

NEWSLETTER

CUI – Graduate School
No.13, December 2016

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Editorial

The year that is drawing to a close has been particularly intense in different respects. Our first four PhD students have successfully completed their doctoral training and obtained their doctor's degree. An impressive number of publications (more than 70) and milestones have been reached. In addition to this, several discussions on the future of our cluster, culminating in the annual meeting in Hohwacht, have generated novel scientific ideas and targets. All this will certainly contribute to the drafting of a strong proposal for the forthcoming call of excellence initiative.

We wish you an enjoyable Christmas holiday and a successful start in the New Year!

Antonio Negretti and Peter Schmelcher

The Hamburg Prize for Theoretical Physics 2016

On November 10 the Joachim Herz Stiftung jointly with CUI awarded Prof. Mikhail Katsnelson (Radboud University Nijmegen, Netherlands) the Hamburg Prize for Theoretical Physics.

He has indeed performed seminal works in the fields of quantum many-body theory, strongly correlated systems, the quantum theory of magnetism as well as graphene. In particular, his contributions on graphene have been considered very pioneering and breakthrough scientific achievements.

We are therefore very much looking forward to his research visits in Hamburg, as his expertise in the fields of superconductivity and strongly correlated systems will be valuable for several groups of CUI working in the field of condensed-matter, magnetism, and degenerate quantum gases.

Graduate Days

The next Graduate Days (GDs) of CUI will take place on March 13-

16, 2017. Given the enthusiastic feedback of the participants of the last edition, the four-days format, in which the soft-skills courses are organised on the last day of the event, will be adopted again.

The scientific programme offers once more a very rich selection of topics: Open many-body quantum systems, molecular dynamics simulations, colloidal soft-matter, attosecond science, photodynamics in biomolecular systems, and ultrafast x-ray scattering. Additionally, two practical and three soft-skills workshops will be organized.

As usual there will be two talks in the later afternoons: The colloquium by Prof. E. Garman (Oxford University and CUI), who will provide a historical overview on crystallography, and the combined industry event by Dr. A. van Staa and Dr. J. Busch (NXP Semiconductors Germany GmbH, Hamburg). The latter talk will offer to young researchers interesting career opportunities.

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

Winter school

The fourth winter school organized by our PhD students will take place on February 20-24, 2017, in the village Juliusruh on the island Rügen at the Baltic Sea. There will be three general courses and three specialised ones, one for each research area of CUI, by invited speakers from different places in Europe. In addition to these lectures, all participating PhD students will give a short presentation on their own research project. Moreover, two discussion meetings are scheduled with the aim of stimulating the information exchange and to figure out new scientific paths and bridges between the different backgrounds within CUI. The latter is particularly important in an interdisciplinary environment as our cluster offers. Indeed, this is also the reason why Stephanie Kesgin-Schäfer and Lara Frenzel, representatives of the PhD students of CUI, have invited Hanne Andersen (Århus University), to teach them how to transfer knowledge across the borders of

Personalia

Dr. Robin Schubert (Institute for Biochemistry and Molecular Biology) has recently attained the PhD degree in Chemistry. In his thesis he has established methods for preparation and scoring of protein nano- and microcrystals, used for experiments at synchrotron and free-electron laser x-ray radiation sources.



Robin Schubert

Prof. Gabriel Bester (Department of Chemistry) has received the Golden Spike Award 2015 of the High-Performance Computing Center of the University of Stuttgart for the work in the field of *Ab initio calculations of the vibrational properties and dynamical processes in semiconductor nanostructures*.



Gabriel Bester

Prof. Günther Huber (Institute for Laser Physics) has been selected as a foreign member at this year's meeting of the Russian Academy of Sciences. With this distinction, the Academy honours the pioneering work of the CUI member in the field of applied laser physics together with his successful and lengthy cooperation with Russian laser physicists at the Prokhorov General Physics Institute in Moscow.



Günther Huber

Prof. Andrea Cavalleri (Max Planck Institute for the Structure and Dynamics of Matter) has been elected Fellow of the American Association for the Advancement of Science for his pioneering contributions to the development and use of ultrafast and ultra-intense laser fields to create and probe photo-induced phase transitions in correlated electron materials.



Andrea Cavalleri

Congratulations to our awardees!

disciplines. With such programme, we wish them a fruitful and exciting period at the Baltic Sea.

Research highlights

In two recent publications, the PhD student Joscha Reichert and his supervisor Prof. Michael Thorwart together with colleagues have proposed to enhance the response of a quantum-mechanical system of interest by exciting the environment with a time-dependent field, for instance, provided by a laser pulse. Usually, this field is used to probe or excite the system and the established theory of quantum dissipative systems neglects the additional impact of the field onto the surrounding environment.

The scientists have studied two model systems: (i) a THz-pumped polarizable molecule in water, and (ii) a quantum-dot-metal-nanoparticle setup immersed in a polarizable medium. Allowing for additional environmental driving directly affects the response of the two systems. This leads to a significant enhancement as well as profound qualitative changes in the response spectra (see Fig. 1). In fact, an additional detailed investigation for a quantum two-level model and pulse-shaped environmental driving reveals clear resonant structures as well. They correspond to modes in the environment such that direct excitation of the system through the environment becomes more ef-

fective. Thus, this research generalizes a textbook case ubiquitously used in physics, chemistry, biochemistry, and engineering. Its predictions may provide a cornerstone in developing new methods to probe and excite quantum systems, trigger and steer chemical reactions and may find a direct application in future XFEL experiments. In particular, for the investigation of THz pumping of polar solvents or the theoretical description of environment-based probing techniques such as surface-enhanced Raman spectroscopy.

Further information can be found in J. Phys. Chem. Lett. **7**, 2015 (2016) and Phys. Rev. A **94**, 032127 (2016).

Important dates in 2017

We remind you that the following events will take place in 2017: January 17, 6 pm New Year's Reception at the CFEL in the seminar rooms I-II-III (ground floor); February 20-24, CUI Winter school; March 13-16, The CUI Graduate Days; April 27, Science on Tap – Wissen vom Fass; October 11-13 (tentative), the Annual Meeting. 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).

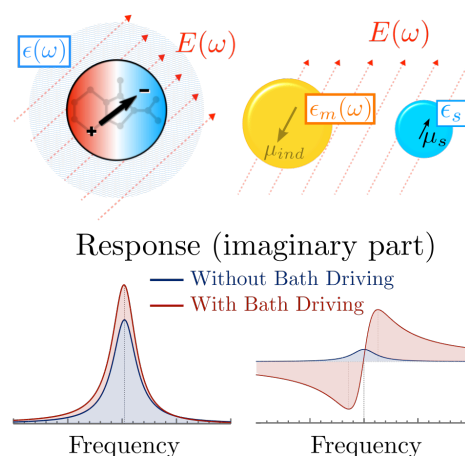


Fig.1: The two model systems under consideration (top left: a polarizable molecule immersed in water; top right: a semiconductor quantum dot in the vicinity of a metallic nanoparticle), where both the environment and the system are coupled to an external electric field through a frequency-dependent dielectric function. The imaginary part of the response shows an enhancement for the polarizable molecule (bottom left) and profound changes in the case of the quantum-dot-nanoparticle setup (bottom right) when environmental driving is added.