

NEWSLETTER

CUI – Graduate School

No.3, August 2013

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Editorial

We are getting close to the first ‘birthday’ of our cluster of excellence CUI. Almost one year has passed and many structures and projects have been implemented and are fully operational, as well as several scientific goals have been already achieved. In particular all the programmes envisaged for the graduate school are now running very well. Still, we are trying to keep up the pace of innovation and improvement in attaining our goal of providing excellent graduate education in fundamental science in Hamburg.

We wish you a lot of fun in reading this third edition of the newsletter. Do keep in mind that you are warmly welcome to provide us with contributions, especially highlights of your scientific research, give us feedback, and make suggestions for improvements.

Antonio Negretti and Peter Schmelcher

International advertisement of positions

We are having an international advertisement for PhD and post-doctoral positions on several webpages and print media. On this occasion we have also launched successfully our electronic web-application, namely a web-based platform where candidates can submit their applications. The deadline for the submission of the applications is August 31, 2013. After the deadline the Graduate School (GS) of CUI will first screen the submitted applications for suitability, i.e. it will be checked whether the admission requirements are fulfilled. Afterwards, the project leaders (PL) of CUI will be informed on how to access the dossiers of the applicants. The PLs can then screen the applications, perform interviews and select the most suitable candidates for the available positions. Further information will be provided soon.

Course programme

A tailored course programme for the winter term 2013-14 is already available on the webpage of CUI (www.cui.uni-hamburg.de/en/).

The programme consists of 8 lectures and 8 seminars, with a very good trade-off between theory and experiment.

There are in particular new lectures on molecular physics, photon-matter interactions and solid-state lasers.

The main CUI lecture is theoretical: *Approaches to the simulation of non-equilibrium dynamics*, given by Prof. Lichtenstein and Prof. Schmelcher.

We would like to note that there are a few topics with respect to the original plan that have not been yet covered:

- Molecular Photochemistry
- Dynamics of Phase Transitions
- Probing and Manipulating Dynamics of Nanosstructures
- Image Refinement and Ele-

ments of Quantum Tomography

We kindly ask you to take this into account when you plan for your lectures for the summer term 2014 and beyond. Your suggestions are warmly welcome and can be sent to the GS coordinator.

Colloquia

The high profile speakers for the CUI-Colloquium for the next winter term 2013-2014 are:

- Prof. J. N. Coleman (Dublin)
November 21, 2013
Tiny but mighty: How learning to make nano-materials today will lead to technology tomorrow
Host: Prof. R. J. Miller
- Prof. G. Rempe (Munich)
December 12, 2013
Quantum Coherent Networks
Host: Prof. Klaus Sengstock
- Prof. E. Garman (Oxford)
January 16, 2014

Personalia

Prof. Günter Huber (Institut für Laserphysik) has received the Charles H. Townes Award of the American Optical Society, which is given for contributions to quantum electronics. Prof. Huber received the award for his seminal contributions to solid-state lasers, in particular the growth, development, and fundamental characterization of new laser materials based on laser active transition metal and rare earth ions.

Prof. Henning Moritz (Institut für Laserphysik) has been awarded a Starting Grant of the European Research Council, which is currently the most prestigious award for research in Europe. Prof. Moritz will realize experiments with ensembles of ultracold atomic fermions, which will be observed with a high-resolution microscope, in order to emulate condensed-matter physics. The goal is to better understand how high-temperature superconductivity works, and therefore to contribute to the development of improved superconductors.

Dr. Melanie Schnell (Center for Free-Electron Laser Science) has been awarded the Helene-Lange-Preis of the EWE-Foundation and of the University of Oldenburg for her extraordinary results both in research and in teaching.

We congratulate Prof. Huber, Prof. Moritz, and Dr. Schnell on such outstanding awards and wishes them all the best in order to achieve all their scientific goals.



Günter Huber



Henning Moritz



Melanie Schnell in the centre

Cross disciplinary methods development for advancing structural biology

Host: Prof. Henry Chapman

The colloquium takes place at CFEL in the seminar rooms I-II-III (Bld. 99, ground floor) at 2 pm.

Research highlights

The group of Prof. G. Grübel together with an international team of researchers from Hamburg, Berlin, and Paris has measured ultrafast quenching of the resonant magnetic scattering cross section under high fluence free-electron laser (FEL) irradiation.

In the last years moderately focused FEL radiation was used for studying nano-scale magnetic domain systems via resonant magnetic scattering techniques. Here, tightly focused FEL radiation tuned to the M absorption edge of cobalt was used. At a fluence of 5 J/cm^2 an unexpected quenching of the magnetic scattering cross section was observed (see Fig. 1).

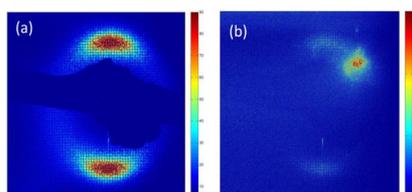


Fig. 1: Detector images of the resonant magnetic scattering of a cobalt/platinum multilayer system. (a) Scattering image from the amount of 1000 FEL pulses with low intensity (7.5 mJ/cm^2). (b) Scattering image of a single FEL pulse with an intensity of 5 J/cm^2 .

Scientists in R. J. D. Miller's group were able to capture the motions leading to charge delocalization in the organic charge transfer salt $(\text{EDO-TTF})_2\text{PF}_6$ following optical excitation. This organic crystal could not survive for even a second in a conventional transmission electron microscope and they were able to obtain super high quality diffraction data in a time-resolved manner. The study was performed in collaboration with groups in Japan and it is the result of a group effort over a period of six years that involved the development of an ultrabright femto-

second electron source at University of Toronto which captured all the relevant molecular motions before sample degradation effects from the laser excitation can take place. These studies show probably the most complex ultrafast structural dynamics observed to date with atomic *spatio-temporal* resolution [see also Nature **496**, 343 (2013)].

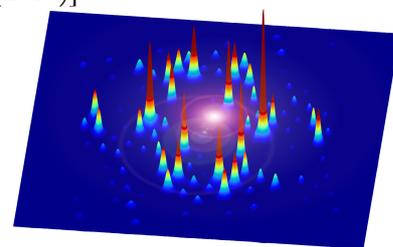


Fig. 2: Electron diffraction pattern of $(\text{EDO-TTF})_2\text{PF}_6$. The photo-induced molecular motions are unveiled by analyzing the peak intensity changes following femtosecond optical excitation.

Prof. J. Küpper, S. Stern, Prof. H. Chapman, and co-workers have reported experimental results on x-ray diffraction of quantum-state-selected and strongly aligned ensembles of the prototypical asymmetric rotor molecule 2,5-diiodobenzonitrile using the Linac Coherent Light Source (LCLS). The experiments demonstrate pioneering steps toward a new bottom-up approach to diffractive imaging of distinct structures of individual, isolated gas-phase molecules. This novel approach, using ultrashort x-ray pulses from a free-electron laser, is suitable to study ultrafast dynamics of isolated molecules (see also arXiv:1307.4577).

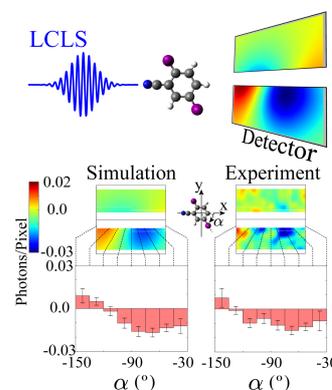


Fig. 3: X-ray diffraction imaging of isolated and aligned gas-phase molecules demonstrates first steps of a bottom-up approach toward single-molecule diffraction.

You are welcome to: ... send us suggestions of topics which you would like to be mentioned in the next newsletter (anegrett@physnet.uni-hamburg.de).