

NEWSLETTER

CUI – Graduate School

No.10, December 2015

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Editorial

The third annual meeting, which took place in November in Hohwacht, was very successful both in terms of scientific status reports and planning for the future of CUI. The attained milestones reported at the meeting, for which the contributions of our graduates has been crucial, demonstrated the high research standards of our centre. We are therefore very much confident concerning the forthcoming next round of the excellence initiative.

We wish you a pleasant reading and a successful start in the New Year!

Antonio Negretti and Peter Schmelcher

The Hamburg Prize for Theoretical Physics 2015

On November 12 the Joachim Herz Stiftung jointly with CUI awarded Prof. J. Ignacio Cirac (Max Planck Institute for Quantum Optics, Garching) the Hamburg Prize for Theoretical Physics.

Prof. J. Ignacio Cirac has performed seminal works in quantum optics, quantum information theory, and many-body systems. In particular, he developed methods to describe and control atoms, molecules, and photons at the quantum level. Further, he contributed to a deeper understanding of simulations of many-body quantum systems, especially by connecting the efficiency of simulation algorithms with the amount of quantum correlations in the system.

Thus, we are looking forward to his research stays in Hamburg, as his expertise will be valuable in several research areas of CUI, e.g., condensed-matter and cold gases.

Graduate Days

The next Graduate Days (GDs) of CUI will take place from the 14th to the 17th March 2016 at the Bahrenfeld campus. Compared to the past

two editions, the next GDs have been extended to four days. The change has been made on the basis of the feedback we obtained from the survey we performed during the event. While the structure of the scientific programme remains the same, the practical- and soft-skill courses have been moved to the fourth day.

As usual there will be two talks in the later afternoons: The colloquium by Prof. B. Altshuler (Columbia University, New York) and the combined industry event by Dr. R.

Riedel (Class 5 Photonics GmbH, Hamburg) and Dr. S. Moré (df-mp, Munich). The latter talk, as two of the soft-skill courses, has a strong focus on start-ups, as this offers to young researchers interesting career opportunities.

For further information on the GDs, please visit the CUI website.

Research highlights

Methods for preparation and scoring of protein nanocrystal suspensions, to be used for serial femto-second crystallography (SFX) ex-

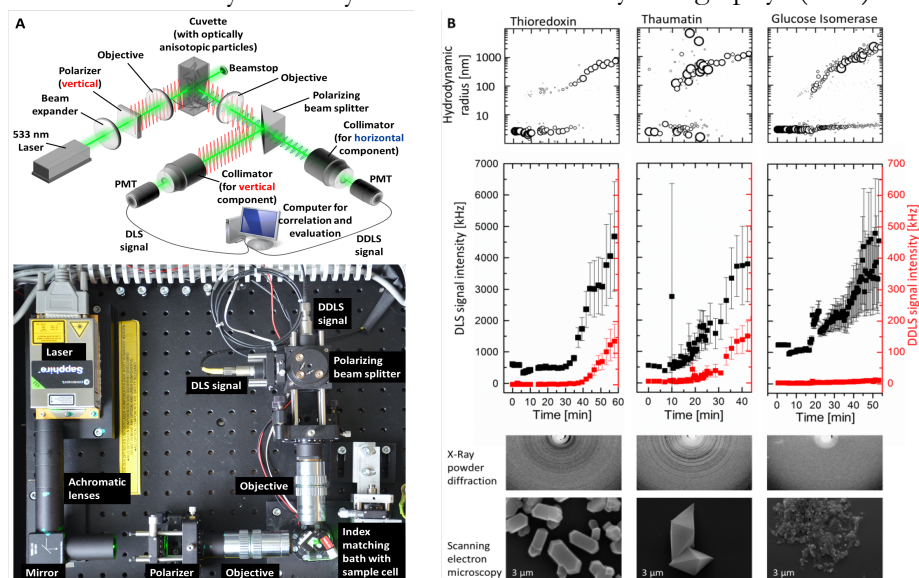


Fig.1: (A) Schematic and photographic image of the depolarized dynamic light scattering (DDLs) instrument. (B) Radial distribution and signal intensity evolution of the DLS (black) and DDLs (red) signal over time. An increase in the DDLs signal intensity, indicating initial steps of crystal growth, was observed for thioredoxin and thaumatin, but not for the cross-check experiment with glucose isomerase, where only amorphous material was obtained. Sample content was verified using X-Ray powder diffraction and scanning electron microscopy.

Personalia

Prof. Andrea Cavalleri (Max Planck Institute for the Structure and Dynamics of Matter) has received the Dannie Heineman Prize 2015 of the Minna-James-Heineman Foundation Hanover for his time-resolved measurements of light-induced phase transitions in highly correlated electron systems.



Andrea Cavalleri

Dr. Melanie Schnell (Max Planck Institute for the Structure and Dynamics of Matter) was awarded the Academy Prize for Chemistry 2015 in recognition of her pioneering development of new methods to study the rotational spectra of state-selected molecules in extremely cold conditions.



Melanie Schnell

The CUI postdoctoral researcher Dr. Sérgio Domingos (Max Planck Institute for the Structure and Dynamics of Matter) has been awarded a fellowship of the Alexander von Humboldt Foundation to support his research activity on high-precision spectroscopy with the aim of revealing dynamic stereo-selectivity in chiral molecules.



Sérgio Domingos

Congratulations to the award winners!

periments, are developed and optimized in CUI research area B.3.1 headed by Prof. C. Betzel. Experiments and procedures established by the CUI PhD student R. Schubert and colleagues demonstrate the successful detection of nano-sized protein crystals at early stages of crystal growth, allowing a most effective differentiation between protein-dense liquid clusters, formation of ordered nanocrystals and amorphous precipitate (see Fig. 1). The novel, non-invasive method is based on quantitative analysis of photon counts obtained from depolarized and polarized dynamic laser light scattering. The detection of nanocrystals exploits the potential of crystalline material to depolarize laser light owing to optical properties like birefringence. The efficient, fast and non-invasive characterization of crystallization experiments in real time is today of fundamental importance for successful preparation of protein nanocrystals and nanocrystal suspensions to be applied for SFX diffraction data collection. All data, results and applied procedures, together with a description of the hardware, have been recently pub-

lished in the Journal of Applied Crystallography **48**, 1476 (2015).

The CUI scientist L. V. Dzemiantsova of the group led by Prof. R. Röhlberger together with Dr. G. Meier has demonstrated theoretically a structure with tunable magnetic properties. The structure consists of exchange-coupled thin films and can be reversibly brought into one of two magnetically stable states: a ferromagnetic ground and a helical metastable state. The authors have shown that the helical state originates from the exchange field in the soft layer, held by the magnetic anisotropy of the hard

layers at the ends. By switching between ferromagnetic and helical states, the exchange-coupled thin films can be used as a device to store a magnetic energy density of a few kJ/m^3 . Alternatively, it can be used as a filter and a fast acting attenuator of ferromagnetic resonances in the GHz range. The lateral size of such a device can be reduced down to a few nanometers. The proposed nanocomposite with a stable helical state provides a new route to store, transmit and process information without the presence of external magnetic fields or currents. The work was published in Scientific Reports **5**, 16153 (2015).

Important dates in 2016

We remind you that the following events will take place in 2016: January 20, 6 pm New Year's Reception at the CFEL in the seminar rooms I-II-III (ground floor); January 29, CUI workshop on Inter-cultural Competence at the CFEL; February 12-13 and March 4-5 academic leadership event (programme for women); February 15 to February 19, third Winter School organised by the PhD students of CUI in the Hotel Schwarzwaldgasthof Rößle in Todtmoos-Strick (black forest); March 14 to March 17, Graduate Days of CUI. 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).

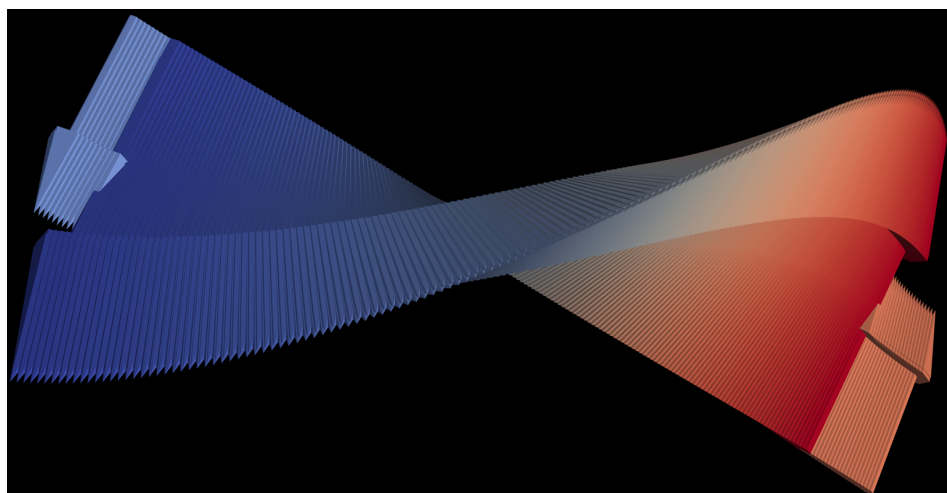


Fig. 2: Three-dimensional representation of micromagnetic simulation data for magnetic moments arranged into a helix.