BMBF). This opens new perspectives for highly competitive experiments, since the photon flux and brilliance of the radiation are significantly increased.

A new high resolution photoemission endstation is currently being developed by TU Dresden, so that in two years the Russian-German Laboratory at BESSY II will be at the forefront of research worldwide. Novel experiments on physics, chemistry, and materials research will be promoted, with binational aspects in intense collaborations being the focus of these efforts.

Beamline scientist Alexander Nelyubov in front of the BESSY II facility in Berlin-Adlershof.

This unique infrastructure is of special importance to G-RISC, since physics and physical chemistry are two core disciplines of this Center of Excellence. G-RISC provided a beamline scientist for facilitating user support and progress at the Russian-German Laboratory. In October 2010, Alexander Nelyubov was hired and he is presently strengthening the team. He will be able to continue working in this stimulating environment until the end of 2011.



Impressions from the Russian German Laboratory at BESSY II: Beamline scientist Alexander Nelyubov at experimental station (left); G-RISC team from St. Petersburg works at the Russian-German Laboratory (Anna Popova, Prof. Dr. Alexander M. Shikin, Artem Rybkin) (right).

Teaching in G-RISC

Prof. Dr. A. V. Soldatov during his teaching.

G-RISC is attempting to bring together both young and established scientists from Russia and Germany. Transfer of knowledge from the experienced to the younger generation is the key to success. Therefore, a balance between research and education is the goal to be found within G-RISC.

From the beginning, G-RISC has encouraged experienced scientists from both countries to share their key competences with students and young scientists by offering compact interdisciplinary courses. Among several proposals, selected teaching projects were funded and realized, whereby care was taken to cover not just narrow fields of expertise, but rather broader topics of common interest to members of G-RISC.

A few highlights in teaching are:

Prof. Dr. A. V. Soldatov (Southern Federal University, Rostov/Don) has broad knowledge in physics and physical chemistry and he has several collaborational projects with German groups based mostly in Berlin. Between June 22 and June 25, 2010 he gave a compact class entitled: "Nanoscale atomic and electronic structure of materials: X-ray spectroscopy and theoretical insight." Topics covered in these lectures were: (i) Introduction: Atomic structure, electronic structure and physical properties; (ii) X-ray spectroscopic techniques; (iii) Theoretical methods for electronic structure and X-ray spectroscopy data analysis, (iv) Nanoscale local atomic structure of the materials on the basis of advanced theoretical analysis of X-ray spectroscopic experiments; and (v) Case studies on nanoclusters, metalloproteins, intermediates in chemical reactions, and catalysts.

His five lectures attracted about 30 people from different Berlin laboratories, where all lectures were videotaped and can be accessed for use either via the G-RISC office or Prof. A. V. Soldatov. Measurements of quality control were undertaken by asking the participants to fill out questionnaires. These indicated that the high expectations were fulfilled and that the concept of such classes appears to be attractive. Another highlight was a research lecture on "Inner-shell spectra of weakly-bound systems," given by Prof. N. Kosugi (Institute for Molecular Science, Okazaki, Japan). It was held right after the lecture series by Prof. Dr. A. V. Soldatov.

This allowed even inexperienced students to follow state-of-the-art research communicated by Prof. Dr. N. Kosugi. This teaching concept of a compact class for non-specialists followed by research talks appears to be most attractive for the educational efforts within G-RISC.

Prof. Dr. O. S. Vasyutinskii (Ioffe Institute, St. Petersburg) is a well-known scientist, who received the Alexander von Humboldt Research Award. Since that time he and his coworkers have visited the Institute of Physical Chemistry at TU Braunschweig. Earlier he had given courses on "Spectroscopy and Molecular Symmetry" at TU Braunschweig. These were incorporated into the framework of his four semester-long guest professorship (DAAD grant).

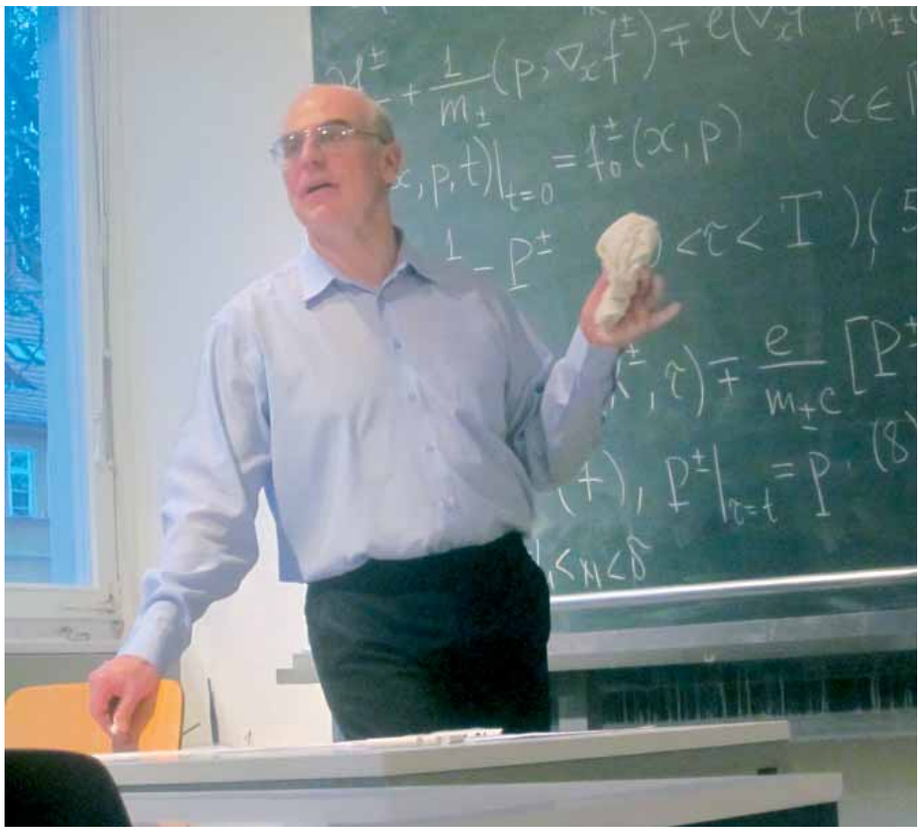
In 2010 he gave a two week lecture on "Theory of molecular (re)alignment and (re)orientation" funded by G-RISC, as an important introduction to cutting-edge molecular spectroscopy, which is of interest to students from physics and chemistry.

Prof. Dr. A. L. Skubachevskii gave several lectures during his stay in Berlin in January 2011, where he devoted his compact class to "Nonlocal problems. Interdisciplinary approach". This is in the sprit of G-RISC, since he aimed to bring together people from all disciplines covered by G-RISC.

The goal of his lectures bridging mostly physics and mathematics was to present an introduction to the theory of nonlocal boundary value problems and their applications to the following interdisciplinary fields: (i) Damping

problem for control system with delay – functional differential equations – nonlocal boundary value problems for ordinary differential equations; (ii) Control of temperature distribution in plasma and multidimensional diffusion processes – nonlocal elliptic boundary value problems – elliptic functional differential equations; (iii) Nonlocal Vlasov equations for rarefied plasma – nonclassical problems containing both partial differential equations and ordinary differential equations.

His lectures were attended by people from different fields covered by G-RISC and Prof. Dr. A. L. Skubachevskii did very well to explain the basic ideas even to non-specialists. Besides the teaching by outstanding scientists in Germany, there are also teaching activities within G-RISC carried out by scientists from Germany in Russia. One of the already existing ties between Russia and Germany is an educational program called ACOPHYS, an acronym that stands for Applied and COmputer PHYSics. It is a master's program taught in St. Petersburg and was launched in 2006.



Prof. Dr. A. L. Skubachevskii during his lecture at Freie Universität Berlin.

Within the framework of ACOPHYS **Prof. Dr. G. Gobsch** (TU Ilmenau) agreed to teach at St. Petersburg on optical properties of nanosystems and in late Spring 2011 gave a course on "Optical properties of nanosystems" He is an outstanding researcher in the field of optical and photoelectrical properties of semiconductors. Prof. Dr. G. Gobsch is one of the organizers of ACOPHYS at the Physical Faculty of St. Petersburg State University. Key issues of his lectures were: (i) Photoelectrical properties of new organic materials and (ii) Discussion of results of joint study of photoreflectivity spectra of III-V semiconductor whiskers. Another outstanding specialist teaching within ACOPHYS is **Prof. Dr. D. Michel** from Leipzig University. In 2010 he delivered a mastership lecture on „Nuclear magnetic resonance of low-dimensional systems" Prof. Dr. D. Michel is a well known specialist in the field of nuclear magnetic resonance, a member of the Saxonian Academy of Sciences and an Honorary Professor of the Physical Faculty of St. Petersburg State University. He is also is one of the organizers of the Russian-German ACOPHYS mastership program and a coordinator of this program.

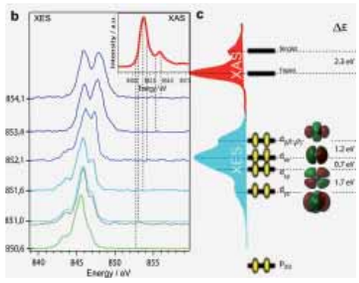
Interested audience at a G-RISC lecture.

Selected Projects in Physics and Geophysics

P-2010a-1	A. V. Soldatov	Southern Federal University Rostov/Don	Absorption and emission spectroscopy on liquids and interfaces
	E. Aziz	HZB Berlin	

Mikhail Soldatov (Rostov/Don), visit to Helmholtz Center Berlin (21.07.2010-07.09.2010)

Soft X-ray absorption (XA) and emission (XE) spectroscopy is a powerful method for probing the local electronic structure of light elements (e.g. C, O, N, S) and transition metals, which are all of importance for biochemical systems. Here, we report for the first time on the XE spectra of a liquid micro-jet sample in a vacuum environment. We developed a high resolution X-ray emission spectrometer and recorded the spectra of pure water in full agreement with those of the literature, as well as of an aqueous solution of $NiCl_2$. For the latter system, ground state Hartree–Fock calculations using a self-consistent reaction field (SCRF) approach were carried out to specify the nature of the d-occupied orbitals. Our results confirm the dark-channel-fluorescence-yield mechanism that we recently proposed for the case of metal ions in aqueous solutions. The ability to record absorption and emission spectra of an aqueous liquid-jet opens the way for the study of biochemical systems in physiological media.



Emission spectra of aqueous $NiCl_2$ at different excitation energies recorded at the Ni 2p-edge and schematic diagram of the occupied and unoccupied Ni-orbitals.

P-2010a-2	A. V. Soldatov	Southern Federal University Rostov/Don	Spectroscopy on atomic and electronic structure of Mn-complexes
	H. Dau	FU Berlin	

Svetlana Suchkova (Rostov/Don), visit to FU Berlin (24.05.2010-24.07.2010)

Photosynthetic water oxidation proceeds at a tetra-manganese complex bound to a cofactor-protein complex denoted as Photosystem II (PSII). To understand this process of fundamental importance for life on Earth, the crucial changes of the active-site occurring upon the individual transitions in the catalytic S-state cycle have been investigated by X-ray absorption spectroscopy at the Mn K-edge. For the S2-S3 transition, the changes in position and shape of the X-ray edge have been interpreted to be either associated with oxidation of Mn(III) to Mn(IV) or with formation of a ligand radical without manganese oxidation. Here, we simulate XANES spectra of simple Mn-complexes using modern codes: Full multiple-scattering code (FEFF 8.4), finite difference method code (FDMnes2009, FDMnes2010). We also pursued an investigation on the electronic structure of Mn complexes based on density functional theory (DFT) calculations performed by using the ADF2009 code. The properties investigated by the DFT approach are the total spin of Mn complexes, the total charge on Mn atoms, the net spin polarization on Mn atoms, and the total energy of complexes. It is concluded that the changes in position and shape of the edge spectra observed for the S2-S3 transition are explainable by the transformation of five-coordinated Mn(III) in a square-pyramidal geometry to six-coordinated Mn(IV).

P-2010a-3	A. V. Soldatov	Southern Federal University Rostov/Don	Local and electronic structure of free and deposited nanoclusters
	M. Neeb	HZB Berlin	

Kirill Lomachenko (Rostov/Don), visit to Helmholtz Center Berlin (15.04.2010-15.05.2010)

Nanoclusters are among the most widely studied objects in modern materials science. Free clusters are of great interest because their properties do not depend on any kind of substrate. Here, we present a XANES study of free Nb_{13}^+ and V_{13}^+ clusters, carried out at HZB Berlin. The data on the local atomic and electronic structure of free Nb_{13}^+ and V_{13}^+ nanoclusters were received from model calculations, where the electronic structure code FEFF8.4 and the non-muffin-tin code FDMNES were applied. These local atomic and electronic structures are in good agreement with the experimental XANES results. This indicates that most likely geometries of these clusters can be determined from this work. For Nb cluster it was shown that 3d-4f transition is much more likely than the 3d-5p transition. In addition, a possible mode of cluster fission is proposed based on the XANES spectra analysis. The experimental results indicate that Nb cluster fission is more effective when the central atom absorbs an X-ray photon.

P-2010a-4	A. S. Vinogradov	St. Petersburg State University	Electronic structure studies of graphene
	K. Horn	FHI Berlin	

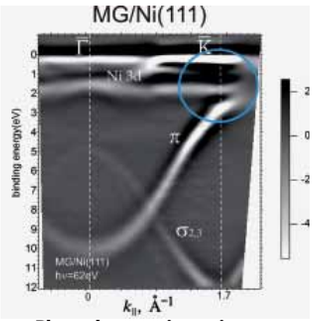
Alexander Generalov, Konstantin Simonov (St. Petersburg),
visit to Fritz-Haber-Institut der Max-Plank-Gesellschaft (24.05.2010-24.06.2010)

Large scale STM image of an epitaxial graphene layer on Rh(111). Inset: a LEED image of the graphene layer on Rh(111).

Graphene, the planar sheet of sp^2-bonded carbon atoms packed in a honeycomb lattice, has received enormous attention in recent years because of its unique physical properties. The investigation of the atomic structure of graphene/Rh(111) may provide an important insight into the interaction of graphene with transition metal substrates as well as deliver valuable information for possible applications, such as a possible template for the growth of metallic nanocluster arrays. Here, we present the results of STM and photoemission studies of the morphology and electronic structure of epitaxial single layer graphene on Rh(111). Our STM experiments show that formation of the graphene layer on Rh(111) is accompanied by variations of local interaction between the graphene layer and the Rh substrate. A simple ball model is successfully used. Results from photoelectron spectroscopy indicate that the bonding strength of the graphene layer on top of the Rh(111) surface is comparable to that observed in graphene/Ru(0001). In order to get further insight into the electronic structure of the system under investigation angle-resolved PES measurements were carried out. The measured dispersions of the Rh-related states are in good agreement with existing theoretical calculations for the Rh(111) surface. A pronounced dispersing character of the π bands is clearly observed. One of the possible explanations for such dramatic changes in the π band dispersion may be a considerable local redistribution of the orbital hybridization in graphene/Rh(111) as a result of the variation of the chemical bonding between carbon and rhodium atoms in the Moiré supercell.

P-2010a-6	A. M. Shikin	St. Petersburg State University	Spin and angle resolved studies of quantum well states
	C. Laubschat	TU Dresden	

Anna Makarova (St. Petersburg), visit to TU Dresden (15.07.2010-15.10.2010)



Photoelectron intensity map vs binding energy and parallel electron momentum of 1 ML graphene on top of Ni(111) ($h\nu$=62eV).

We explored the electronic structure of noble metal films synthesized on tungsten substrates using angle-resolved photoelectron spectroscopy. Our investigations in the scope of the present project consist of two parts: (i) analysis of quantum-size phenomena in the system of copper layers on W(100) and (ii) a study devoted to the system of silver and gold bilayers on W(110). The appearance of discrete valence electron states, so-called quantum-well states, in the double layered structure of copper pseudomorphic layers on W(100) was successfully disentangled. Apparently, those states reveal the properties similar to those reported for the experimentally studied Shockley and Tamm surface states that allow us to describe them in a corresponding manner. As for systems of silver and gold bilayers on W(110), we have investigated modification of electronic structure of thin silver layers on W(110) by admixture of Au atoms. Band structure changes in mixed systems with different amounts of gold and silver atoms were explored.

P-2010a-7	A. A. Pavlychev	St. Petersburg State University	Shape resonance processes in free SF_6 molecular clusters
	E. Rühl	FU Berlin	

Ksenia Brykalova (St. Petersburg), visit to FU Berlin (01.09.2010-30.09.2010)

The parametrization of asymmetric resonance features in continuous X-ray absorption spectra with asymmetric Lorentz and modeling interferential functions is performed in this project. Focus of the project is the asymmetric $4e_g$ shape resonance of SF_6 that has been studied in earlier experimental work in the S 2p-excitation regime in molecules and free variable size clusters. The nature of the $4e_g$ shape resonance asymmetry in X-ray absorption and photoemission spectra is studied in detail, employing the quasi-atomic approach. Fitting of the experimental results by model interferential functions is pursued, allowing for a comparison between the theoretical and experimental data. It is found that the asymmetry of the $4e_g$ shape resonance depends on the electro-optical characteristics of the core-excited atom. Further, the combination of the asymmetry-Lorentz and modeling-interferential-function methods is suitable for fitting and decomposing complex resonance features in X-ray absorption of free molecules and clusters. *L*- and *M*-functions used to analyze the experimental and theoretical spectra in the vicinity of the S $2p_{1/2,3/2} \rightarrow 4e_g$ shape resonance indicate a higher transparency of the molecular barrier than is expected from earlier work.

P-2010a-8	A. A. Pavlychev E. Rühl	St. Petersburg State University FU Berlin	Vibrational and rotational exciations associated with K-shell ionization in CO, N_2 and CO_2 molecules

Yury Krivosenko (St. Petersburg), visit to FU Berlin (14.07.2010-28.07.2010)

Rotational and vibrational excitations accompanying core level excitation and photoionization of molecular nitrogen into the excited $B^2\Sigma_u^+$ cation state are studied in this project. The rotational recoil effect induced, by the X-ray photoionization of the $B^2\Sigma_u^+$ state is analyzed. The dependence of the rotational recoil energy is theoretically investigated in a wide spectral regime, starting with (N 1s → π*-transition) valence excitations and reaching the vicinity of the resonance, when the photon energy is close to 400.88 eV. An analytical expression revealing an effective internuclear distance and mean rotational recoil energy are derived. Two different results for the transition through intermediate state and for the direct transition from the neutral ground state to the final ionized state are performed. It is shown how the vibrational motion can influence the rotational recoil by means of the effective internuclear distance. Furthermore, taking molecular vibrations into account leads to a 17% increase of the rotational recoil energy. The trend of the rotational recoil energy is shown to increase specifically in the vicinity of the $1\sigma_u \rightarrow 1\pi_g$ resonance, which is in agreement with previous experimental work.

P-2010a-10	A. M. Shikin O. Rader	St. Petersburg State University HZB Berlin	Modification of electronic structure of graphene monolayers

Anna Popova (St. Petersburg), visit to Helmholtz Center Berlin (12.07.2010-08.09.2010)

Investigations of graphene monolayer have attracted considerable interest in recent years due to its unusual electronic structure (linear "photon-like" dispersion of electron states near the Fermi level in the region of the K-point of the Brillouin zone) and its related unique transport properties. The presence of a substrate will influence the electronic properties of the graphene layer. The main aim of our work was investigation of principal features of electronic properties which appear as the result of the interaction of the graphene layer with different substrates. In the present work the electronic structure of such systems as 1 ML graphene on top of Ni(111), SiC(0001), Cu/Ni(111), and Au/Ni(111) was studied. All data were compared to each other and with the electronic structure of bulk monocrystalline graphite. In addition, for more detailed studies of the interaction of graphene with intercalated metal, the electronic and the crystal structures of this metal Au on top of W(110) were investigated by scanning tunneling microscope (STM). The experimental results show a modification of the electronic structure in the region of the K-point of the Brillouin zone near the Fermi level for intercalation of different metals (Au, Yb, Y, Gd) underneath a graphene monolayer formed at surfaces of thermally annealed SiC(0001) and thin films of Ni(111) on W(110).

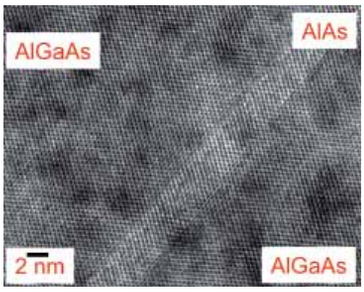
P-2010a-11	V. K. Adamchuk D. Vyalikh	St. Petersburg State University TU Dresden	Photoemission insight into electronic properties of graphene on boron nitride

Dmitry Usachov (St. Petersburg), visit to TU Dresden (14.06.2010-14.09.2010)

It has been demonstrated that freeing a single-atom thick layer of hexagonal boron nitride (h-BN) from tight chemical bonding to a Ni(111) thin film grown on a W(110) substrate can be achieved by intercalation of Au atoms into the interface. This process has been systematically investigated using angle-resolved photoemission spectroscopy. It has been shown that the transition of the h-BN layer from the "rigid" into the "quasi-freestanding" state is accompanied by a change of its electronic structure and the lattice constant, as well. Using chemical vapor deposition, a monolayer of carbon atoms packed into a two-dimensional honeycomb lattice (graphene) has been successfully synthesized on the insulating, quasi-freestanding h-BN monolayer. We anticipate that the *in situ* synthesized weakly interacting graphene/h-BN double layered system could be further developed for technological applications and may provide perspectives for further inquiry into the unusual electronic properties of graphene.

P-2010b-2	O. F. Vyvenko M. Seibt	St. Petersburg State University U. Göttingen	Combined optical and structural investigation of GaAs/AlGaAs single quantum well quality

Yury Kapitonov (St. Petersburg), visit to Universität Göttingen (26.10. 2010-25.11. 2010)



High resolution TEM image of MBE grown structures

Epitaxial structures with single GaAs/AlGaAs quantum wells were investigated and growth process structures were characterized by photoluminescence. A focused ion beam workstation was used for ultra-thin sample preparation. These samples (so-called lamellas) were studied using transmission electron microscopy. Different parameters, such as layer thickness and uniformity, heterointerface roughness, and aluminum distribution were measured. Energy-dispersive X-ray spectroscopy was used to obtain information about the composition of epitaxial layers. Important information about epitaxial layer thickness and composition was obtained. The roughness of heterointerfaces was measured. These data will be used in further epitaxial growth processes. The experience gathered will permit the establishment of the same FIB sample preparation and TEM investigation at St. Petersburg State University.

P-2010b-7	A. A. Pavlychev E. Rühl	St. Petersburg State University FU Berlin	Spatial localization of the shape resonance process in molecular SF_6 clusters

Ekaterina Klyushina (St. Petersburg), visit to FU Berlin (15.09. 2010-16.10.2010)

Resonance phenomena in X-ray absorption spectra of free, clustered, and solid SF_6 near the fluorine K ionization threshold are investigated. Special emphasis is put on X-ray absorption spectra of free, clustered, and solid SF_6 recorded in the F 1s→a_{1g}, t_{1u}, t_{2g} regimes. A comparison of high resolution spectra shows that distinct differences in line shapes of the t^{1u} resonance in free SF_6 and clustered SF_6 occur. It is shown that the inversion symmetry occurring in F 1s-excited free molecules is broken in molecular units bound in clusters and the solid. Due to the strong spatio-temporaral localization of the F $1s^{-1}a_{1g}$, F $1s^{-1}t_{1u}$, F $1s^{-1}$ t_{2g} resonances the triply degenerated F $1s^{-1}t_{1u}$ and F $1s^{-1}$ t_{2g} transitions are split into singly and doubly degenerated components. The splitting is maximal for free molecules and minimal for solid SF_6. This splitting can be used to estimate the size of the experimental results on free SF_6-clusters. An elongation of the interatomic S – F^{+}_{1s} bond is deduced from the modeling work; it is evidently to due to F 1s core hole localization.

G-2010b-1	V. N. Troyan S. Shapiro	St. Petersburg State University FU Berlin	Microearthquakes and seismic wave propagation in fractured fluid-saturated rocks

Olga Melchaeva (St. Petersburg), visit to FU Berlin (01.11.2010-31.12.2010)

One of the questions concerning seismicity in the area of industrial underground activities is a problem of induced and natural seismicity discrimination. It is supposed here that if any changes in seismic regime due to industrial activities take place, they should be reflected in changes of seismicity characteristics, which can be found with the help of a non-linear dynamics approach. An object of study is the seismicity in the area of the Geysers geothermal power plants located in a seismically active area in California. An intensive water injection began there in 1997. To study possible aftereffects of the injection, the Calpine Geysers earthquake catalogue was analyzed with the help of the Grassberger-Procaccia non-linear method. The catalogue was divided into two parts: before and after the start of injection. As a characteristic of seismicity, seismic activity was calculated as a sum of the cube roots of seismic-event energies occurring during a day. The obtained time series were analyzed with the help of correlation integral calculations. It was shown that the increase in injection volumes resulted in a change of the seismicity in the Geysers geothermal area; that appears as an increase of the deterministic component of the seismic regime and an attractor appearance with fractal dimensionality 4.5.

Selected Projects in Physical Chemistry

C-2010a-1	O. S. Vasyutinskii K.-H. Gericke	Ioffe Institute, St. Petersburg TU Braunschweig	Time resolved translational and rotational molecular motion of biologically relevant molecules using femtosecond lasers

Tatiana Korzinina (St. Petersburg), visit to TU Braunschweig (01.08.2010-31.08.2010)

In this project the experimental and theoretical study of the two-photon excited polarized fluorescence of p-terphenyl dissolved in cyclohexane was presented. The fluorescence was produced within a two-color two-photon excitation scheme utilizing simultaneous absorption of two femtosecond laser pulses at 400 nm and at 800 nm with a total excitation energy of 4.649 eV. The fluorescence was detected by a time correlated single photon counting system with two detectors. Using different combinations of the absorbed photon polarizations it was possible to extract seven time-dependent molecular parameters from the experiment which contain all information on the dynamics of the three-photon process under investigation. The analysis of the obtained molecular parameter values was based on *ab initio* calculations of the vertical excitation energies and transition matrix elements in p-terphenyl and enabled determination of the whole structure of the two-photon absorption tensor, fluorescence lifetime, and the rotational correlation time.

Sebastian Herbrich (TU Braunschweig), visit to Ioffe Institute, St. Petersburg (28.09.2010-25.10.2010)

These joint research project investigations on the alignment, orientation, and rotational correlation times in biological relevant molecules are provided. Within the framework of a previous project a fully quantum mechanical theoretical treatment of the two-photon two-color excited fluorescence in an arbitrary asymmetric top molecule was established and the experiments on the dynamics of two-color two-photon excited fluorescence of p-terphenyl were carried out. The biologically relevant molecules are: indole, N-acetyl-L-tryptophanamide (NATA), and 2-methyl-5-**t**-butyl-p-quaterphenyl (DMQ). The full power of the theoretical methods developed in the previous studies will be exploited. The interpretation of the obtained results requires additional intensive theoretical and computational support. The computations are performed by the Russian part of the team in St. Petersburg.

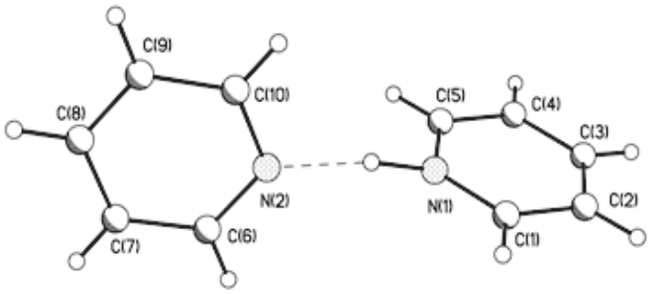
C-2010a-2	K. G. Tokhadze I. G. Shenderovich	St. Petersburg State University FU Berlin	Elucidation of geometry and proton dynamics in complex hydrogen bonded species in solution

Julia Rozhkova (St. Petersburg), visit to FU Berlin (10.09.2010-10.10.2010)

Protonation of acridine by strong acids results in a characteristic extension of its absorption spectrum, intensity increase, and a shift to longer wavelengths of its luminescence spectrum. A considerably more challenging task today is the elucidation of the structures of complexes of acridine hydrogen bonded to weaker acids. For example, absorption and luminescence spectra of acridine (pK_a=5.56) with acetic acid (pK_a=4.80) in dichloromethane show that the concentration of acid can be insufficient to form a complex with proton transfer with acridine. This observation might indicate that acetic acid cannot donate the proton to acridine in a low polar solvent. In contrast, at higher acetic acid concentration proton transfer takes place at compositions other than 1:1, which are presented in the solution. The positions of the luminescence maxima correlate with the pK_a of the acids. The stronger the proton donor, the stronger is the long-wavelength shift of the luminescence.

Shushu Kong (FU Berlin), visit to Russian Academy of Sciences, Moscow (16.05.2010-31.05.2010)

The understanding of the relation between spectral parameters and the structure of strong hydrogen bonds is crucial for the elucidation of reaction pathways in many chemical and biological systems. Homoconjugated ions of $[A\cdots H\cdots A]^-$ and $[B\cdots H\cdots B]^+$ types are benchmark systems of strong hydrogen bonds, since the proton affinities of the partners are the same. The present study deals with the protonated homodimer of the pyridine cation, $[Pyr\cdots H\cdots Pyr]^+$. The degree of protonation influences the ipso-angle of pyridine. The ideal C-N-C angle should be 120°. It is shown from X-ray diffraction experiments that the protonation of nitrogen atom in pyridines increases this angle to several degrees and deprotonated pyridines are characterized by smaller values of C-N-C angles.

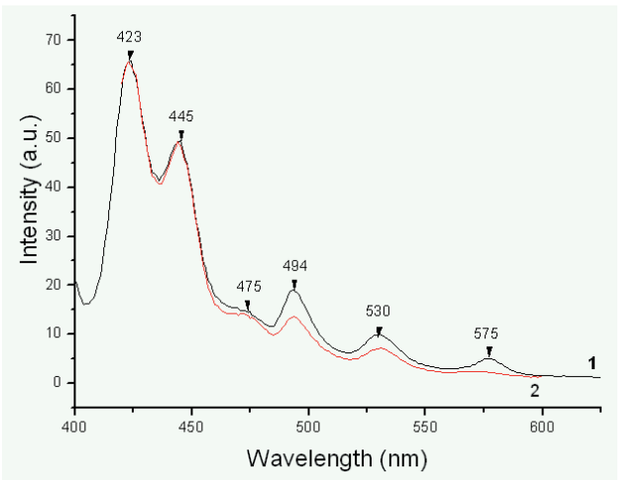


The XRD structures of $[Pyr\text{-}H\cdots Pyr]^+$

C-2010a-3	I. G. Korotkov I. G. Shenderovich	St. Petersburg State University FU Berlin	Morphology of amorphous solids on the nanoscale

Andrey Gurinov (FU Berlin), visit to St. Petersburg State University (31.05. 2010-30.06.2010)

In recent years novel porous materials that are periodically structured on the mesoscopic length scale have been synthesized. These periodic mesoporous materials opened up intriguing new application possibilities in catalysis, drug delivery, size selective molecular separation, and other fields, which in turn have encouraged some of us to study the structure and the dynamics of guest molecules in these materials. While the local host-guest interactions have been widely investigated in the past, much less is known about surface binding and surface diffusion of complex guest molecules able to form competing or cooperating interactions with the host surface. In particular, we are interested in adsorption of short polymer chains and complex heterocycles onto highly ordered, mesoporous silicas. The obtained data should help to describe the morphology of the studied materials on a nanometer scale. The spectral characteristics of the luminescence of the adsorbed molecules were studied using UV-VIS spectroscopy. The main goal of this study is to inspect the effect of the host guest interactions on the photochemical properties of the adsorbed molecules and determine whether optical methods are feasible for discriminating between bulk and adsorbed phases.



Luminescence spectra of anthracene on SiO_2: 1 – 385 nm excitation; 2 – 405 nm excitation.

C-2010a-5	Yu. S. Tver'yanovich P. St. J. Russell	St. Petersburg State University MPI Erlangen	Hybrid optical fiber devices based on doped and undoped chalcogenide glasses

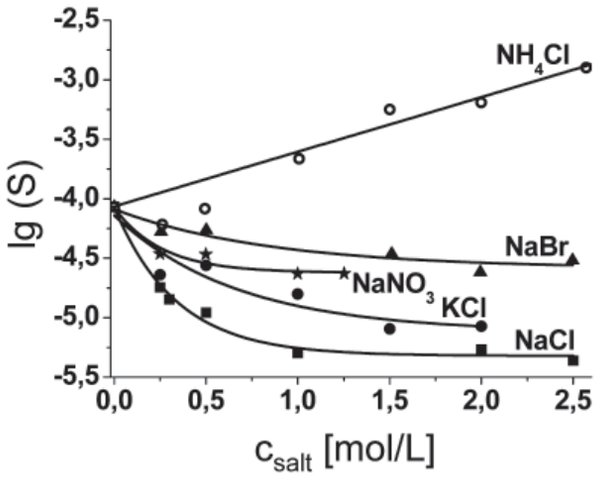
Ekaterina Tereshchenko (St. Petersburg), visit to MPI Erlangen (10.07.2010-10.09.2010)

This project contains results of a collaborative project on investigations of filling fibers composed of $Ga_4Ge_{21}Sb_{10}S_{65}$. The glass composition was developed, prepared, and investigated at the Chemical Faculty of St. Petersburg State University. Basic achievements of the project were the establishment of the most suitable parameters (temperature, pressure, time) for the filling process of glass fibers made of $Ga_4Ge_{21}Sb_{10}S_{65}$, by studying the influence of the filling process on the structure of the glass. Further important aspects of this collaboration included various methods of definition of a dispersion of refractive index of the extended fibers and an attempt to stretch the fibers made of $Ga_4Ge_{21}Sb_{10}Se_{65}$ by means of vacuum pumps. During the project a considerable quantity of fibers consisting of the glasses $Ga_4Ge_{21}Sb_{10}S_{65}$ and $Ga_4Ge_{21}Sb_{10}Se_{65}$ was studied. Optimum parameters of temperature and pressure for the process of pulling optical fibers have been developed. It is also shown that the filling process does not influence the structure of the glasses.

C-2010b-2	A. I. Victorov S. Enders	St. Petersburg State University TU Berlin	Effect of ion specificity on hydrophobic interactions and self-assembly of ionic amphiphiles in aqueous salt solution

Sofia Koroleva (St. Petersburg), visit to TU Berlin (11.11.2010-12.12.2010)

It is well known that the presence of a specific salt results in salting-in or salting-out effects that affect the solubility of hydrocarbons. When solubility decreases it is called salting-out, otherwise salting-in. Thus, modulation of the hydrophobicity of surfactant tails by a specific salt should also be expected. The goal of this work is to estimate quantitatively the change of the hydrophobic term owing to specific salts. We perform experimental measurements of solubility and analyze available literature data. The results on the solubility of hexane in solutions of different salts (NaCl, NaBr, $NaNO_3$, KCl, NH_4Cl) at varying salt concentration have been investigated. We found that the logarithm of hexane solubility decays exponentially, in contrast to the results of previous work. Future work is required to verify the experimental results obtained from this project and to clarify the possible reasons of disagreement with the results of previous work.



Logarithm of solubility [mol/L] of hexane in aqueous solutions of different salts (NaCl, KCl, $NaNO_3$, NaBr, NH_4Cl) vs. concentration (lines are only guides for the eyes)

C-2010b-4	K. G. Tokhadze I. G. Shenderovich	St. Petersburg State University FU Berlin	Radiation - a unique tool for science: From Nanoscience to Geophysics. Elucidation of geometry and proton dynamics in complex hydrogen bonded species in solution.

Alexandra Borisova (St. Petersburg), visit to FU Berlin (07.09.2010-21.09.2010)

The goal of this project is to develop a strategy for combining the advantages of different experimental and theoretical methods to study the geometry and proton dynamics in complex hydrogen bonded species. The aim of the current part of this project was to investigate the crystal structure of H-bonded cation-anion molecular complexes of collidine (2,3,5-trimethyl pyridine) with different substituted benzoic acids. A new DFT based strategy has been applied to elucidate the position of the proton to partially cope with the well-known problem of impossibility of precise localization of hydrogen atoms in X-ray diffraction investigations. X-ray diffraction investigations of the above mentioned systems showed that they are prone to form complexes with a 2:1 acid to base ratio. This is due to the preferability of H-bond formation in comparison with C-H…O interactions. It is evident from the present work that the distances provided by DFT calculations are very close to results from NMR estimations.

C-2010b-6	E. S. Shubina P. Tolstoy	Inst. for Organic Chemistry (RAS), Moscow FU Berlin	Hydrogen bonded complexes involving organometallic acids and bases

Gleb Silantiev (Moscow), visit to FU Berlin and Universität Greifswald (01.10.2010-30.11.2010)

In the framework of this project the synthetic and experimental skills of working with liquefied freon gas mixtures and their use as a solvent for low-temperature NMR spectroscopy were acquired at FU Berlin in the group of Dr. P. Tolstoy during the first month. These skills were used for independent work at the University of Greifswald (group of Prof. Dr. K. Weisz) during the second month of stay to study proton transfer to transition metal complexes. This study was initiated at INEOS RAS (Moscow; group of Prof. Dr. E.S. Shubina) for the examples of diiron complex – model of [FeFe]-hydrogenase active site – and of ruthenium hydride CpRuH(dppe) using IR and UV spectroscopy in a wide temperature range. The understanding of the acquired results was only possible in combination with NMR measurements. The data obtained in German laboratories allowed us to establish the hydrogen bonded intermediates of the process and characterize their structures. The results have also revealed interesting details of the reaction mechanism which will be the subject of future investigations.

Selected Projects in Mathematics

M-2010a-1	A. L. Fradkov E. Schöll	St. Petersburg State University FU Berlin	Synchronization and control of complex networks with time delay

Judith Lehnert (TU Berlin), visit to St. Petersburg State University (01.06.2010-30.06.2010)

Within the field of synchronization and control of complex networks with time delay a generic model of one single unstable fixed point was studied for collaborative work with Prof. Fradkov. Here, the speed gradient method was used to adjust the feedback gain for the control of an unstable steady state. As an extension to previous work the role of different initial conditions and the role of noise were investigated. Firstly, these two aspects were studied for diagonal coupling. Furthermore, studies were carried out for the case where the control is only applied to the first component of the focus. It is shown for both coupling types that the control method is successful for a large range of initial conditions and is robust for small and intermediate noise strengths. As a long term goal it would be interesting to use such adaptive control methods (i) in networks and (ii) with more complex models, such as the model of a SNIPER or the FitzHugh-Nagumo model. There, an unstable focus is controlled by adaptive Pyragas control.

M-2010a-2	A. L. Fradkov E. Schöll	St. Petersburg State University TU Berlin	Synchronization and control of complex networks with time delay

Anton Seliyanov (St. Petersburg), visit to FU Berlin (27.09.2010-27.10.2010)

We consider networks of delay-coupled Stuart-Landau oscillators. As has been shown in the literature, the value of the coupling phase is a crucial control parameter. By applying the speed-gradient method we derive an adaptive algorithm for tuning the coupling phase, so that a desired synchronous state is obtained. We propose a goal function whose minimum corresponds to different states of cluster synchronization. We demonstrate that the speed-gradient method allows one to find the coupling phases for which the various states of synchronization, i.e. in-phase oscillation, splay state, or different cluster states, are stable. Even without knowledge of exact values of the system's parameters we can provide a specific state of synchrony in a multistable regime.

M-2010a-3	A. L. Skubachevskii B. Fiedler	Peoples' Friendship University Moscow FU Berlin	Stability and control of nonlocal spatio-temporal systems. Thermocontrol problems with hysteresis

Pavel Gurevich (FU Berlin), visit to Peoples' Friendship University of Russia (Moscow) (29.03.2010-12.04.2010)

In this project, we consider dynamic systems with hysteresis. Models with hysteresis naturally arise in a mathematical description from many physical processes. Our prototype model describes various processes of thermal control, where the temperature regulation in a domain is performed via heating (or cooling) elements on the boundary of the domain. The regime of the heating elements on the boundary is based on the registration of thermal sensors inside the domain and obeys the hysteresis law. In particular, such processes take place in chemical reactors, climate-control systems, biological cells, etc. Generalizations to various phase-transition problems with hysteresis as well as some related issues of optimal control have been studied by many authors. The most important questions here concern the existence and uniqueness of solutions, the existence of periodic solutions, and large-time behavior of solutions. Our approach is based on regarding the problem as an infinite-dimensional dynamic system. By using the Fourier method, we reduce a boundary-value problem for the heat equation to infinitely many ordinary differential equations, whose solutions are coupled with each other via the hysteresis operator. The co-existence of several periodic solutions is explored, and scenarios of their appearance as well as change of stability are studied.

M-2010a-4	A. L. Skubachevskii P. Gurevich	Peoples' Friendship University Moscow FU Berlin	Stability and control of nonlocal spatio-temporal systems. Spectral theory of nonlocal elliptic problems

Ksenia Darovskaya (Peoples' Friendship University, Moscow)
visit to FU Berlin (23.04.2010-23.05.2010)

We study an ordinary differential operator with nonlocal boundary conditions and a spectral parameter. Boundary conditions are given by Riemann integrals, which contain a linear combination of the unknown function and its derivatives. In the Sobolev space and in the space of right-hand members we introduce equivalent norms, depending on the spectral parameter. In terms of these norms we obtain an a priori estimate of solutions for sufficiently large values of the spectral parameter. In addition, we determine a rule for how to choose equivalent norms in the space of right-hand members for such problems. As a result of this project, we have obtained a priori estimates of solutions for the problems with three classes of integral conditions. The next step is to prove the Fredholm solvability for the conditions considered in this work, and we plan to study the corresponding parabolic problems.

M-2010a-5	A. L. Fradkov E. Schöll	St. Petersburg State University TU Berlin	Implementation of tools for e-teaching

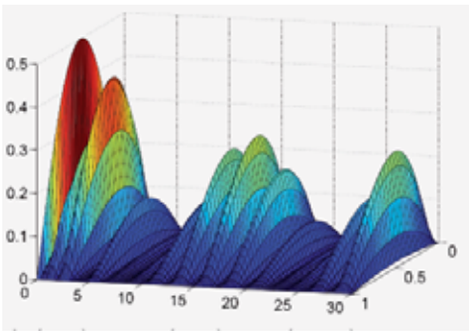
Philip Hövel (TU Berlin), visit to St. Petersburg State University (08.06.2010-16.06.2010)

Multimedia and e-learning are valuable tools for enhancing students' education. By internet-based techniques, students from different locations around the globe can profit from jointly performed lecture series. For this purpose, lectures could be given using e-chalk (http://www.e-kreide.de/), which means that they are available on the web for download or replay including audio by students from all institutions participating in the G-RISC framework immediately after the lecture is finished. With respect to future workshops, the new computer equipment can also be used as a presentation platform for the benefit of those advanced students who are entering the international conference community. In addition, different working groups can profit from an enhanced multimedia infrastructure via virtual group meetings. In these meetings, all group members will come together at their home institution and are connected via the internet to other groups within the same project. This will facilitate discussion and scientific exchange.

M-2010a-6	V. Reitmann B. Fiedler	St. Petersburg State University FU Berlin	Control of the temperature fields under boundary microwave heating

Yuri Kalinin (St. Petersburg), Sur-Place Stipend in period March-October 2010

A coupled system derived from Maxwell's equations and the heat transfer equation is studied. We investigate the problem of microwave heating in the presence of external Bohr almost-periodic perturbation. We consider the system where microwave radiation is generated by Maxwell's equations and heat transfer in some material is represented by the heat transfer equation. Maxwell's equations are nonlinearly coupled with the heat equation including a local density of heat source by microwaves. We show that under certain conditions, solutions of the system converge to an almost periodic solution of the system and remain bounded. If these conditions do not hold, then runaway of the solution or a blow-up in finite time may occur. For the system with perturbations a cocycle formulation is present. In the case of almost-periodic perturbations conditions for the existence of almost periodic solutions are derived for the one-dimensional case. The first results in this direction are presented in a submitted publication. It was shown that almost-periodic perturbation on the boundary of the interval results in oscillations of the temperature profile. We plan to extend these results to the multi-dimensional case.



Solution component of the system for different $p \in [0.5, 0.5]$

M-2010b-2	V. Reitmann R. Picard	St. Petersburg State University TU Dresden	Electromagnetic wave propagation in complex materials with thermo-electric coupling

Nail Yumaguzin (St. Petersburg), visit to TU Dresden (1.11.2010-30.11.2010)

The original problem under consideration describes the possibility of treating tumors in biological tissue by local hypothermia. This problem formulation suggests a complex non-homogeneous medium structure and the importance of the precise control over the hypothermia process. This process is modeled by electromagnetic waves (generated by an external source) and heat effect (Joule's law) in organic material. We consider a system in which electromagnetic radiation is generated by Maxwell's equations and the heat effect in some material is represented by the heat transfer equation. Under certain assumptions it is shown that solutions of the system converge to zero solution. For this system with homogeneous Dirichlet boundary conditions a dynamical system is constructed. Under certain assumptions it is shown, using special energy functionals, that any solution tends to a stationary zero solution if the time tends to infinity. We plan to extend our work to a more complex medium, to cover the initial applied problem of some organic medium and of a two-phase material. Furthermore, we have to interpret properties of weak solution of the initial problem in more details concerning the needs of applied problems.

M-2010b-4	A. L. Skubachevskii B. Fiedler	Peoples' Friendship University Moscow FU Berlin	Functional differential equations with contracted and expanded arguments

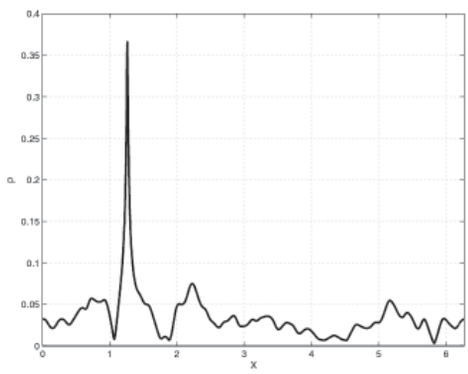
Alla Tasevich (Moscow), visit to FU Berlin (20.11.2010-20.12.2010)

During the project the functional differential equations with the Dirichlet's conditions and with contraction and expansion of arguments were studied. Necessary and sufficient conditions are obtained under which a Gårding type inequality holds. These results allow us to verify coerciveness by using a special symbol of the equation considered. The domain of operators participating in the equation was appreciably extended. In this way the previous results to a wider class of operators are generalized. We considered some functional differential equations and their properties. Our aim is to extend the domain of strongly elliptic operators. The next step is studying more generalized functional operators. Maybe they will have contractions of some variables and expansion of others.

M-2010b-6	A. L. Skubachevskii B. Fiedler	Peoples' Friendship University Moscow FU Berlin	Stability and control of nonlocal spatio-temporal systems. Functional differential equations and nonlinear water waves

Roman Shamin (Moscow), visit to FU Berlin (20.11.2010-20.12.2010)

During project performance important results in research of nonlinear water waves have been received. The equations describing freak waves are investigated. The freak waves are nonlinear waves with the extreme amplitude. These waves represent very important and difficult objects in oceans. In our work we investigated these waves theoretically and numerically. To describe the wave dynamics we use functional differential equations on functions in conform variables. We propose approximations of such equations using a differential inclusion, which allows us to construct proof computations. During the numerical experiments we confirmed the formation of freak waves in nonlinear dynamics of an ideal liquid with free surface. We have determined probabilities of the occurrence of freak waves in the ocean.



Frequencies of occurrence of freak waves depending on dispersion.

M-2010b-7	A.L. Skubachevskii W. Jaeger	Peoples' Friendship University Moscow U. Heidelberg	Stability and control of nonlocal spatio-temporal systems. Elliptic function differential equations

Anna Luchanskaya (Moscow), visit to Universität Heidelberg (02.11.2010-01.12.2010)

During my visit to the group of Professor Jaeger I got a chance to familiarize myself with research of members of the group and discuss some important problems with them. I found out several new applications of difference operators and partial differential equations, such as: transport of hormones, screw theory, derivative based methods for dde models in systems biology, advection-diffusion-reaction problems. Most of the time was devoted to work on the project entitled: "Stability and control of nonlocal spatio-temporal systems. Elliptic function differential equations". In the future, we plan to consider necessary and sufficient conditions of strong ellipticity for the operator under consideration in an arbitrary domain. Additionally, we intend to consider the boundary value problem for such an operator and its higher derivatives.

Funded Projects in Physics

Project No.	Principal Investigators	Location	Title of Project
		First Funding Period (March – October 2010)	
P-2010a-1	A. V. Soldatov E. Aziz	Southern Federal University Rostov/Don HZB Berlin	Absorption and emission spectroscopy on liquids and interfaces
P-2010a-2	A. V. Soldatov H. Dau	Southern Federal University Rostov/Don FU Berlin	Spectroscopy on atomic and electronic structure of Mn-complexes
P-2010a-3	A. V. Soldatov M. Neeb	Southern Federal University Rostov/Don HZB Berlin	Local and electronic structure of free and deposited nanoclusters
P-2010a-4	A. S. Vinogradov K. Horn	St. Petersburg State University FHI Berlin	Electronic structure studies of graphene
P-2010a-6	A. M. Shikin C. Laubschat	St. Petersburg State University TU Dresden	Spin and angle resolved studies of quantum well states
P-2010a-7	A. A. Pavlychev E. Rühl	St. Petersburg State University FU Berlin	Shape resonance processes in free molecular SF_6 clusters
P-2010a-8	A. A. Pavlychev E. Rühl	St. Petersburg State University FU Berlin	Vibrational and rotational exciations associated with K-shell ionization in CO, N_2, and CO_2 molecules
P-2010a-10	A. M. Shikin O. Rader	St. Petersburg State University HZB Berlin	Modification of electronic structure of graphene monolayers
P-2010a-11	V. K. Adamchuk D. Vyalikh	St. Petersburg State University TU Dresden	Photoemission insight into electronic properties of graphene on boron nitride
		Second Funding Period (July – December 2010)	
P-2010b-1	V. F. Agekyan G. Bacher	St. Petersburg State University U. Duisburg-Essen	Optical study of nanostructures contained magnetic ions
P-2010b-2	O. F. Vyvenko M. Seibt	St. Petersburg State University U. Göttingen	Combined optical and structural investigation of GaAs/AlGaAs single quantum well quality
P-2010b-3	Yu. S. Dedkov K. Horn	St. Petersburg State University FHI Berlin	Functionalization of Moiré graphene on Rh(111)
P-2010b-4	B. V. Novikov D. Michel	St. Petersburg State University U. Leipzig	Nuclear magnetic resonance of low-dimensional systems
P-2010b-5	V. M. Shabaev G. Plunien	St. Petersburg State University TU Dresden	Charge exchange, excitation and ionization processes in heavy-ion collisions
P-2010b-6	A. V. Soldatov E. Rühl	Southern Federal University Rostov/Don FU Berlin	Local and electronic structure of sulfur-containing proteinogenic amino acids functionalizing nanoparticles: XANES and DFT analysis
P-2010b-7	A. A. Pavlychev E. Rühl	St. Petersburg State University FU Berlin	Spatial localization of the shape resonance process in molecular SF_6 clusters

Project No.	Principal Investigators	Location	Title of Project
P-2010b-9	A. M. Shikin E. Rühl	St. Petersburg State University FU Berlin	Beamline scientist at the Russian-German Laboratory at BESSY II
		Third Funding Period (January – July 2011)	
P-2011a-1	B. V. Novikov G. Gobsch	St. Petersburg State University TU Ilmenau	Study of nanosystem optical properties and delivering of mastership lectures accord course "Optical properties of nanosystems" in the frame of joint Russian-German mastership program "ACOPHYS"
P-2011a-2	E. O. Filatova F. Schäfers	St. Petersburg State University HZB Berlin	Characterization of internal structure of thin Al_2O_3, HfO_2 and SiO_2 films synthesized on Ge(100) by X-ray reflection spectroscopy
P-2011a-3	A. A. Pavlychev E. Rühl	St. Petersburg State University FU Berlin	Electronic, vibrational and rotational excitations associated with X-ray ab sorption and inner-shell photoionization in free and caged molecules, molecular clusters and the solid
P-2011a-4	N. A. Kasyanenko S. Santer	St. Petersburg State University U. Potsdam	Light-induced reversible DNA compaction by photosensitive surfactants
P-2011a-5	V. M. Shabaev G. Plunien	St. Petersburg State University TU Dresden	Screened vacuum-polarization corrections to the hyperfine splitting in heavy lithium- and boron-like ions
P-2011a-6	A. M. Shikin O. Rader	St. Petersburg State University HZB Berlin	Modification of electronic and spin structure of graphene under interaction with metals with different structure of the valence band and different atomic numbers
P-2011a-7	A. M. Shikin C. Laubschat	St. Petersburg State University TU Dresden	Modification of structural properties in biomolecules by noble metals
P-2011a-8	V. K. Adamchuk C. Laubschat	St. Petersburg State University TU Dresden	Synthesis of nitrogen-doped graphene layers and characterization of their structural and electronic properties
P-2011a-9	V. K. Adamchuk C. Laubschat	St. Petersburg State University TU Dresden	Theoretical insight into the electron-hybridization phenomena in Eu-based heavy-fermion systems
P-2011a-10	A. S. Vinogradov B. Friedrich	St. Petersburg State University FHI Berlin	Directional and spectroscopic properties of molecules in combined electric and magnetic fields
P-2011a-11	A. V. Soldatov E. Aziz	Southern Federal University Rostov/Don HZB Berlin	X-ray absorption fine structure and X-ray emission spectroscopy on liquids: Probing structure and dynamics
P-2011a-12	A. V. Soldatov W. Kuch	Southern Federal University Rostov/Don FU Berlin	Local atomic, electronic and magnetic structures of new magnetic materials: combining experiment and theory

Project No.	Principal Investigators	Location	Title of Project

Funded Projects in Geophysics

Second Funding Period (July – December 2010)

G-2010b-1	V. N. Troyan S. Shapiro	St. Petersburg State University FU Berlin	Microearthquakes and seismic wave propagation in fractured fluid-saturated rocks

Third Funding Period (January – July 2011)

G-2011a-1	G. M. Shved C. Jacobi	St. Petersburg State University U. Leipzig	Studies of short-period atmospheric gobal waves from simultaneously co-located microbarometer and seismometer measurements

Funded Projects in Physical Chemistry

First Funding Period (March – October 2010)

C-2010a-1	O. S. Vasyutinskii K.-H. Gericke	Ioffe Institute, St. Petersburg TU Braunschweig	Time resolved translational and rotational molecular motion of biologically relevant molecules using femtosecond lasers
C-2010a-2	K. G. Tokhadze I. G. Shenderovich	St. Petersburg State University FU Berlin	Elucidation of geometry and proton dynamics in complex hydrogen bonded species in solution
C-2010a-3	V. I. Korotkov I. G. Shenderovich	St. Petersburg State University FU Berlin	Morphology of amorphous solids on the nanoscale
C-2010a-5	Yu. S. Tver'yanovich P. St. J. Russell	St. Petersburg State University MPI Erlangen	Hybrid optical fiber devices based on doped and undoped chalcogenide glasses

Second Funding Period (July – December 2010)

C-2010b-1	O. S. Vasyutinskii K.-H. Gericke	Ioffe Institute, St. Petersburg TU Braunschweig	Time resolved translational and rotational molecular motion of biologically relevant molecules using femtosecond lasers
C-2010b-2	A. I. Victorov S. Enders	St. Petersburg State University TU Berlin	Effect of ion specificity on hydrophobic interactions and self-assembly of ionic amphiphiles in aqueous salt solution
C-2010b-4	K. G. Tokhadze I. G. Shenderovich	St. Petersburg State University FU Berlin	Radiation - a unique tool for science: From Nanoscience to Geophysics. Elucidation of geometry and proton dynamics in complex hydrogen bonded species in solution.
C-2010b-5	V. I. Korotkov I. G. Shenderovich	St. Petersburg State University FU Berlin	Radiation - a unique tool for science: From Nanoscience to Geophysics. Morphology of amorphous solids on the nanoscale.
C-2010b-6	E. S. Shubina P. Tolstoy	Inst. for Organic Chemistry (RAS), Moscow FU Berlin	Hydrogen bonded complexes involving organometallic acids and bases

Project No.	Principal Investigators	Location	Title of Project
C-2010b-7	Yu. S. Tver'yanovich P. St. J. Russell	St. Petersburg State University MPI Erlangen	Passive and active silica-chalcogenide microstructured fibers
		Third Funding Period (January – July 2011)	
C-2011a-1	V. I. Korotkov I. G. Shenderovich	St. Petersburg State University FU Berlin	Radiation - a unique tool for science: From Nanoscience to Geophysics. Clustering of adsorbed molecules on amorphous silica surfaces
C-2011a-2	M. U. Antipin I. G. Shenderovich	RAS, Moscow FU Berlin	Radiation - a unique tool for science: From Nanoscience to Geophysics. Search for a correlation between the structure and luminescence of acridinium crystals
C-2011a-3	R. V. Talroze E. Rühl	RAS, Moscow FU Berlin	Photoluminescence of nanoparticles organized by self-assembled liquid crystal polymer matrix
C-2011a-4	E. S. Shubina K. Weisz	RAS, Moscow U. Greifswald	Hydrogen bonding and proton transfer to organometallic complexes of ruthenium
C-2011a-5	A. S. Shulakov B. Paulus	St. Petersburg State University FU Berlin	First-principles calculations of the electronic structure and X-ray spectra of the rare earth and other metal surfaces

Funded Projects in Mathematics

		First Funding Period (March – October 2010)	
M-2010a-1	A. L. Fradkov E. Schöll	St. Petersburg State University TU Berlin	Synchronization and control of complex networks with time delay
M-2010a-2	A. L. Fradkov E. Schöll	St. Petersburg State University TU Berlin	Synchronization and control of complex networks with time delay
M-2010a-3	A. L. Skubachevskii B. Fiedler	Peoples' Friendship University Moscow FU Berlin	Stability and control of nonlocal spatio-temporal systems. Thermocontrol problems with hysteresis
M-2010a-4	A. L. Skubachevskii P. Gurevich	Peoples' Friendship University Moscow FU Berlin	Stability and control of nonlocal spatio-temporal systems. Spectral theory of nonlocal elliptic problems
M-2010a-5	A. L. Fradkov E. Schöll	St. Petersburg State University TU Berlin	Implementation of tools for e-teaching
M-2010a-6	V. Reitmann B. Fiedler	St. Petersburg State University FU Berlin	Control of the temperature fields under boundary microwave heating
M-2010a-9	S. A. Kashchenko U. Bandelow	Yaroslavl State University WIAS Berlin	Nonlinear dynamics in laser systems
M-2010a-11	G. V. Osipov A. Pikovsky	Nizhny Novgorod State University U. Potsdam	Neuron Ensembles: From Dynamics to Statistics

Project No.	Principal Investigators	Location	Title of Project
M-2010a-12	G. A. Leonov B Fiedler	St. Petersburg State University FU Berlin	Sets of diffeomorphisms of smooth manifolds with various shadowing properties
		Second Funding Period (July – December 2010)	
M-2010b-1	S. A. Kashchenko U. Bandelow	Yaroslavl State University WIAS Berlin	Nonlinear dynamics in laser systems
M-2010b-2	V. Reitmann R. Picard	St. Petersburg State University TU Dresden	Electromagnetic wave propagation in complex materials with thermo-electric coupling
M-2010b-4	A. L. Skubachevskii B. Fiedler	Peoples' Friendship University Moscow FU Berlin	Functional differential equations with contracted and expanded arguments
M-2010b-6	A. L. Skubachevskii B. Fiedler	Peoples' Friendship University Moscow FU Berlin	Stability and control of nonlocal spatio-temporal systems. Functional differential equations and nonlinear water waves
M-2010b-7	A. L. Skubachevskii W. Jaeger	Peoples' Friendship University Moscow U. Heidelberg	Stability and control of nonlocal spatio-temporal systems. Elliptic function differential equations
M-2010b-8	V. Reitmann H Kantz	St. Petersburg State University MPI Dresden	Functionals that uniquely determine asymptotic dynamics of the microwave heating systems
M-2010b-9	A. L. Skubachevskii B. Fiedler	Peoples' Friendship University Moscow FU Berlin	Stability and control of nonlocal spatio-temporal systems. Dynamical systems with hysteresis
		Third Funding Period (January – July 2011)	
M-2011a-1	A. L. Fradkov E. Schöll	St. Petersburg State University TU Berlin	Adaptive control of complex networks with time delay
M-2011a-2	A. L. Skubachevskii B. Fiedler	Peoples' Friendship University Moscow FU Berlin	Nonlocal Problems. Interdisciplinary Approach
M-2011a-3	G. V. Osipov J. Kurths	Nizhny Novgorod State University HU Berlin	Dynamics and control of complex media consisted of oscillatory, excitable and passive elements with applications to cardiology
M-2011a-4	A. L. Fradkov E. Schöll	St. Petersburg State University TU Berlin	Adaptive synchronization for delay-coupled networks of Stuart-Landau oscillators
M-2011a-5	V. Reitmann P. Gurevich	St. Petersburg State University FU Berlin	Cusp bifurcation in the microwave heating system

Funded G-RISC Workshops

Project No.	Principal Investigators	Location	Title of Project
Second Funding Period (July – December 2010)			
W-2010b-1	E. Rühl	HZB Berlin (October 18-20, 2010)	First German-Russian Interdisciplinary Workshop on the Structure and Dynamics of Matter
W-2010b-2	A. L. Skubachevskii	Peoples' Friendship University of Moscow (August 14-19, 2011)	The International Workshop: "Spatio-Temporal Dynamical Systems"
W-2010b-4	A. M. Shikin	St. Petersburg State University (November 15-19, 2010)	The first Russian-German- interdisplinary International Student Conference "Science and Progress"
W-2010b-5	A. V. Soldatov	Southern Federal University Rostov-on Don (December 16-17, 2010)	German-Russian Interdisciplinary Workshop "Nanodesign: Physics, Chemistry, Computer Modeling"

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