HGSFP

NEWSLETTER

Heidelberg Graduate School of Fundamental Physics

No. 2/November 2008

Main topics:

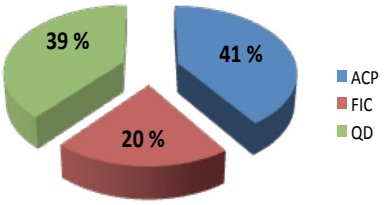
Editorial

The directors of the Graduate School of Fundamental Physics are pleased to note that all the programmes envisaged for the school are now running extremely well. To mention one particular point: many students have been using the possibility of making scientific visits to their collaborators at partner institutes ranging from Harvard to Bologna. The feedback we have received so far is overall very positive. We are also extremely proud of our students, who have shown so much initiative in defining and organising their own winter school and workshops. Time is passing by so quickly, and some of our students are already completing their degree and will join our alumni club. To all of you, staff, students and alumni alike, we wish you lots of pleasure in reading this edition of our newsletter. Do remember that you are warmly welcome to provide contributions, give us feedback and make suggestions for improvements.

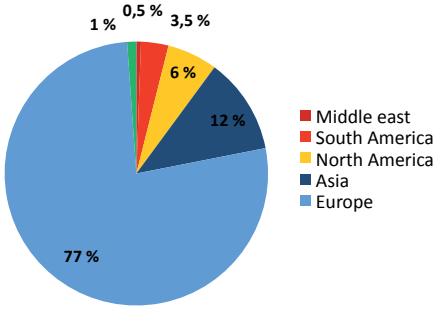
Peter Schmelcher

Facts and figures

■ The number of doctoral students at the Graduate School is growing steadily. As of November 2008, a total of 180 students are registered. Broken down into the branches, we have 73 students currently doing research in Astronomy and Cosmic Physics, 70 in the branch Quantum Dynamics and Complex Quantum Systems and 37 in the branch Fundamental Interactions and Cosmology. The percentage of female students lies on average at 23%, with most female doctoral students working in the branch of Astronomy and Cosmic Physics with a total of 32%. ◀



Distribution of students in the three branches: Astronomy and Cosmic Physics, Fundamental Interactions and Cosmology and Quantum Dynamics and Complex Quantum Systems



Distribution of the countries of origin of the students

The »Graduate Days«

■ The coming »Graduate Days« will take place in spring from 23rd to the 29th March 2009. This time, the Hans-Jensen lecture will be held by Anthony Leggett, and will focus on testing the limits of quantum physics.The lecture programme this time will contain one soft skills course on effective presentations together with lectures on various topics in theoretical and experimental physics.

Once again, we will host an industry lecture that will be held by Prof. Andreas Mielke from the company „vm Solutions“, and who will be able to give you insights into methods and applications of physical ideas outside of the context of the University. ◀

Student representation and projects

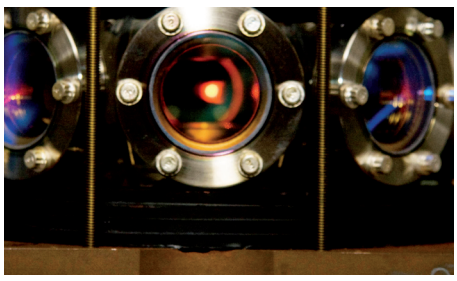
■ The graduate students have a new voice in the board of directors! Patrick Plötz was elected spokesperson on Friday 14th of November and will succeed Bernd Hezel in representing the interests of the PhD students within the graduate school. His deputy will be Michael Henke. A big thanks goes to Bernd Hezel and Marc Deissenroth for the work they have put into representing the students in the Graduate School.

The next major students‘ project is already due in January: After the convincing success of the first HGSFP Winter School, the next school will again take place in Obergurgl, Austria from 6th to 11th of January 2009. Lecture series on astronomy, high energy physics and quantum dynamics will run in parallel for about ten students from each branch. The organizers hope to provide the great balance of recreational activities and scientific benefit that the attendees have attested to from the past event. ◀

Students in discussion at the Graduate School Central Office

Ultracold Fermi Gas at the MPI-K

■ An ultracold Fermi gas containing a mixture of atoms in three different spin states has been realized in the group of Selim Jochim at the MPI-K. Such a gas is particularly interesting as this three-component mixture has the same SU(3) symmetry as a single-flavor quark system with its three colors. As the interactions in the atomic gas can be tuned at wish by applying a magnetic field, such a gas could be an ideal system to study some of the many interesting phases that are proposed to exist in dense quark matter. A first step in this direction has already been done: By studying the loss of atoms from the gas, a loss resonance was observed for a particular value of the interaction strength between the particles, which indicates the formation of a three-body bound state. ◀



Starting point for experiments with ultracold fermions: Li-6 atoms in a magneto-optical trap


Jürgen Schaffner-Bielich


Norbert Christlieb


Manfred Salmhofer


Klaus Blaum


Björn Malte Schäfer

Personalia

■ The HGSFP congratulates Lorenz Cederbaum for receiving an advanced investigator grant from the European Research Council for the coming five years. We in addition congratulate Victor Lendermann and Stefan Groot Nibbelink for obtaining the Hengstberger prize, which will enable them to organise and host a symposium on extra dimensions and mini black holes during the course of 2009. The HGSFP will in addition contribute substantially to this event. We are also glad to announce that Professor Carl Bender of the University of Washington, St. Louis, USA has been awarded a joint professorship from the University of Heidelberg within the excellence initiative, and will thus be a regular guest at the HGSFP.

In this newsletter, we have profiled our new staff members, Jürgen Schaffner-Bielich, Klaus Blaum, Norbert Christlieb and Manfred Salmhofer in order to introduce their research fields to you. In addition, we welcome Björn Schäfer who joins us as a junior research group leader at the HGSFP. ◀

Galactic Archaeology

■ Prof. Norbert Christlieb started his new job as a Professor for Astronomy at the Landessternwarte Heidelberg in April 2008.

His main research field is „Galactic archaeology"; that is, investigations of the earliest phases of formation and chemical evolution of our Galaxy by means of old, metal-poor stars that can be found in the halo of the Milky Way. He is involved in a number of large international survey projects which aim at finding more of these very rare objects. ◀

Quarks in the cosmos

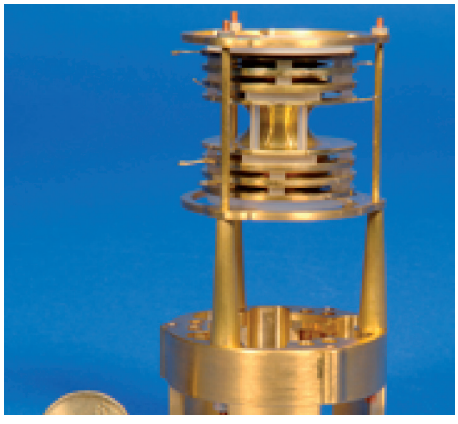
■ The research group of Jürgen Schaffner-Bielich works on in the field of quarks in the cosmos, combining the physics of matter under extreme conditions with astrophysics and cosmology. Topics currently under investigation are the observational signatures for the presence of quark matter in the core of neutron stars and in core-collapse supernovae as well as cosmological aspects of the phase transition to a quark-gluon plasma in the early universe. Our research is strongly linked to relativistic heavy-ion physics, where the properties of the quark-gluon plasma are studied in the lab, as at the international facility for antiproton and ion research (FAIR) at GSI Darmstadt.

Jürgen Schaffner-Bielich has his office in the Institute of Theoretical Physics in Philosophenweg 16. ◀

High precision spectrometry

■ A growing demand for accurate mass values in various fields of physics in the past two decades triggered a continuous development of the experimental techniques. Especially in the field of short-lived radionuclides a progress towards more and more exotic nuclei is ongoing.

Their short half-lives of less than a few 10 ms and very low production rates at radioactive ion beam facilities called for fast and precise measurement procedures. Here, the adoption of the separated oscillatory field method (Nobel Prize in physics for N. Ramsey in 1989) to Penning trap mass spectrometry was one of the major steps in the recent past. Developed and established for the first time by the group of Klaus Blaum at the triple-trap mass spectrometer ISOLTRAP, this technique is now routinely in use. Prof. Blaum is at the Max Planck Institute for Nuclear Physics. ◀

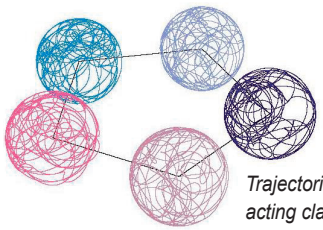

Mass spectrometer for precision measurements

Mathematical Physics

■ Manfred Salmhofer works on Mathematical Physics, in particular on constructive quantum field theory, quantum statistical mechanics, and the renormalization group. The applications concern fundamental aspects of complex systems, for example Fermi liquid theory and its breakdown, competition of order parameters, emergence of irreversibility, and transport theory. Manfred Salmhofer's office is at the Institute of Theoretical Physics, Philosophenweg 19. ◀

Chaotic Dance of Nuclear Spins

■ An experimental study of atomic nuclei in a substance used widely for medical imaging of human lungs has revealed a new fundamental property of interacting nuclear spins in solids.


Trajectories of five interacting classical spins

Radically different signals measured by nuclear magnetic resonance (NMR) exhibit identical long-time behavior. It has been proposed that this universality is related to the chaotic motion of the nuclear spins, which erases the memory of the initial spin state. Such universal behavior is extremely challenging both to establish experimentally and to understand theoretically and had remained undiscovered in the 60 years since the advent of NMR.

In the experiment, nuclei of xenon were "hyperpolarized" with a laser in the gas phase, liquefied and then solidified. The resulting enormous nuclear polarization made it possible to track the spin signal with great sensitivity. The experiment focuses attention on an unsolved 20th-Century problem – the role and the implications of chaos in the behavior of large ensembles of quantum particles. The observed universal behavior indicates that, contrary to conventional wisdom, collective quantum dynamics exhibits extreme randomness even when the individual behavior of quantum particles is not yet randomized. This research is performed by Boris Fine at the Institute of Theoretical Physics. ◀

You're welcome:

... to send us suggestions of topics which you would like to be mentioned in the next newsletter: info@gsfp.uni-heidelberg.de

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