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CUI THE HAMBURG CENTRE FOR ULTRAFAST IMAGING

NEWSLETTER

CUI – Graduate School

No.8, April 2015

Main topics

Editorial

The New Year for the Graduate School of CUI started with the second edition of the Graduate Days, which turned out to be a great success in terms of organization, participation, and quality of the lectures.
The summer term 2015 offers once again a rich course programme with a few new lectures and seminars.
We are very proud of the fact that again some CUI members received important recognitions and that there were a substantial number of publications with major scientific results in very high-profile journals, as shown in our research highlights section.

Antonio Negretti and Peter Schmelcher

The Graduate Days

From March 9 to March 11, 2015, the second edition of the CUI Graduate Days (GDs) took place, an event devoted in general to the education and training of Master and PhD students, but, most importantly, to the formation of a common scientific language among the research groups of CUI.
For the GDs, more than 80 applicants registered via the online application form, half of them being not CUI members. With great pleasure we had this time also PhD students from out of Hamburg such as the Max-Planck Institute for Polymer Research in Mainz, who found the event quite interesting and were very impressed by the programme.
As last year, the course programme has been split into three parallel sessions. In the morning as well as in the early afternoon we had three courses, one for each CUI research area. In addition to the block courses, in the later afternoon four courses on financial risk and markets, on LabView, on project management, and on the soft skill course *Setting goals, making decisions and stimulating creativity*, took place.
In the evening of Monday March 9, Dr. Thomas Pattard, Managing Editor of the Physical Review A journal of the American Physical Society, explained the work behind the review process of a submitted manuscript and the new strategies for improving it.
On Tuesday March 10, Prof. Atac Imamoglu reported, during the colloquium, on his recent experiments at ETH in Zürich on high-mobility of two-dimensional electron gases showing that it exhibits simultaneously strongly correlated phases and non-perturbative coupling to a microcavity mode.
Finally, on Wednesday evening Dr. Wolfgang Becken (Rodenstock

Fig. 1: The special talk by Dr. Thomas Pattard (American Physical Society) during the graduate days of CUI.

Personalia

Prof. Michael Potthoff (Institut für Theoretische Physik) has been appointed as "outstanding referee" by the American Physical Society (APS). The programme, established in 2008, recognizes scientists who have been exceptionally helpful in assessing manuscripts for publication in the APS journals.

Michael Potthoff

Prof. Jochen Küpper (Center for Free-Electron Laser Science) has been nominated Fellow of the Royal Society of Chemistry for his outstanding contributions to the advancement of the chemical sciences.

Jochen Küpper

We congratulate both of them on such awards!

GmbH, Munich) has presented in a very scientific manner the actual optics research carried out within the research unit of the company and the professional perspectives after the PhD studies.

Course programme

The summer term has just started and consequently the course programme has been prepared. As usual, seminars and lectures have been selected on the bases of the interdisciplinary research carried out within our cluster.

The main lecture of this term is *Structural biochemistry*, given by Prof. C. Betzel, Dr. M. Perbandt, Prof. B. Meyer, Prof. R. Willumeit, Dr. F. Buck, and Dr. T. Hackl.

The detailed programme can be downloaded at the CUI webpage.

Research highlights

The breaking of time reversal symmetry via the spontaneous formation of chiral order is ubiquitous in nature. In a recent publication the experimental group of Prof. A. Hemmerich in collaboration with the CUI postdoc Dr. W.-M. Huang and Prof. L. Mathey have presented an unambiguous demonstration of this phenomenon for atoms that are Bose-Einstein condensed in the second Bloch band of an optical lattice. As a key tool they have used a matter wave interference technique (see Fig. 2), with which they directly observed the phase properties of the superfluid order parameter. It also allowed them to reconstruct the spatial geometry of certain low energy excitations, associated with the formation of domains of different chirality. Their work marks a step forward in optical lattice physics where orbital degrees of freedom play an essential role for the formation of exotic quantum matter, similar to the importance of orbital motion in electronic systems. The work has been recently published in Physical Review Letters **114**, 115301 (2015).

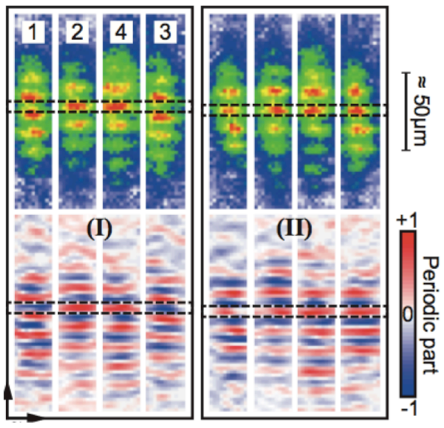

Fig. 2: Characteristic interference patterns in momentum spectra are shown, which prove that the atoms have condensed in a coherent superposition of two momentum states in the second Bloch band.

Spin dynamics in thin magnetic films is studied by nuclear resonant scattering of synchrotron radiation in the research project C.3.2 "Ultrafast Spin Dynamics in Magnetic Nanosystems" lead by Dr. G. Meier and Prof. R. Röhlsberger. The experiments performed by the postdoc of CUI Dr. L. Bocklage and coworkers go beyond the temporal and spatial resolution limit of conventional magnetic microscopy. The novel method is capable of probing externally excited spin counterpart of Mössbauer spectroscopy. It allows the determination of the precession trajectory of the magnetization at GHz frequencies, i.e. at frequencies several orders of magnitude higher than possible so far. This is of fundamental importance for exploring new concepts in information technology utilizing the spin of the electron. The work will appear in Physical Review Letters.

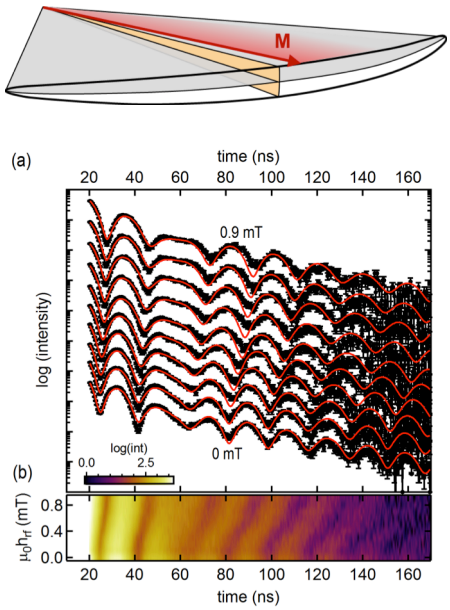

Fig. 3: (Upper panel) Scheme of the measured spin wave precession orbit. (Lower panel) Time spectra at various high frequency excitation field amplitudes from 0 to 0.9 mT and fits to a stochastic relaxation model (red) (a) as well as a logarithmic intensity map of the time spectra (b) are shown.

Mildred Dresselhaus Guest Professors 2014

We warmly welcome Prof. Roseanne Sension (University of Michigan) and Dr. Anouk Rijs (Radboud Universiteit in Nijmegen) as CUI guest professors.

We wish them a very productive and successful work during their stays at CUI.

Important dates in 2015

We remind you that at November 7 the Night of Knowledge/Open Day and in November 11-13 the next CUI international workshop in conjunction with the Hamburg Prize for Theoretical Physics will take place. Please, mark these dates in your agenda!

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).