Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

CLUSTER OF EXCELLENCE
CUI: ADVANCED
IMAGING OF MATTER

10 YEAR JUBILEE MILDRED DRESSELHAUS GUEST PROFESSORSHIP

14 – 15 MARCH 2024

GREETING

Dear Guests,

We warmly welcome you to the 2024 Jubilee of our Mildred Dresselhaus Guest Professorship Program.

We are so proud that we can celebrate the tenth anniversary of this special program that allows us to host excellent female professors and role models. It is a pleasure that so many of the prizewinners accepted our invitation to the anniversary celebration, and I am really looking forward to attending their lectures, that will both cover the topics of science and diversity.

It also shows us that we are on the right track with this program. The Mildred Dresselhaus Program is one of the keystones of our research cluster. When the Hamburg Centre for Ultrafast Imaging (CUI) was launched, we wanted to create a program that would recognize outstanding female scientists and at the same time bring female (and male) scientists in the early stages of their careers into contact with successful, established female researchers. We also felt it was important for the program to have a close connection to our research. And that's how our guest professorship program came about, which has given us a fantastic network over the past few years.

We wish you all fascinating discussions and experiences.

Prof. Dr. Francesca Calegari
Spokesperson of the Cluster of Excellence “CUI: Advanced Imaging of Matter”

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GREETING

Dear readers, dear participants,

I am delighted that you are attending this event to mark the 10th anniversary of the Mildred Dresselhaus Program.

The Mildred Dresselhaus Visiting Professors Program is a success story.

When the Cluster of Excellence CUI was established, the idea was born to bring young female scientists into contact with top-class female scientists. As part of the program, outstanding (young) female scientists are not only rewarded with personal prize money but are also given the opportunity to work in the cluster for up to six months and benefit from the excellent research conditions.

So, a great format was formed and when Mildred Dresselhaus from the Department of Physics at the Massachusetts Institute of Technology (MIT) agreed to become the namesake for the Guest Professorship Program in 2012, the joy was great. Mildred Dresselhaus has dedicated her entire professional life to improving opportunities for women in the sciences. CUI has already been able to attract 20 outstanding female scientists to Hamburg since 2013. They have been excellent advisers and role models for young female scientists who are still at the beginning of their scientific careers.

As Equal Opportunity Officer at Universität Hamburg, I am more than grateful for CUI's commitment and look forward to the next 10 years with this successful program.

In this spirit, I wish you a great conference.

Dr. Angelika Paschke-Kratzin

CONTENT

01 PARTICIPATING AWARD WINNERS

We would like to thank all of the award winners for their participation and for their contribution to a successful jubilee:

Prof. Lin X. Chen, Argonne National Laboratory and Northwestern University, USA (2023)

Dr. Liuyan Zhao, University of Michigan, USA (2023)

Prof. Dr. Olga Smirnova, Max-Born-Institut, Germany (2022)

Prof. Dr. Prineha Narang, Harvard University, USA (2021)

Dr. Caterina Vozzi, CNR-IFN Milan, Italy (2020)

Dr. Giulia Fulvia Mancini, University of Pavia, Italy (2020)

Prof. Dr. Ruth Signorell, ETH Zurich, Switzerland (2018)

Prof. Dr. Alicia Palacios, Universidad Autónoma de Madrid, Spain (2018)

Prof. Dr. Anna Krylov, University of Southern California, USA (2017)

Prof. Dr. Cristiane Morais Smith, Universiteit Utrecht, NL (2016)

Prof. Dr. Elspeth Garman, University of Oxford, UK (2015)

Dr. Liesbeth Janssen, Heinrich-Heine-Universität, Germany (2015)

Prof. Dr. Roseanne Sension, University of Michigan, Ann Arbor, USA (2014)

Dr. Rosario González-Férez, Universidad de Granada, Spain (2013)

02 THE PROGRAM

THURSDAY, 14 MARCH 2024, CFEL (BUILD. 99, GROUND FLOOR)

08:15 – 08:45, REGISTRATION & WELCOMING WORDS

Prof. Dr. Norbert Ritter, Dean of the MIN Faculty

08:45 - 09:30, PROF. DR. ALICIA PALACIOS

"Time Management" & "A glance of recent applications to explore attosecond electron dynamics"

Chair: Prof. Dr. Nina Rohringer

09:45 - 10:30, PROF. DR. ROSARIO GONZÁLEZ FERÉZ

"Ultralong-range Rydberg Molecules: Electronic Structure and Rydberg blockade"

Chair: Prof. Dr. Jochen Küpper

COFFEE BREAK

11:00 - 11:45, PROF. DR. ROSEANNE SENSION

"Watching Molecules in Action: Cobalamins as a case study"

Chair: Prof. Dr. Christian Bressler

12:00 - 12:45, PROF. DR. PRINEHA NARANG

“Out of equilibrium control of quantum matter”

Chair: Dr. Thore Posske

13:00 NETWORKING LUNCH WITH MILDRED DRESSELHAUS PROFESSORS (HARBOR)

14:30 - 15:15, PROF. DR. CRISTIANE MORAIS SMITH

“Quantum Fractals”

Chair: Prof. Dr. Andreas Hemmerich

15:30 - 16:15, PROF. DR. RUTH SIGNORELL

“Aerosol particles - Photochemistry, formation, and imaging”

Chair: Prof. Dr. Francesca Calegari

16:15 COFFEE BREAK

16:45 - 17:30 PROF. DR. OLGA SMIRNOVA

Ultrafast molecular chirality: a topological connection

Chair: Prof. Dr. Francesca Calegari

18:00 - 18:45: RECEPTION WITH DRINKS AND FINGER FOOD

18:45 - 20:00: AWARD CEREMONY

- Dr. Linyuan Zhao: Probing and Designing Multipolar Orders in Quantum Materials
- Prof. Dr. Lin X. Chen: Ultrafast functional Structural Dynamics of Photoactive Transition Metal Complexes in Solar Energy Conversion Processes

FRIDAY, 15. MARCH 2024, CFEL (BUILD.99, GROUND FLOOR)

08:45 - 09:30, PROF. DR. ELSPETH GARMAN

"Radiation damage and metal identification in Structural Biology: why do we care?"

Chair: Prof. Dr. Arwen Pearson

09:45 - 10:30, PROF. DR. GIULIA FULVIA MANCINI

"Multiscale Ultrafast Microscopy across X-ray tabletop and facility-scale sources & Imposter Syndrome"

Chair: Prof. Dr. Francesca Calegari

10:30 - 11:00, GROUP PHOTO

11:00 COFFEE BREAK

11:30 - 12:30, PROF. DR. ELSPETH GARMAN

“10 Years of the CUI Mildred Dresselhaus Program: what have we learned?”

Chair: Eileen Schwanold

12:30 NETWORKING LUNCH

14:00 - 14:45, PROF. DR. CATERINA VOZZI:

“Learnings gathered throughout a scientific career”

Chair: Prof. Dr. Francesca Calegari

14:50 - 15:35, PROF. DR. ANNA KRYLOV

“Water: A perpetual challenge for theory and experiment alike“

Chair: Prof. Dr. Robin Santra

15:40 - 16:25, PROF. DR. LIESBETH JANSSEN

“Ideas, Plans, and Research Proposals”

Chair: Fabian Westermeier

APPROXIMATELY 16:30 NETWORKING DRINKS AND FAREWELL

03 KEYNOTE

PROF. DR. ELSPETH GARMAN, UNIVERSITY OF OXFORD

"10 Years of the CUI Mildred Dresselhaus program: what have we learned?"

Mildred Dresselhaus (MD), the 'Queen of Carbon', was an inspirational scientist and a truly worthy namesake for this innovative guest scientist program at CUI. The first MD Junior and Senior Guest scientists were selected in 2013 for awards presented at a Hamburg Town Hall ceremony in January 2014. Since then, another 18 of us have had the honour of being MD awardees. In 2019 the first 10 of us participated in a 3-day MD Conference which was both enlightening and challenging, as we heard about the wide range of science being researched and also considered the various issues facing women in STEM. In this talk I will try to draw together, using input from the other awardees, what lessons have been learned in the last 10 years, and perhaps look into my crystal ball to give some pointers for the future development of the MD program.

In my own field of Crystallography, there is a proud historical record and current practice of outstanding researchers who were/are women, in stark contrast to the field in which I was trained: experimental nuclear structure physics. It is interesting to reflect on why crystallography is a positive outlier in the STEM arena, and also how this can not only be maintained but also further improved. William Henry and William Lawrence Bragg, father and son, contrary to the norm for the times during which they worked (first half of the 20th century), had many women in their research groups (WH Bragg: 10/17 and WL Bragg 4/6 [1]), establishing crystallography as a subject in which women don't just survive, but in which they can excel. Crystallographers trained by the Braggs then became inspiring role models for several more generations of highly successful female researchers.

04 ABSTRACTS

04.1 PROF. DR. ALICIA PALACIOS, UNIVERSIDAD AUTÓNOMA DE MADRID

"Time Management" & "A glance of recent applications to explore attosecond electron dynamics"

Jobs in research and academia have shown to present high levels of stress coming from multiple sources. One of the main work-related stress factors is the need of multitasking, for which, the ability of an effective time management can make a difference. The first part of the talk will provide a review on available tools for efficient time management and on planning skills in the academic environment.

As a hybrid talk, in the second part, a brief summary of recent applications on attosecond pump-probe techniques to access ultrafast electron phenomena in atoms and molecules in gas phase will be presented. Ongoing progress on the implementation and developing of new theoretical tools to describe these processes will be briefly discussed.

04.2 PROF. DR. ROSARIO FEREZ, UNIVERSIDAD DE GRANADA

"Ultralong-range Rydberg Molecules: Electronic Structure and Rydberg blockade"

The exotic properties of Rydberg atoms make them unique probes of their environments. In hybrid systems, they form ultralong-range molecules when combined with ground-state atoms [1, 2], ions [3], or polar molecules [4,5], which inherit these exciting properties. When the diatomic polar molecule is immersed into the wave function of the excited atom, the anisotropic scattering of the Rydberg electron from the

permanent electric dipole moment of the dimer is responsible for the binding mechanism in these Rydberg molecules [4, 5]. In this work, we explore the electronic structure and main properties of these exotic ultralong-range molecules, which are formed by a Rydberg atom interacting with RbCs. Our focus is the regime where the charge-dipole interaction of the Rydberg electron with the diatomic polar molecule induces a coupling between the quantum defect Rydberg states and the nearest degenerate hydrogenic manifold [6]. We present adiabatic electronic states evolving from the Rydberg degenerate manifold and from the quantum defect states, and analyze the non-adiabatic coupling between these potentials, and decay rates and formation rates. In addition, we present the first experimental demonstration of the Rydberg blockade due to the charge-dipole interaction between a single Rb atom and a single RbCs molecule. The atom and molecule are confined in optical tweezers, which are used to control their relative distance. For a separation of 310 nm, the charge-dipole interaction between the Rydberg electron and atomic core with the dipole moment of RbCs provokes the blockade of the transition to the Rb Rydberg state. The observed excitation dynamics are in excellent agreement with the theoretical results obtained using the electronic structure of the Rydberg Molecule Rb-RbCs [7].

References:

[1] C.H. Greene, A.S. Dickinson, and H. R. Sadeghpour, Phys. Rev. Lett. 85, 2458 (2000).

[2] V. Bendkowsky et al, Phys. Rev. Lett. 105, 163201 (2010)

[3] N. Zuber, et al. Nature 605, 453 (2022).

[4] S.T. Rittenhouse and H.R. Sadeghpour, Phys. Rev. Lett. 104, 243002 (2010).

[5] R. González-Férez, H.R. Sadeghpour and P. Schmelcher, New J. Phys. 17, 013021 (2015).

[6] R. González-Férez, et al, J. Phys. B: At. Mol. Opt. Phys. 53, 074002 (2020).

[7] A. Guttridge et al, Phys. Rev. Lett. Phys. Rev. Lett. 131, 013401 (2023). xx

O4.3 PROF. DR. ROSEANNE SENSION, UNIVERSITY OF MICHIGAN

"Watching Molecules in Action: Cobalamins as a case study"

The fate of a photoactive molecule is determined by the electronic and structural rearrangements that follow excitation. Femtosecond X-ray free electron lasers (XFELs) have made it possible to use X-ray absorption spectroscopy to probe changes in electronic configuration and atomic structure as a function of time, beginning from the initial excited state. Both 'movies' of coherent or ballistic motion and 'snaphots' of local minima or kinetic intermediates are possible. Polarization anisotropy, long exploited in ultrafast optical measurements, permits decomposition of the X-ray transient difference signal into contributions along the direction parallel to the transition dipole initially pumped, and perpendicular to this transition dipole. This decomposition allows the analysis of asymmetric sequential structural changes of photoexcited molecules in isotropic solution. We have used femtosecond X-ray absorption near edge structure (XANES) at the Co K-edge to characterize the excited state dynamics of cobalamins, B12 coenzymes and analogues at the Linac Coherent Light Source (LCLS) in California. Femtosecond X-ray Emission spectroscopy (XES) and Co-L edge absorption measurements at the Eupopean XFEL provide additional insight into the electronic evolution coupled to structural rearrangement. In addition to presenting the experimental results and future potential of ultrafast X-ray spectroscopy, the talk will also focus on the skills and organization required for running experiments at these facilities.

04.4 PROF. DR. PRINEHA NARANG, UCLA

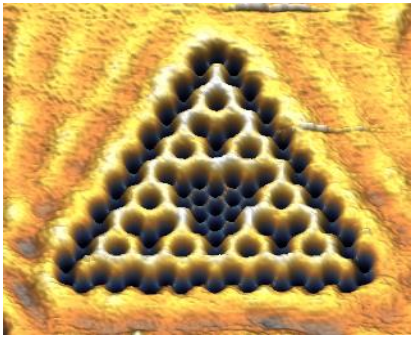
"Out of equilibrium control of quantum matter"

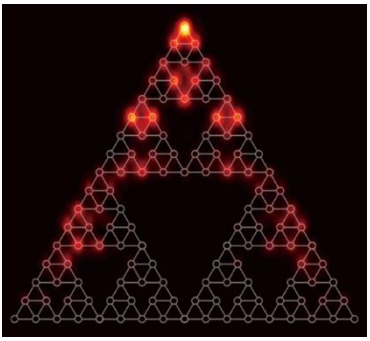
04.5 PROF. DR. CRISTIANE MORAIS SMITH, UTRECHT UNIVERSITY

"Quantum Fractals"

The human fascination for fractals is very ancient, but it was only in the last century that mathematicians classified these structures. In the 80's, the foundational work of Mandelbrot triggered enormous activity in the field. The focus was on understanding classical fractals.

This century, the task is to understand quantum fractals. In 2019, we realized a Sierpinski gasket using a scanning tunneling microscope to pattern adsorbates on top of Cu(111) and showed that the wavefunction describing electrons in a Sierpinski gasket fractal has the Hausdorff dimension d = 1.58 [1]. However, STM techniques can only describe equilibrium properties.

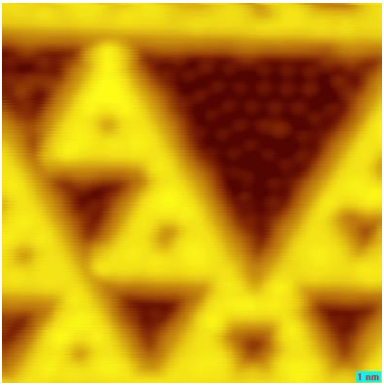




In 2021, we went a step beyond and using photonics experiments we unveiled the quantum dynamics in fractals. By injecting photons in waveguide arrays arranged in a fractal shape, we were able to follow their motion and understand their quantum dynamics with unprecedented detail. We built 3 types of fractal structures to reveal also the influence of geometry [2].

Recently, we investigated topological effects in self-formed fractals of Bi on InSb [3]. In these systems, the spin-orbit coupling is very strong, thus leading to a quantum spin Hall effect. Muffin-tin calculations indeed reveal topological corner and edge modes in these fractal

structures, in agreement with experimental observations.



[1] S.N. Kempkes, M.R. Slot, S.E. Freeney, S.J.M. Zevenhuizen, D. Vanmaekelbergh, I. Swart, and C. Morais Smith, *"Design and characterization of electronic fractals*", Nature Physics 15, 127(2019) [see also 15 years of Nature Physics, Nature Physics 16, 999 (2020)].

[2] X.-Y. Xu, X.-W. Wang, D.-Y. Chen, C. Morais Smith, and X.-M. Jin, "*Quantum transport in fractal networks*," Nature Photonics 15, 703 (2021).

[3] R. Canyellas, Chen Liu, R. Arouca, L. Eek, G. Wang, Yin Yin, D. Guan, Y. Li, S. Wang. H. Zheng, Canhua Liu, Jinfeng Jia, and C. Morais Smith, "*Topological corner and edge states in Bi fractals on InSb*," ArXiv: 2309.09860 (2023).

04.6 PROF. DR. RUTH SIGNORELL, ETH ZURICH

"Aerosol particles: Photochemistry, formation, and imaging"

Photochemical processes have been identified as the main causes of degradation and oxidation of matter in atmospheric aerosol particles. When light interacts with an aerosol particle, the light intensity can be greatly amplified inside the particle as the latter acts as a light-amplifying cavity. These optical confinement effects result in an acceleration of photochemical reactions in aerosol particles compared with reactions in extended condensed matter. We have studied and quantified the acceleration of in-particle photochemistry using photoacoustic spectroscopy [1] and X-ray spectro-microscopic imaging of single aerosol particles [2].

If time permits, I will briefly explain how we investigate the very first steps of aerosol formation, and how we use photoelectron imaging and coherent diffraction imaging for aerosol characterization.

1. J.W. Cremer, K.M. Thaler, C. Haisch, R. Signorell, „Photoacoustics of single laser-trapped nanodroplets for the direct observation of nanofocusing in aerosol photokinectics", Nat. Commun., 7, 10941 (2016)

2. P.C. Arroyo, G. David, P.A. Alpert, E.A. Parmentier, M. Ammann and R. Signorell, „Amplification of light within aerosol particles accelerates in-particle photochemistry", Science, 376, 293-296 (2022).

O4.7 PROF. DR. OLGA SMIRNOVA, MAX-BORN-INSTITUT BERLIN

"Ultrafast molecular chirality: a topological connection"

An object is said to be chiral if it cannot be superimposed on its mirror image by any rotation. The two mirror images of the same chiral molecule are called enantiomers and are often referred to as "left"- and "right"-handed. While the physical properties of the two enantiomers of the same chiral molecule are nearly identical, the geometric property of chirality leads to vastly different chemical properties of the two enantiomers. The need for rigorous selection of a specific enantiomer, a now standard requirement in drug design, is one of the many reasons behind the ever-greater need for improving sensitivity of chiral sensing.

Yet, standard optical methods of chiral detection still use the same principles as the method discovered by Louis Pasteur in the XIX century: the linear interaction between chiral molecules and light, which becomes chiral-sensitive due to the magnetic field component of the light wave.

Ultrafast non-linear spectroscopies promise to increase the enantio-sensitive signal by three orders of magnitude [1] by removing the need to rely on the interaction with the magnetic field component of light. The second important feature of non-linear light-matter interactions is the opportunity to imprint topological properties of light on matter, presenting an opportunity to achieve topologically robust enantio-sensitive

observables.

I will describe our very recent results [2,3] on marrying chiral and topological properties in ultrafast electronic response of chiral molecules in the gas phase, enabling highly efficient and robust chiral observables. I will present two vignettes where topological connection appears in optical or electronic chiral response:

(i) **Chiral topological light**: a new concept enabling chiral-sensitive and topologically robust properties of high harmonic emission, generated by such light in chiral molecular gases [2]

(ii) **Temporal geometry**: a concept encompassing the emergence of geometric fields in electronic response of chiral molecules

(iii) **Enantio-sensitive exceptional points**: chiral topology in non-Hermitian chiral systems [3]

References:

[1] “Ultrafast chirality: the road to efficient chiral measurements” D Ayuso, A F Ordonez, O Smirnova, (Perspective) Phys. Chem. Chem. Phys., 2022, 24, 26962-26991, (2022)

[2] “Chiral topological light for detecting robust enantio-sensitive observables” N Mayer, D Ayuso, M Ivanov, M. Khokhlova, E Pisanty, O Smirnova, arXiv preprint arXiv:2303.10932, 2023

[3] “Enantiosensitive exceptional points” N Mayer, N Moiseyev, O Smirnova, arXiv preprint arXiv:2306.12293, 2023

04.8 PROF. DR. ELSPETH GARMAN, UNIVERSITY OF OXFORD

"Radiation damage and metal identification in Structural Biology: why do we care?"

Structural biology relies on X-ray crystallography to provide much of the three dimensional information on macromolecules that informs biological function [1]. My group has helped to establish improved methods for macromolecular crystallography (MX) to enable problems not previously accessible to structure solution to be tackled. A notable example has been the development of protocols to cryocool protein crystals prior to diffraction data collection at 100K, reducing the rate of radiation damage (RD) [2] by around a factor of 70 compared to holding the crystal at room temperature. However, even at 100 K, RD is still a limiting problem as it can prevent structure determination and the changes can mislead the experimenter when interpreting the biology of the structure.

Our contributions have included full dose modelling of the diffraction experiment (RADDOSE-3D, www.raddo.se) and RADDOSE-XFEL) to allow data collection optimisation strategies [3,4,5], as well as the recent identification of a single metric, Bnet, by which the level of damage in a single PDB entry can be assessed [6].

Our work also addresses the accurate identification of metal atoms bound to protein structures. Metalloproteins comprise over one-third of proteins, with approximately half of all enzymes requiring metal to function. Identifying the bound metal and its environment is a prerequisite to understanding biological mechanism. However, there are no routine analysis methods with the sensitivity and quantitative accuracy to do this. We have developed microProton Induced X-ray Emission (PIXE) as a tool for quantifying metals in proteins using the known sulphur content (methionines and cysteines) as an internal standard. We have automated this method to permit high throughput analysis of many samples, validating the approach by using it to analyse

four distinct sets of 30 proteins identified as metalloproteins in the Protein Data Bank (PDB) [7]. In all four sets, we found that over half of the metals had been misidentified in the deposited structural models. The PDB is a critical resource for researchers worldwide and in 2021 there were on average 1.86 million downloads per day in the US alone, suggesting that over 350,000 models downloaded per day may not contain the correct metal. This has profound implications for those using the models, whose understanding of them may therefore be flawed.

References:

[1] EF Garman (2014) Developments in X-ray Crystallographic Structure Determination of Biological Macromolecules. Science 343: 1102-1108

[2] EF Garman. (1999) Cool Data: Quantity and Quality. Acta Cryst. D55: 1641-1653.

[3] OB Zeldin, M Gerstel & EF Garman (2013) RADDOSE-3D: time- and space-resolved modeling of dose in macromolecular crystallography J.Appl.Cryst. 46: 1225-1230

[4] OB Zeldin et al & EF Garman (2013) Predicting the X-ray lifetime of protein crystals. PNAS 110: 20551-20556

[5] JL Dickerson, PTN McCubbin & EF Garman (2020) RADDOSE-XFEL: Femtosecond time-resolved dose estimates for macromolecular XFEL experiments. J.Appl.Cryst. 53, 549–560

[6] KL Shelley & EF Garman (2022) Quantifying radiation damage in the Protein Data Bank.

Nature Communications 13:1314- 1325

[7] GW Grime et al. & EF Garman (2020) High-Throughput PIXE as an Essential Quantitative Assay for Accurate Metalloprotein Structural Analysis: Development and Application. J Am Chem Soc. 142(1):185-197Xx

04.9 PROF. DR. GIULIA FULVIA MANCINI, UNIVERSITY OF PAVIA - LUXEM

"Multiscale Ultrafast Microscopy across X-ray tabletop and facility-scale sources & Imposter Syndrome"

Part 1: Multiscale Ultrafast Microscopy across X-ray tabletop and facility-scale sources

Microscopic imaging is critical for discovery and innovation in science and technology. Throughout history, advances in microscopy have dramatically accelerated advances in other areas of science including materials, biological, nano, and energy sciences, as well as nanoelectronics, data storage, and medicine. To this date, current imaging techniques with soft X-ray/EUV light are nowhere near their fundamental limits in terms of spatial, spectral or temporal resolution. In this talk I will present recent advances in this field with X-ray Free-Electron Lasers (XFELs) and High-Harmonic Generation (HHG) sources.

Part 2: Career Talk on Impostor Syndrome

I have been privileged to know and work with some of these scientists, and in this highly personal account, I will comment on the general attitude and climate towards women in STEM and how I perceive that it is changing but still needs further improvement. I will draw on my experiences during the last 47 years as a scientist who happens to be a woman.

Reference:

[1] Maureen M. Julian, "Women in Crystallography," in *Women of Science: Righting the Record*, ed. G. Kass-Simon and Patricia Farnes (Bloomington: Indiana University Press, 1990), pp. 342

04.10 DR. CATERINA VOZZI, CNR-IFN MILAN

"Learnings gathered throughout a scientific career"

Jobs in research and academia have shown to present high levels of stress coming from multiple sources. One of the main work-related stress factors is the need of multitasking, for which, the ability of an effective time management can make a difference. The first part of the talk will provide a review on available tools for efficient time management and on planning skills in the academic environment.

As an hybrid talk, in the second part, a brief summary of recent applications on attosecond pump-probe techniques to access ultrafast electron phenomena in atoms and molecules in gas phase will be presented. Ongoing progress on the implementation and developing of new theoretical tools to describe these processes will be briefly discussed.

04.11 PROF. DR. ANNA I. KRYLOV, USC

"Water: A perpetual challenge for theory and experiment alike"

Spectroscopy provides a way to see what atoms and electrons are doing; however, in order to translate spectroscopic signals into a molecular story, theoretical modeling is needed. I will discuss recent progress in spectroscopy modeling in the condensed phase and illustrate successes and remaining challenges by examples, focusing on the many computational challenges presented by water itself.

04.12 PROF. DR. LIESBETH JANSSEN, EINDHOVEN UNIVERSITY OF TECHNOLOGY

"Ideas, Plans, and Research Proposals"

Developing new research ideas, research plans, and research proposals is essential for the modern scientist, yet these skills receive little attention in formal training programs for PhD students and postdocs. In this talk, I will offer some tips and tricks on how to create new research ideas, how to make a critical selection of your ideas and a subsequent research plan, and, if external funding is required to execute your research plan, how to write a competitive research proposal. Overall, I hope that this talk will help you in navigating the path from nothing to ideas, from ideas to plans, and from plans to proposals.

05 THOUGHTS ABOUT THE PROGRAM AND A CAREER IN SCIENCE

"The Mildred Dresselhaus program is truly unique in more than one aspect: The outstanding achievements of its name-giver, the way it honors and supports female scientists over the whole span of their careers, the opportunities it offers to foster collaborations within an exciting research environment, and last but not least the pleasure it gives us in meeting dear colleagues, discussing science and beyond."

— PROF. DR. RUTH SIGNORELL

"The best part of my career has been interacting with the inspirational, enthusiastic, and brilliant postgraduate and

undergraduate students who have worked in my research group over the last 30 years. Without them I would have achieved much much less. Without them I would have achieved much much less! The Mildred Dresselhaus Guest Professorship enabled me to interact similarly with the young researchers at CUI and was a wonderful experience.!"

— PROF. DR. ELSBETH GARMAN

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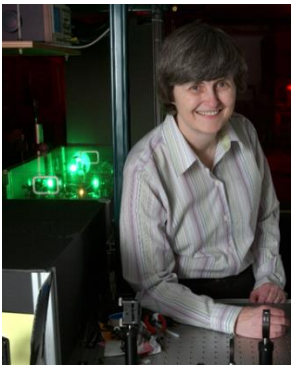
"The most-precious moments in the life of a scientist are like a spark — a jolt of fascination with something you never before noticed, a sudden inspiration to look at an old problem from a new angle, a fresh idea. For me, such moments come when my mind is not cluttered by the daily grind — when I am away from my regular work, when I meet new people and hear new stories. Many such ideas have come to me during my sabbaticals far away from home, and I hope many ~~such~~ programs continue to operate."

— PROF. DR. ANNA I. KRYLOV

“Prof. Mildred Dresselhaus has inspired generations of female scientists, and I feel fortunate and grateful to be among them."

— DR. LIUYAN ZHAO



“I had the opportunity to meet Mildred Dresselhaus when she visited the University of Michigan. Her experience and persistent determination for success was an inspiration as I moved forward in my career. From the early days of ultrafast optical spectroscopy to the present frontiers of ultrafast X-ray spectroscopy the same kind of persistence and determination has led us forward.”

— PROF. DR. ROSEANNE SENSION

“The quote I chose is from Mildred Dresselhaus: "Diversity should not be a problem but rather an opportunity to involve a large talent pool."

— DR. GIULIA FULVIA MANCINI

“Prof. Mildred Dresselhaus was one of the outstanding role models for women in science as well as my career. Her long-time contributions to science have inspired many female scientists including myself in many ways. I am very grateful for one of the legacies left by her, this Guest Professorship in her honor. By coincidence, I am following her footsteps from our Ph.D. research in the University of Chicago as the start of our scientific careers.”

— PROF. DR. LIN X. CHEN

“The first law of motion applies in physics: unbalanced forces are required to overcome the inertia of structural inequality. The Mildred Dresselhaus program contributes to these forces by giving visibility and support to female scientists. Step by step, hoping to reach equality."

— PROF. DR. ALICIA PALACIOS

“It was an honor to get the Mildred Dresselhaus Award; she was an excellent scientist and an inspiring role model. This well-recognized Award has been a great motivation in my scientific career, which partially contributed to my promotion to the full University Professorship and my professional recognition within the field of atomic and molecular physics.”

— PROF. DR. ROSARIO GONZÁLEZ-FÉREZ

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"Diversity is not a goal in itself, but a means to realize the full potential of people and organizations. The Mildred Dresselhaus program is an excellent example of how diversity can be embraced and celebrated to make a positive impact in science."

— DR. LIESBETH JANSSEN

"As the first female professor at MIT, Mildred Dresselhaus has opened the path to half of the world population towards a successful career in academia!"

— PROF. DR. CRISTIANE MORAIS SMITH

“I had the privilege of interacting with Millie while I was at MIT as a postdoc finding my way in physics. Her questions were always insightful, and I still vividly recall our discussions on electron-phonon interactions. Her legacy of scientific excellence in the face of adversity is truly remarkable!"

— PROF. DR. PRINEHA NARANG

“Thanks to trailblazers such as Mildred Dresselhaus, I, a woman and an immigrant, can realize my dream of being a physicist, the dream I had since I was 5 years old.”

— PROF. DR. OLGA SMIRNOVA

"I'm grateful to the Mildred Dresselhaus Guest Professorship at CUI that allowed me to strengthen my network and collaborate with several outstanding colleagues at Hamburg University and DESY. I admire the mentoring program at the University of Hamburg established for supporting women in science and it is a great pleasure to be part of it. As a mentor, I share my experience trying to support the next generation of young female scientists for a more inclusive scientific community."

— DR. CATERINA VOZZI

06 LIST OF ALL AWARD WINNERS

- Prof. Lin X. Chen, Argonne National Laboratory and Northwestern University, USA (2023)
- Dr. Liuyan Zhao, University of Michigan, USA (2023)
- Prof. Dr. Olga Smirnova, Max-Born-Institut, Germany (2022)
- Dr. Benedetta Flebus, Boston College, USA (2022)
- Prof. Dr. Jie Shan, Cornell University, USA (2021)
- Prof. Dr. Prineha Narang, Harvard University, USA (2021)
- Dr. Caterina Vozzi, CNR-IFN Milan, Italy (2020)
- Dr. Giulia Fulvia Mancini, University of Pavia, Italy (2020)
- Prof. Dr. Ruth Signorell, ETH Zurich, Switzerland (2018)
- Prof. Dr. Alicia Palacios, Universidad Autónoma de Madrid, Spain (2018)
- Prof. Dr. Anna Krylov, University of Southern California, USA (2017)
- Prof. Dr. Tanya Zelevinsky, Columbia University, New York, USA (2017)
- Prof. Dr. Cristiane Morais Smith, Universiteit Utrecht, The Netherlands (2016)
- Dr. Friederike Ernst, Stanford University, USA (2016)
- Prof. Dr. Elspeth Garman, University of Oxford, UK (2015)
- Dr. Liesbeth Janssen, Heinrich-Heine-Universität, Germany (2015)
- Prof. Dr. Roseanne Sension, University of Michigan, Ann Arbor, USA (2014)
- Dr. Anouk Rijs, Radboud Universiteit, Nijmegen, The Netherlands (2014)
- Prof. Dr. Tamar Seideman, Northwestern University, Chicago, USA (2013)
- Dr. Rosario González-Férez, Universidad de Granada, Spain (2013)

07 HOW TO REACH CAMPUS BAHRENFELD

07.1 FROM HAUPTBAHNHOF HAMBURG

Travelling time approx. 35 min. by city train and bus.

To Campus Bahrenfeld/DESY main entrance:

Take the S31 (direction to Altona), S3 (direction to Pinneberg) or S1 (direction to Blankenese/Wedel) and leave at Altona station. Continue by bus line 1 (direction Schenefelder Holt) directly to the main entrance of Campus Bahrenfeld/DESY (bus stop “Zum Hünengrab (DESY)”). You may also continue by city train S1 or S11 (direction Blankenese/Wedel) to Othmarschen and then continue with bus line 1 (direction Schenefelder Holt).

To side entrance/Mercure Hotel:

Take the S11 (direction Altona/Blankenese) or S21 (direction Holstenstraße/Elbgaustraße) or S31 (direction Altona) and leave at Holstenstraße station. Turn right at the bottom of the stairs and cross the street for the bus station of line 3 and X3 (in front of “Neue Flora” and supermarket “Edeka”). Take bus line 3 or X3 (direction Stadionstraße/Schenefeld) to bus stop Luruper Chaussee (DESY). Cross the street and turn left for Mercure Hotel or right for side entrance.

Optional:

Taxi, although not recommended due to traffic and building sides on this route. Travelling time approx. 25 minutes (without traffic).

07.2 FROM HAMBURG AIRPORT FUHLSBÜTTEL

Travelling time approx. 50-60 minutes

By city train:

Continue with city train line S1 (direction Blankenese/Wedel) to Othmarschen station. Then take bus line 1 (direction Schenefelder Holt) to the main entrance of Campus Bahrenfeld/DESY (bus stop "Zum Hünengrab (DESY)"). You may also switch at Hauptbahnhof Hamburg and Holstenstraße to arrive directly in front of the Mercure Hotel (see description above) which is approx. 5 – 10 minutes quicker, but not recommended with heavy luggage, because you have to switch twice.

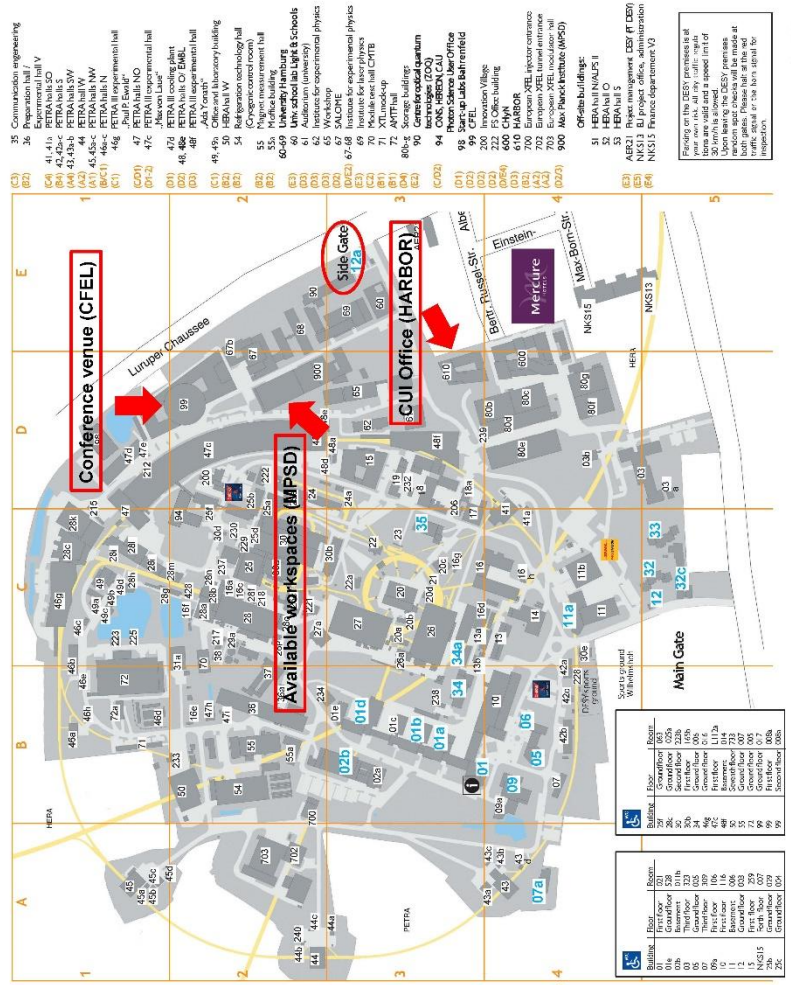
Optional:

Taxi, although not recommended due to traffic and building sites on this route. Travelling time approx. 50 minutes (without traffic).

07.3 FROM ANYWHERE BY CAR

Campus Bahrenfeld/DESY main entrance: Exit the Autobahn (A7) at HH-Bahrenfeld. Arriving from the south: turn left onto the main road (Osdorfer Weg). Arriving from the north: turn right onto the main road (Osdorfer Weg). After approx. 1.5 km, turn right onto Notkestraße. The main entrance of Campus Bahrenfeld/DESY is the second road on the left.

Side entrance/Mercure Hotel: Exit the Autobahn (A7) at HH-Bahrenfeld. Arriving from the south: turn left onto Osdorfer Weg and take the first right into Theodorstraße. At the large crossroads (approx. after 1 km), turn left onto Luruper Chaussee. After approx. 400 m you will see the Mercure Hotel on the left-hand side and after approx. another 100 m you will see the side entrance on the left-hand side. Arriving from the north: turn right onto Osdorfer Weg and take the first right into Theodorstraße. At the large crossroads (approx. after 1 km), turn left onto Luruper Chaussee. After approx. 400 m you will see the Mercure Hotel on the left-hand side and after approx. another 100 m you will see the side entrance on the left-hand side.



WIFI on Campus via Eduroam

08 CONFERENCE VENUE

Campus Bahrenfeld is in Hamburg-Bahrenfeld. You will find various shops within a walking distance of maximum 10 minutes. If you are staying at the Mercure Hotel you will have a five-minute walking distance to 'Trabrennbahn-Bahrenfeld', where you can find various shops like bakeries, fast-food restaurants and a pharmacy among others.

Pharmacy "Floriani Apotheke": Haus 9, Wichmannstraße 4, 22607 Hamburg

Bakery "Bäcker Körner": Ebertallee 228, 22607 Hamburg

Bakery "Bäckerei Allaf": Luruper Chaussee 141, 22761 Hamburg

Within a five-minute walking distance from the main entrance Campus Bahrenfeld/DESY, you will find various supermarkets, restaurants, bakeries, drug stores at 'Osdorfer Weg'. Just leave the main gate and continue on 'Notketraße' southwards and continue on 'Zum Hühnengrab' until 'Osdorfer Weg'.

Drugstore "Budni": Osdorfer Weg 106, 22607 Hamburg

Shopping Mall "Elbe-Einkaufszentrum": Osdorfer Landstraße 131-135, 22609 Hamburg (20 minute-walk).

09 PUBLIC TRANSPORT

The public transportation service is called Hamburger Verkehrsverbund (HVV). It runs four underground lines (U-Bahn), nine city railways (six S-Bahn and three A-Bahn lines), 649 bus lines and six ferry lines in the harbor and on the river Elbe. The MetroBus lines from 1 to 14 are directed

to the city center and/or to the center of certain city quarters. The lines 20-27 provide cross- connections. The Schnellbus lines, identified by an "S", require an extra-fee. This is not the case for the HVV Ferries: they are named with a double-digit number and can be used with an HVV ticket without extra-costs.

You can find further information on http://www.hvv.de/en or via the App "HVV".

Tickets

You can buy tickets at ticket machines, via the HVV App or at the online shop. Purchasing tickets via the App, at ticket machines or online is recommended, because the "timetable info" will show you the right ticket and they are often slightly cheaper.

Single and Day tickets

With the single ticket you can get on, change lines, get off- and back again, as long as it is on the most direct route to your destination. Return journeys and round trips are not permitted. It is often worth buying the 9am day ticket even if you only travel twice that day and the 9am group ticket is often best, even if there are only two of you. 9am day and 9am group tickets are valid Mon-Fri from 12am to 6am and from 9am until 6am the following morning, all day on Saturday, Sunday and public holidays.

Hamburg Card

If you arrive earlier or prolong your stay in Hamburg, you might want to consider buying the Hamburg CARD. The Hamburg CARD is a discovery ticket that allows you to explore Hamburg conveniently, affordably, and flexibly at any time. Benefits are

- unlimited travel by bus, train and harbor ferry (HVV)
- up to 30% discount at harbor tours, Alster trips and city tours
- up to 50% discount at attractions and museums
- up to 28% discount* at musicals and theatre
- 20% discount** at restaurants and coffee shops

*Remaining tickets for regular events at the box office

**on food when presenting the card before ordering

The Hamburg CARD is available as a single ticket or a group ticket and can be purchased online or at the local tourist information (central station, harbor, airport, Dammtor railway station and most hotels) and HVV ticket vending machines. You can purchase the Hamburg Card for one day or for up to five days. Please note that buying a 3-day- ticket is cheaper than buying three single tickets.

Source: hamburg-travel.com

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10 HAMBURG – GATEWAY TO THE WORLD

The Free and Hanseatic City of Hamburg is, with a population of over 1.8 million, the second-largest city in Germany. Located in northern Germany, the city's metropolitan region is home to more than five million people. Hamburg is especially known for its location on the River Elbe and two of its tributaries, the River Alster and the River Bille. Europe's third-largest port is based in Hamburg, which led to the nickname "Hamburg - Gateway to the World". Various companies within the media, commercial and logistic industries are located in Hamburg, including multinationals Airbus, Aurubis, Blohm + Voss, Beiersdorf and Unilever. Hamburg is a major domestic and international tourist destination and ranked 18th in the world for livability in 2016. In 2015, the Speicherstadt and Kontorhausviertel were declared World Heritage Sites by UNESCO. Hamburg is also known for several theatres, the entertainment district Reeperbahn (St. Pauli), and is often referred to as the third-largest Musical-Capital in the world. Hamburg also gained international media coverage with cultural venues like the Elbphilharmonie. Sightseeing Spots are

- Hamburger Hafen (Harbor of Hamburg)
- Speicherstadt (largest warehouse district in the world on timber-pile foundations)
- Fischmarkt (big market close to the harbor)
- Hamburger Michel (St. Michaelis Church, Hamburg's main church and landmark)
- St. Pauli und Reeperbahn (entertainment district of Hamburg)
- Binnen- and Außenalster (inner and outer Alster, panoramic view)
- Alter Elbtunnel (Old Elbe Tunnel, 24 m beneath the Elbe)
- Hamburger Rathaus (City Hall of Hamburg)
- Miniatur Wunderland Hamburg (miniature wonderland)

Elbphilharmonie (Elbe Philharmonic)

11 CUI ORGANIZING TEAM

Eileen Schwanold, Sarah-Christin Stöwer, Annika Schonefeld, Cindy Hirsch, Ingeborg Adler

12 IMPRINT

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LEGAL FORM AND LEGAL REPRESENTATION

Universität Hamburg is a public corporation. It is represented by the President of the University, Prof. Dr. Hauke Heekeren, Edmund-Siemers-Allee 1, 20146 Hamburg, Germany.

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