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Biogas Boom Reloaded? – An agro-economic perspective

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In 2009 and 2012, reforms of the Renewable Energy Sources Act (RESA) led to a real boom in biogas production in German agriculture. This had multiple impacts on the profitability and competitiveness of the farms [1]. From 2016 onwards, further amendments of the RESA, especially the reduction of the guaranteed feed-in tariffs, stopped the expansion of biogas production almost completely. However, at the latest since the gas crisis caused by Russia's war in Ukraine, biogas production is coming back into focus, also under the aspect of supply security (e.g. [2]). The current approximately 9500 biogas plants in Germany supply around 50 billion kilowatt hours per year, which is roughly equivalent to the output of all solar plants in Germany. However, unlike solar and wind plants, biogas requires raw materials. And in addition to agricultural waste products, these also include food and animal feed. As a result, biogas plants influence the production structure and tend, for example, to intensify livestock farming [1], which in turn has negative effects on soil, the environment and biodiversity. What are the implications of these trade-offs for agriculture and policy? Can a sustainable expansion of biogas production in Germany succeed?

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Advanced thermochemistry computations for improved microkinetic modeling

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Heterogeneous catalysis is a promising and growing field as it reduces the reliance on fossil fuels and can make energy generation and chemical conversion processes cleaner and more efficient. Developing and improving theoretical tools for catalytic process optimization with respect to efficiency and selectivity is imperative for a more sustainable future. Microkinetic reaction mechanisms are useful to determine the optimal catalysis conditions when modeling chemical reactors. The reaction mechanisms should be thermodynamically consistent, in which case accurate free energies of the species involved are required.

The open-source code ADTHERM used to generate adsorbate partition functions and free energies that include anharmonic effects, utilizing recent developments in high performance computing, is presented. Specifically, the degrees of freedom that correspond to the motion of an adsorbate relative to the surface (3D for an atom, 6D for a nonlinear adsorbate) are treated as coupled and anharmonic. The coupled partition function is computed using classical phase space representations. The high-dimensional integrals are solved using Monte Carlo sampling methods. The method is to be a part of the Sandia National Laboratories' Exascale Catalytic Chemistry (ECC) computational framework for automated chemistry [1].

The presented method is used to obtain the partition functions and derive the thermodynamic properties of hydrogen [2] and methanol on Cu(111), as well as carbon monoxide on Pt(111). The adsorbate potential energy surface (PES) is constructed using machine learning in combination with density functional theory (DFT) calculations. The plane-wave code Quantum ESPRESSO is used. The PyTorch machine learning framework is used for constructing surrogate PESs for the adsorbates. The method implemented in ADTHERM results in a more accurate depiction of adsorbate partition functions than obtained with standard analytical methods. The subsequently more accurate free energies will in turn lead to improved microkinetic reaction mechanisms and hence better catalytic reactor models.

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Towards Sustainable Public Transport in Cities in SSA: Strategies and Solutions

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The relevance of sustainable transport to the society as seen in seven out of the 17 sustainable development goals (SDGs) cannot be overemphasized. The 13th SDG highlights the need to pursue holistic sustainable transport solutions through the prioritization of public transport, non-motorized transport, and cleaner and efficient internal combustion engine vehicles. Presently, the state of road-based public transport in Accra city-region and Dar es Salaam city in Sub-Sahara Africa is environmentally unsustainable with both cities experiencing rapid motorization and urbanisation, dominance of use of low capacity vehicles for public transport, and having issues with coordination and communication mechanisms among key actors for public transport provision. It is against this background that this research comparatively investigates strategies and solutions for sustainable public transport in Accra city-region and Dar es Salaam city. This research adopts qualitative research design and associated methodological options. Accordingly, qualitative expert interviews with actors have been conducted remotely in the two collective case study cities. Findings from the research regarding existing legal and regulatory capacity of actors reveal that there is inadequate enforcement of transport regulations in Accra city-region partly due to lack of political will, and absence of government regulation on subsidies for mass public transport operations; whereas in Dar es Salaam city, there is lack of specific Bus Rapid Transit (BRT) laws and regulations. Similarly, the research reveals that the existing logistical capacity of government agencies, and private transport operators in both cities are inadequate. A strong political will, establishment of public transport authorities in both cities, and upgrading the existing technical capacity of private transport operators, public transport operators, and government agencies are therefore prerequisites for holistic sustainable transport solutions.

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Soils diversity at Mars

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Soils correspond to loose, unconsolidated materials resulting from the physical and chemical alteration of rocks by several processes. Soils can be used to estimate the bulk composition of the crust by looking at their primary constituents, and they bring important clues concerning the past environmental conditions on Mars as they contain some secondary phases.

My main objective is to study the chemistry and mineralogy of soils on Mars, depending on their grain size and on their location. We use data from SuperCam (onboard Perseverance [1,2]) at Jezero crater [3] and data from ChemCam (onboard Curiosity [4,5]) at Gale crater [6]. The objective is to investigate the hypothesis of a local component in the coarser grains, and to investigate the homogeneity of the fine-grained soils over the planet [7,8].

At Gale crater, very coarse grains and pebbles were mainly felsic (Si and alkali-rich) and were observed at the beginning of the traverse [7], where igneous felsic float rocks were observed – forming directly from the erosion of these rocks. However, at Jezero crater, very coarse grains correspond mainly to olivine (rich in Mg) and they are observed in both units visited by the rover so far: Seitah (olivine-rich rocks [9]) and Maaz (basaltic lavas, dominated by pyroxenes [10]). They seem to have travelled more than at Gale crater, but this will be investigated more in detail.

Finest particles of the soils carry the volatiles fraction (H, Cl and S) in both craters. At Jezero, they seem to be less enriched in S, but slightly enriched in Cl. This could mean that local contributions occur even in the fine-grain soils. Much less data on soil targets have been acquired at Jezero so far. Therefore, more statistics are needed to fully compare both datasets.

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Game-Theoretical Modeling for Green Hydrogen Markets

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Green hydrogen is hydrogen that has been produced through a chemical process known as electrolysis using renewable energy, only. It has the potential to transform energy systems since it can be stored and transported in gas form, providing a clean alternative to natural gas. However, as an energy source, hydrogen is still in its nascent stage of development and many practical questions remain. In this talk, we focus on how an intraday market using green hydrogen as a storage device can be modeled mathematically. We start with a model developed for natural gas markets [1] and describe how the physics of gas transport change when using hydrogen gas. We describe how game theory can provide solution concepts that describe market behavior for a group of noncooperative wholesalers. One central difficulty when modeling energy systems based on renewable energy is that their short-term supply fluctuates based on environmental factors such as the weather. In mathematics, such uncertainty can be described using stochastic modeling. We describe first results in understanding stochastic models for physics-based problems [2] and how algorithms can be designed to solve such problems computationally.

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Enabling sustainable technologies through the recovery of specialty metals form industrial residues – A spotlight on Scandium

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The fast progress of more sustainable and environmentally friendly technologies in all areas of life comes with many challenges. One of these challenges is the diverse set of raw materials that is required for many of these technologies. This set includes the rare earth metal Scandium (Sc), which is an enabler for lightweight applications and solid-oxide-fuel cells. In the last decade, insecurity in Sc supply and demand has evidently decelerated the implementation of Sc containing applications. For the EU, it is therefore of high interest to establish a reliable, European Sc value chain.

Sc rarely occurs in natural ore deposits and is currently recovered only as a by-product of other metallurgical production routes outside of Europe[1]. Within Europe, it was found to be enriched in bauxite residue (BR), which is a waste stream accumulating during Alumina (Al_2O_3) and Aluminum production [2]. To develop efficient technologies for the recovery of Sc from BR, the knowledge about the Sc association and mineralogy in the waste stream is highly important. In this study, we therefore present the results of mineralogical and geochemical investigations of Sc in BRs of different origin. Five different BRs were investigated and compared by applying several complementary methods. These included electron microprobe analyses, Raman spectroscopy, laser-ablation ICP-MS and X-ray absorption near edge structure. The Sc recovery by leaching was systematically studied by using a design of experiments to understand the influence of different leaching parameters. Subsequent analyses with X-ray diffraction delivered insights into the phases that liberate Sc into solution. The results provide in-depth knowledge about the general occurrence of Sc in different BRs and enable to draw conclusions on the connection between the primary bauxite ore and the BR. The research was funded by the EU's H2020 SCALE program under GA No. 730105.

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Flexibility requirements in a 100% renewable German power system with growing shares of sector coupling technologies

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Fighting the global climate crisis calls for a drastic decarbonization of the energy system. In Germany, the transition towards a carbon-neutral energy system follows two strands of action. First, replacing fossil-fueled power generation with renewable energy technologies. And second, decarbonizing other sectors, such as heat and transport, through electrification, also called sector coupling. A power system based on renewable energy technologies will incorporate high shares of wind and photovoltaic production which are intermittent and dependent on the weather. As power generation and demand must be balanced at all times, the demand of flexibility to achieve this balance will rise with higher intermittency and seasonal weather patterns. On the other hand, sector coupling technologies, such as heat pumps and electric vehicles, have the potential to shift their demand in time and therefore offer flexibility [1]. In this study, we measure the flexibility requirements of a fully renewable Germany power system with increasing shares of electric vehicles and heat pumps. We therefore adapt the methodology introduced in [2] and formulate an optimization problem to determine the flexibility demand in terms of storage requirements at different timescales, namely daily, weekly and seasonal. Our results show an increase in flexibility requirements with growing shares of sector coupling technologies. This increase can be explained by a rising power consumption through the electrification of heat and transport. However, when utilizing the flexibility of the sector coupling technologies, the additional storage requirements can be reduced to roughly half. Our results therefore stress the importance of utilizing the flexibility of sector coupling technologies to reduce the required storage in highly renewable power systems.

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Infrared nanoscopy and tomography of intracellular structures: glimpse inside cells with infrared light

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Infrared (IR) microscopy and spectroscopy, while being sensitive to the samples' chemical composition, suffer from poor lateral resolution due to diffraction. Therefore, imaging of the cellular inner structure in the IR range of the electromagnetic spectrum proves to be challenging. An approach to overcome this limitation is by using scattering-type near-field optical microscopy (sSNOM) and nano-Fourier transform infrared (nanoFTIR) spectroscopy, achieved by combining the high spatial resolution of atomic force microscopy (AFM) and the chemical sensitivity of IR absorption. We were able to resolve the subcellular structure of C. reinhardtii and assign the IR absorption of various organelles to molecular vibrations with spatial resolution of 20 nm. For instance, this allowed to resolve the microtubular structure of the algal flagellum. The necessity and power of chemical imaging was demonstrated by scanning the nuclear area, where several nuclear bodies were distinguished in the sSNOM images while remaining hidden in the AFM topography. Finally, a stack of sSNOM images, obtained by sequential scanning of serial sections, was used to reconstruct a three-dimensional image. Thus, we demonstrate that sSNOM tomography allows visualizing three-dimensional intracellular structures at nanometer resolution where the contrast originates from molecular vibrations of chemical bonds.

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The Combinatorial Side of Graph Neural Networks

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The management of resource production and consumption is a major challenge towards the sustainable use of energy. To tackle it, we need to be able to make predictions based on the available data, i.e., to foresee the future. This renders the problem attractive for machine-learning approaches.

Graphs constitute a simple and common abstraction to model energy systems. Thus, graph neural networks (GNNs) are a natural candidate architecture for machine-learning tasks on power grids. The question which functions those message-passing neural networks can actually learn and which ones exceed their power is meaningful far beyond the sketched problem and has been studied extensively in computer science.

In this talk, I will take up a graph-theoretical perspective on the setting. I will touch on combinatorial methods to analyse and understand large networks and discuss some of my research concerning the expressive power of GNNs and of their extensions to higher-dimensional neural networks, which are more complex, but also more expressive than the standard recurrent GNNs.

Mathematical modelling of intraday electricity markets

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With the launch of the Single Intraday Coupling (SIDC) in 2018 a single European cross-zonal intraday electricity market was created with the goal to increase the overall efficiency of electricity trading. Being based on a continuous trading mechanism, SIDC promotes competition, increases liquidity and allows for easier sharing of energy generation resources as it enables market participants to balance their positions until one hour before delivery time. Thereby, the SIDC serves as an important component in the ongoing energy transition. In this talk, I will present a mathematical modelling approach to analyse the evolution of prices and volumes on the European intraday electricity market. Starting from a microscopic description of the market, I will derive high frequency approximations of the underlying order book dynamics. The resulting stochastic differential equations will provide the necessary analytical tractability for possible applications. I will present two specific models, focussing on different aspects of intraday electricity markets: the first one aims to capture the high variability of intraday electricity prices, while the second one is designed to study the effect of cross border trading on market efficiency. The resulting models will be visualised through simulation studies.

From corrective to proactive maintenance, what wind energy industry has done?

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Wind energy industry has boomed due to the need of energy transition from the past decades. Siemens Gamesa Renewable Energy (SGRE), as one of the leading wind turbine manufacturers and service providers, has continuously developed sustainable maintenance strategies to pave the way from corrective to proactive maintenance through data-driven maintenance management. By the intensified use of condition data-based models, the remaining life of components is more accurately forecasted, thereby minimizing material consumption, maintenance activities and downtime while increasing first-time fix rate. Therefore, it can significantly reduce Levelized Cost of Energy (LCoE) over the lifetime of wind farms, increase turbine availability and optimize energy production.

Synthesis of catalysts towards the use of methanol and ammonia as chemical energy carriers

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The energy transition from fossil fuels poses a paradigm shift, since, among other issues, renewable sources are local and volatile. [1] A solution for this problem is chemical energy conversion, where energy from renewable sources such as solar or wind can be exchanged in the form of molecules, hereby energy carriers, which can be later transported using existing shipping infrastructure. There are several possible candidates, but both ammonia and methanol appear as the most promising ones, since they are already included in chemical industrial processes, and as liquids, are easier to transport than, for instance, hydrogen. [2] We focus our investigations on the specific processes of (a) ammonia decomposition and (b) methanol synthesis from CO_2, and try to link the physicochemical properties from the catalysts used with their activity or stability over time. By using automated synthesis reactors, mixed metal oxides as catalysts precursors were prepared in highly controlled conditions via precipitation, giving materials with high surface areas (up to 90 m^2/g), phase purity in XRD analysis and good elemental distribution as shown from SEM/EDX studies. In particular for methanol synthesis, ZnO/ZrO_2 demonstrated a higher productivity at higher temperatures (300-350 °C) than the industrial standard, hinting to the possibility of a CO-free reaction pathway. For the case of ammonia decomposition, the synthesis of $MgFe_2O_4$ was studied in a systematic way, with variations in the synthesis temperature, aging time, presence of oxidant and base used for the precipitation. We could demonstrate that the phase purity –which we can control by the preparation method- does play a role in the activity, closely related to the availability of potentially reduced iron species. Furthermore, we carried out a thorough characterization with TEM/EDS that gave further insights into the mixed particle/platelet morphology of these materials and their local Mg-rich or Fe-rich composition.

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Communication: Closing the gap to implement low-carbon energy

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Communication is not only a basic human need but is also the medium by which we convey information across entities. Yet, effective communication in strategic implementation of low-carbon energy is often overlooked or not ascribed enough importance. This is extremely probable in the case of renewable energy implementation where misinformation or inaccurate fact disclosures can lead to opposition from local stakeholders, resulting in a failure of the project implementation [1]. Having a well-planned communication strategy in place could mitigate such situations [1], provided it is built on research into industry and public attitudes towards low-carbon energy, their points of influence as well the effect that energy has on the regular lives of stakeholders, alongside other contextual factors [2]. This further falls into the broader realm of Energy Communication [2],[3] which is an upcoming intersectional and interdisciplinary field that aims to provide a deeper understanding of the various factors that can define the energy transition. Using literature review as a research methodology [4], this research aims to touch upon the problems and challenges related to effective communication in a low-carbon energy implementation context, possible solutions and the road ahead when it comes to developing communication strategies as well as energy communication as a field of research.

Disclaimer: The opinions mentioned in the abstract or during the course of the presentation are solely those of the author, and do not reflect the opinion of the author's employer in any way.

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Quantum simulations of materials for renewable and sustainable energy

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The increasing demand for energy and the impact that conventional energy technologies (mostly based on fossil fuel) has on the environment have led to an urgent need for the development of efficient ways of capturing, storing and transforming energy in a more renewable and sustainable way. In this talk I will discuss how high-performance computer simulations combined with state-of-the-art first-principles methods can be used to predict and design materials for renewable energy applications. In the first part of the talk, I will present a study of the electronic, optical and transport properties of transition metal nitrides (Ta_3N_5) [1,2] and oxides ($BiVO_4$) [3] for solar water splitting. The second part will focus on the investigation of heterostructures formed by organic molecules and two-dimensional materials for wearable and portable photovoltaic devices [4].

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Lessons from the Microcosmos - Nanotechnology, social sciences and biology meet in the world of microbes

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Bacteria had/have essential role in the evolution and sustenance of our ecosystem, and their presence is also necessary for a healthy human body. Beyond their biological importance they are often used in basic technological processes. Bacteria, with their size of a couple of micrometers, are the easiest organisms, however under specific circumstances they perform complex, multicellular behavior.

Micro- and nanotechnology is getting more and more popular in microbiology research. Miniaturized systems can be created in which the behavior of microorganisms can be studied both on the level of populations and single cells, while changing the microenvironment at will. In the microscopic regime ("in the world of low Reynolds numbers") we can investigate phenomena that otherwise cannot be observed in macroscopic systems.

In our laboratory we use the technique of microfluidics to model characteristic properties of the natural habitats of microbial communities. This way we get information on their motile behavior, growth, social life, communication, cooperative behavior, and even on their evolution. This presentation gives an overview of these studies with a special focus on our research on the evolution of antibiotic resistance. The problem of constantly evolving resistant bacteria is one of the biggest threats to global health, food security, and development today. We study the effect of heterogeneous environment on these evolutionary processes. Individual cells might behave different than a community, therefore we also perform single cell level studies. Experiments carried out on single cell level might reveal the importance of phenotypic heterogeneity beyond population level responses.

Environmental - Hemorrhage due to the Ever Increasing Demand and Usage of Paper in Sub-Saharan Africa: E-Technologies to the Rescue.

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In developing nations like Uganda, environmental degradation has become a major problem. According to (Cooper, 2018), 41% of Uganda's total area is degraded. This is partially due to the usage of paper, particularly in the business and education sectors. While corporations utilize paper for packaging, educational institutions have long used pen and paper to take notes and exams (Natumanya et al., 2021, Wandosell et al., 2021). Due to the fact that paper is made from trees, the rising demand for it has resulted in deforestation which has direct negative impact on climatic change that contributes to global warming and its effects. As paper is frequently burned or thrown in pits, Uganda's recycling rate for paper, which is the current method of preventing recurrent deforestation, is still lower than the global paper recycling rate of 38% (Wandeka et al., 2022). Through the use of e-learning technologies, it is possible to reduce the use of paper in educational institutions by obtaining reasonably priced technology that is simple to obtain and use. In order to reduce the use of paper in educational institutions, an electronic examination framework that supports free electronic hand-writing has been developed and tested on smartphones (Natumanya and Nabaasa, 2022). The adoption of such a framework will lead to a big reduction in the amount of paper used institutions of learning. The testing of the framework was based on rather expensive smartphones involving few students and lecturers. This research aims to avoid the problem of environmental degradation at source by identifying appropriate, affordable hardware(tablets) in which the software that supports the framework shall be installed, a full scale deployment done and a study carried out to ascertain the security, feasibility, acceptability and possibly changes by users (students and lecturers) in institutions of learning.

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Responsive polymers in action: microrobots and integrated photonics controlled by light

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Shape changing polymers with a nano 3D structuration allow for functional microstructures with a wide range of applications in tunable photonics, micro-robotics and cryptography. Among responsive materials, liquid crystal based polymeric formulations, thanks to the reversible shape change and refractive index variation, open for a dynamic tuning of the optical properties by external stimuli. The photonic structure morphology can be finely controlled in elastic materials such as liquid crystalline networks (LCNs).[1]
LCN are defined as "artificial muscles" and their anisotropic deformation can be programmed by a proper molecular alignment design with a sub-millisecond dynamics.[2] The 4D micro-structuration (3D design with a well-controlled temporal deformation) is achieved by photo-polymerization of smart materials with Two photon Direct Laser Writing (TP-DLW).[3] We explored all these ingredients in the field of polymer photonics to fabricate a 2D diffractive grating structure for optical beam steering with sub-millisecond time response.[2] and tunable whispering gallery mode resonators (WGMR) integrated in photonic circuits for dynamic signal manipulation and filtering.[4] On the other hand, the muscle-like behavior of LCNS can be fully exploited in micro-robotic applications that include a micro-robot able to autonomously walk when illuminated by light and a micro-hand capable to selectively grab micro-objects of different colors.[5] On the other hand, the remarkable tunable birefringence of liquid crystals at the phase transition efficiently modulates the refractive index. Such reconfigurability has been fully exploited in disordered photonic media made by dye doped liquid crystals for cryptographic primitives such as physical unclonable functions. [6-7] The stability and complexity of the cryptographic functions have been studied for different liquid crystalline formulations highlighting as tunable material properties represent a promising solution for novel cryptographic primitives for authentication processes in the Internet of Things era.

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Formation of bismuth iron oxide-based core–shell structures and their dielectric, ferroelectric and magnetic properties

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Materials exhibiting more than one ferroic properties such as ferroelectric, ferroelastic, ferro/ antiferromagnetic ordering are known as multiferroic materials. In order to realize the true potential of these materials for applications in memory and spintronics what is importantly required is to achieve an appreciable magnetoelectric coupling. Both $BiFeO_3$ and $Bi_2Fe_4O_9$ are multiferroic of type I and type II respectively exhibiting transitions above room temperature. This work is to give an insight to the growth of these phases in the process of the preparation of $BiFeO_3$ by means of thermo mechanical alloying. Bismuth and iron oxides subjected to ball milling followed by controlled annealing treatments showed the formation of core–shell nanostructures with $Bi_2Fe_4O_9$ as the core and a shell of $BiFeO_3$ and $Bi_{25}FeO_{40}$ phases as deduced based on the analysis of transmission electron microscopy results. The mechanism of formation of such bismuth iron oxide based core–shell structures with Bi richer phases distributed radially outwards has been elucidated based on a model proposed in this study. Hyperfine components at Fe sites have been studied using Mössbauer spectroscopy to understand the local structure and magnetic properties and defect associated components of each of the phases. The system of such core–shell particles surrounded and separated by haematite particles is observed to be ferroelectric and exhibit a giant dielectric response. Bulk magnetization studies indicate the weak ferromagnetic ordering of the resultant phases. Both the giant dielectric and weak ferromagnetic properties are understood to be caused mainly by oxygen vacancies associated with nano-shells of bismuth ferrite of the core–shell structures.

A TAIL OF TWO CITIES: HUMAN – DOG RELATIONS IN URBAN INDIA AND GERMANY

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The urban, seen as a living space, is a heterogenous composition of interactions between its inhabitants, built through their everyday lived experiences (Simone, 2013). The concept of urban has come far from its static descriptions based on demographics and structure to more dynamic concepts of everyday experiences. Yet, these experiences are still limited to those of humans. In our research, we observe the interactive city to understand how it is inhabited and configured by its human and nonhuman inhabitants equally. Through a combined lens of ethnography and ethology, we observe the human-dog interactions arising due to shared urban spaces in our two comparative cities: Delhi and Berlin. Both cities offer diverse cultural and historical backgrounds, shaping multispecies interactions. These interactions are laced with ecological, political, and social dynamics which contribute to the sustainability of cities. Through our research, we develop the idea of a 'pet city', where we attempt to understand the pet-keeping in cities through observing various aspects of human-dog relations including ownership, care, health, behaviour, and politics. We further the idea of sustainable multispecies cities, where the urban structures are inclusive of both human and nonhuman experiences.

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Modelling, Simulation and Optimization of Energy Transport Networks

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For a sustainable and CO2-neutral energy supply, the entire energy cycle in electricity, gas and heating networks must be considered. In order to make network utilization and expansion reliable and efficient, supply and demand should be compared, and flexibility between energy sources and storage should be used. This requires both vertical communication between the network levels and horizontal communication between the energy sources. Despite rapid advances in hardware and software, there is still a need for further development in the energy sector for the higher-level monitoring and control tasks as well as the exchange of data and models. In the present talk we give a short insight in new mathematical developments for an integrated simulation and analysis of network scenarios for energy supply with electricity and gas. Our focus is on network topological partitions, stability analysis and model criteria for the coupling of networks in order to enable a stable numerical simulation and thus a reliable scenario analysis for coupled networks.

Photonics Cluster Berlin Brandenburg – high technology for a sustainable world

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The future is made of light – Optics, Photonics and Microelectronics are key technologies when moving towards a more sustainable future. They are central innovation drivers for technological changes in almost all fields of applications.

Berlin Brandenburg has grown into one of the world's most important locations for the photonics industry and offers the best conditions for concentrated research, development and production thanks of the exceptional Research and development landscape and high density of excellent universities, institutes and research facilities as well as the high degree of networking between research and industry.

The Photonics Cluster Berlin Brandenburg is a strong network of companies, startups and research institutions. Lighting solutions for smart horticulture and vertical farming, sensing technologies for a circular economy and sustainable production lines, advanced materials creating greener and more sustainable products as well as optical communication and detection systems for autonomous and efficient driving are just a few topics of the photonics sector in the German Capital region. In addition, future applications of quantum technologies (QT) also show interesting potential for a sustainable future and the QT-ecosystem in Berlin Brandenburg is continuously growing.

As part of the business development agency of Berlin, Berlin Partner für Wirtschaft und Technologie, the photonics cluster offers a variety of support services. In addition to topics such as location, financing, talent, technology transfer between research and industry or international relations, we also provide support with the subject of corporate sustainability.

The presentation will give an overview of the photonics ecosystem in Berlin and Brandenburg and the important role of technology and knowledge transfer regarding a sustainable development of our society between research and industry.