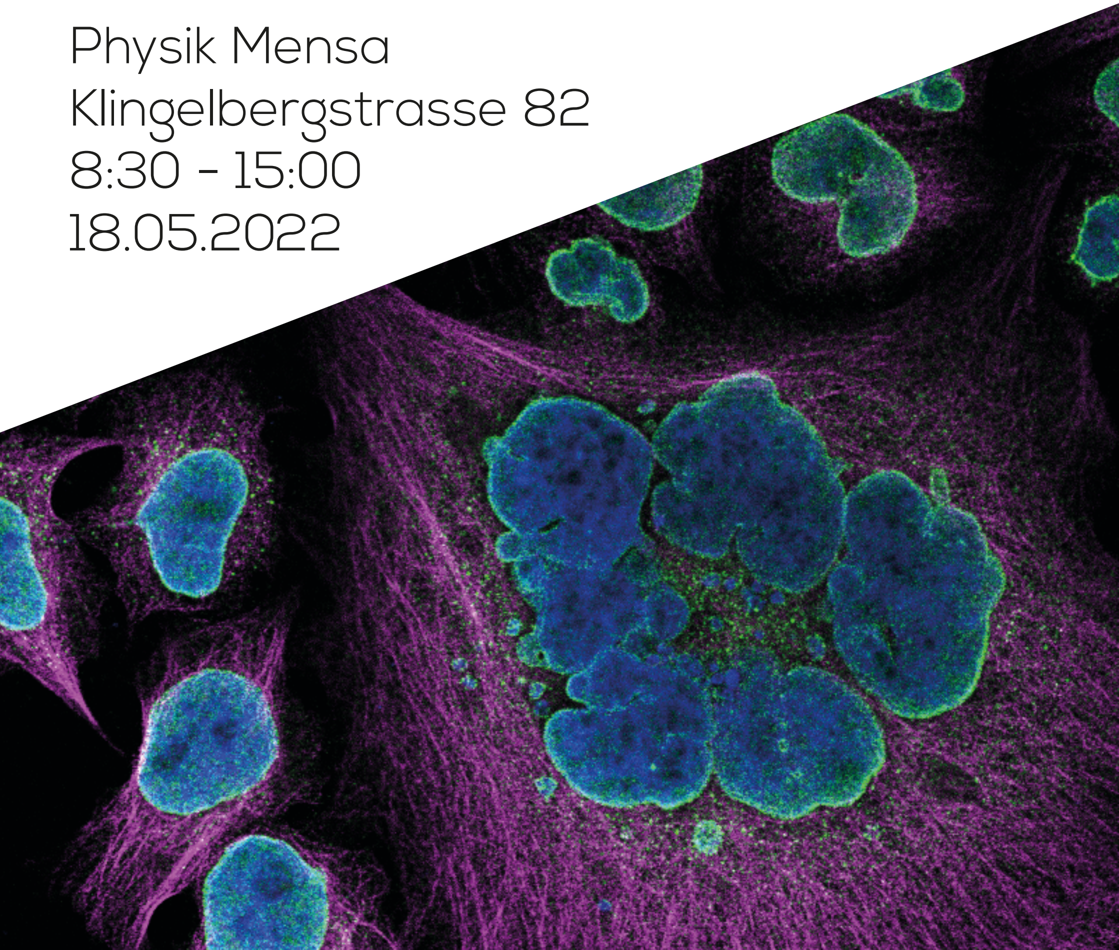
Small Talk.

Booklet.

University of Basel

SNI
SWISS NANOSCIENCE INSTITUTE
EINE INITIATIVE DER UNIVERSITÄT BASEL UND DES KANTONS AARGAU

Physik Mensa
Klingelbergstrasse 82
8:30 - 15:00
18.05.2022



"If I have seen further it is by standing
on the shoulders of Giants."
- *Isaac Newton*

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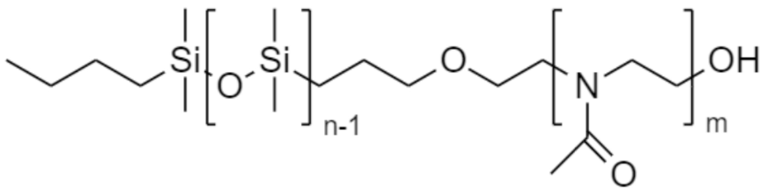
Self Assembling Polymers: Cascade Reaction

- *Davide D'Accurso*

By using film rehydration, the diblock copolymer $PDMS_{25}$-b-$PMOXA_{10}$ is driven into self-assembly. During self-assembly, various molecules can be added to the polymer mixture. This method produces nanocompartments, with the added molecules within the inner core. Two nanocompartments are produced under addition of molecules commonly used in pyrosequencing. DNA replication undergoes in the first nanocompartment, producing pyrophosphate. Pyrophosphate undergoes a chemical reaction in the second compartment yielding ATP. A surrounding solution containing luciferase and D-luciferin allows the ATP production to be detectable via spectroscopy. For this, it is crucial to standardize a self-assembly procedure, which yields both nanocompartments with the required molecules within the spheres. Characterization of the samples is done via Static Light Scattering, Dynamic Light Scattering and Nanoparticle Tracking Analysis. The ratio of radius of gyration and hydrodynamic radius is obtained in order to determine their structure. The homogeinity is measured via polydispersity index.

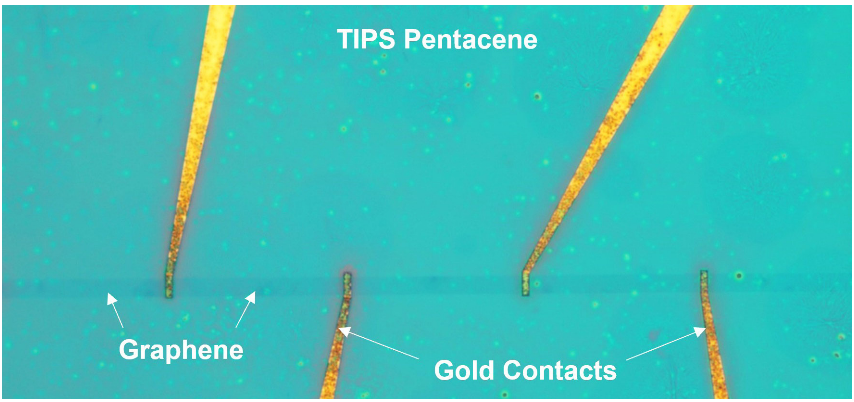


$PDMS_{25}$-b-$PMOXA_{10}$

Hybrid Graphene/ TIPS-Pentacene Phototransistor

- Gabriel Weber

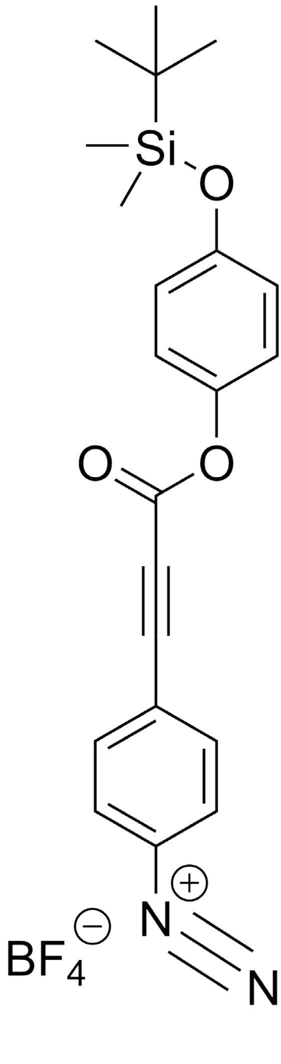
Graphene experiences rapid growth in interest for electron-device fabrication, because of its excellent charge carrier mobility and the possibility to manufacture single atom thick channels. The fabrication of graphene by exfoliation and chemical vapor deposition (CVD) enables rapid progress in graphene research. These processes provide high-quality graphene for various applications. Especially graphene-based transistors are of high interest. However, to realize graphene-based optoelectronics, an additional absorbing layer is needed, due to the weak light absorption of graphene. In this block course, we investigated a hybrid phototransistor, consisting of a CVD graphene layer, which was covered with a thin film of TIPS-pentacene. The hybrid phototransistor device reached a field-effect mobility of μFE,dark = (1530 ± 30) cm^2/Vs, a response time of 250 ms, but a gain in conductance of only 1.007. Therefore, we propose to conduct future investigations regarding the transfer and cleaning procedure of CVD graphene to improve the performance of phototransistor devices.



Synthesis of Diazonium Salts for Electrochemical Grafting on Metal Surfaces

- *Elaine Schneider*

Modification of surfaces at the nanoscale is a current technological challenge. Conventionally, surface modification is achieved by depositing bifunctional molecules containing an anchor group and an active subunit from solution or gas phase. Applications with patterns of varying surface modifications at the nanoscale, such as microfluidic chips, necessitate the application of new grafting techniques. Of particular interest are electrochemical immobilization strategies that allow for precise functionalization of electrodes, ideally as single atom layer, which can be achieved with diazonium salts. Combining this strategy with a protected alkyne group that allows for further modification via click chemistry facilitates electrochemical multiplexing, meaning that functionalized areas can be partially deprotected and modified selectively while nearby functionalized areas stay passive in the presence of the same solution of reactant. Here, I report on the partial synthesis of a compound designated for this purpose.

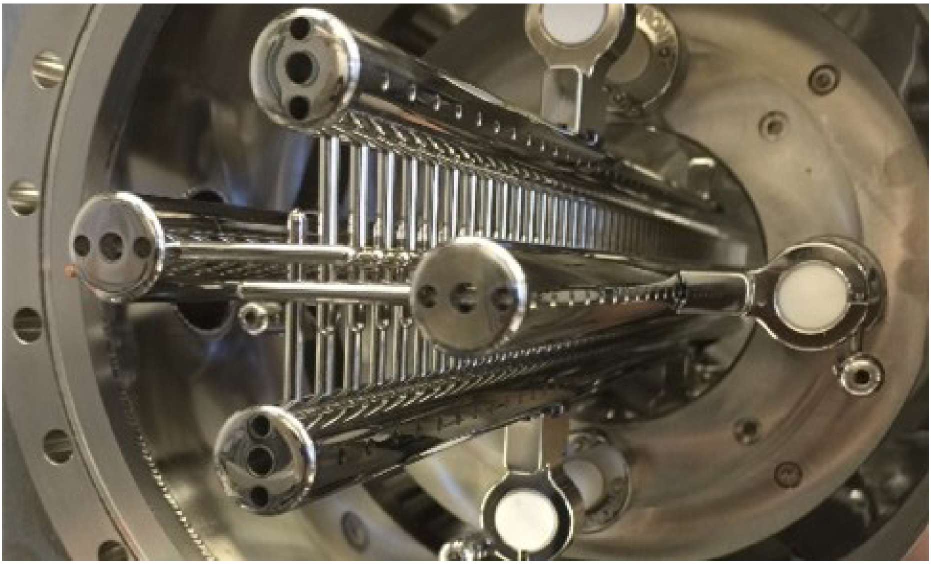


Si
O
O
O
N
N
BF4

Efficiency of Stark Deceleration Modes For Generation of Cold OH Radicals

- Michelle Arnet

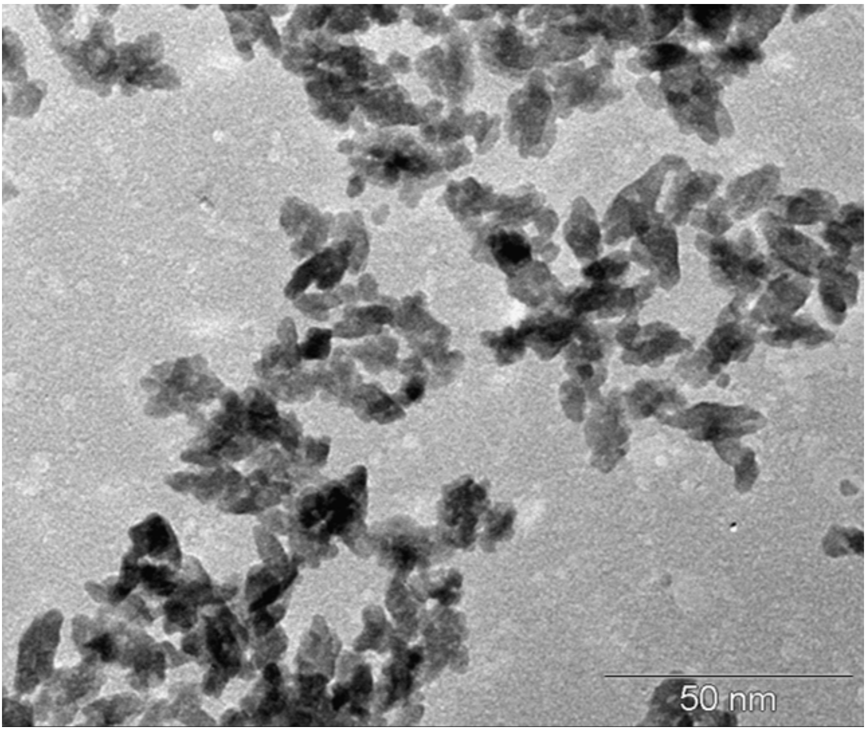
Stark decelerators allow the production of transitionally cold molecules with applications in trapping, spectroscopical and collisional studies. By implying time-varying inhomogeneous electric fields on a pulsed polar molecular beam, a selected portion of the beam can be decelerated to arbitrary low velocities. To increase the efficiency of Stark deceleration, and hence the number of decelerated molecules per experiment, recently focusing modes have been introduced. Focusing modes enhance transverse stability of decelerated molecular packages, regarding the conventional normal mode by applying new field distributions. In this work, we decelerated OH radicals up to 30 m/s by the normal mode and three focusing modes to evaluate their efficiency. In comparison to the normal mode, increased efficiency was observed for all focusing modes for all deceleration strengths. At final declaration velocities, sufficiently small for trapping, the applied 12.5 kV and 13.5 kV focusing modes decelerated at least 6 times more molecules than the normal mode.



Fast-Synthesis of Nanocrystals: A Method Comparison

- *Martina Krummenacher*

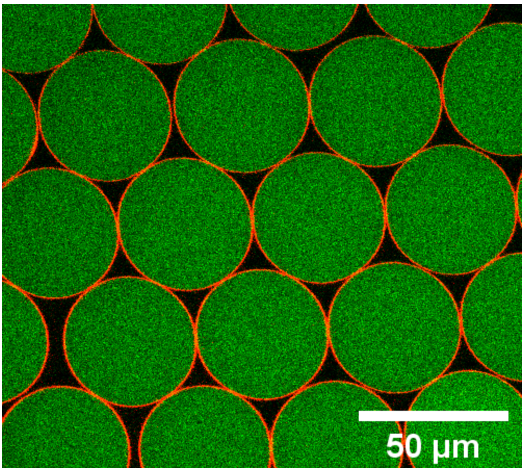
Nanocrystals doped with rare earth ions (RENPs) exhibit photoluminescence properties in the UV-Vis and near infrared region. Due to their tunable emission and excitation wavelength, biocompatibility and high tissue penetration depth, they are promising candidates for bioimaging, drug monitoring, theranostic and for electronic applications. Looking to future scope, efficient, low cost and scalable manufacturing methods for high quality nanocrystal production becomes a critical factor. Guichard et al. presented a method in which RENPs could be synthesized without inert atmosphere within 15 minutes at 260 °C in the microwave. In the De Roo laboratory, rare earth doped nanocrystals were manufactured in inert atmosphere either by 3 hours the microwave at 300 °C or by 72 hours in the autoclave at 300 °C. The aim of this project was to compare the emission efficiency and the hydrodynamic size of the synthesized nanocrystals. Therefore, 10% Eu doped ZrO_2 nanocrystals were synthesized by the methods currently used and the method proposed by Guichard et al. To prevent aggregation, the nanocrystals were stabilized with oleic acids and solved in n-Hexane. For the comparison of the emission efficiency, the nanocrystals quantum yield was measured by photoluminescence and the hydrodynamic size was measured by dynamic light scattering. Nanocrystals synthesized by the fast synthesis have a hydrodynamic size of 38.81 nm and a quantum yield of 2.23 %. The nanocrystals synthesized in the autoclave or the microwave have a hydrodynamic size of 5.27 and 5.28 and a quantum yield of 16.77 % and 6.28 % respectively. The fast synthesis method proposed by Guichard et al. is less laborious and a cost efficent approach to synthesize rare earth doped nanocrystals. However, the products quality suffers from aggregation which reduces the quantum yield. Thus the fast synthesis method has to be modified and is currently not used in the De Roo laboratory.



Microfluidic Formation of Polymer GUVs for Cell Mimicking

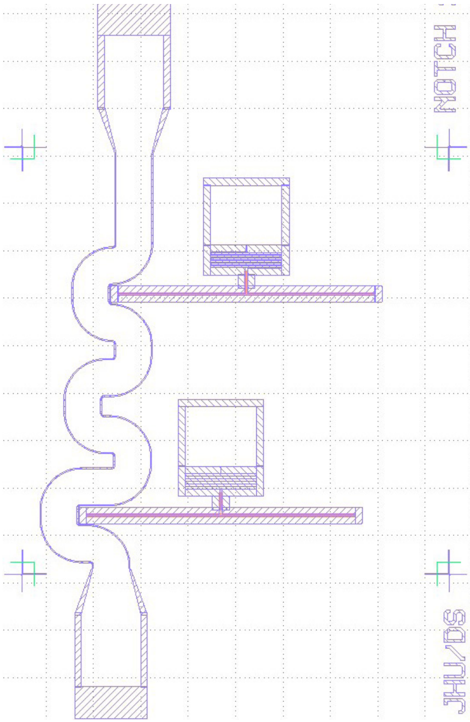
- Katja Ammann

In the past few years, polymer vesicles have been used to realize cell mimicking. Compared to lipid vesicles, polymer vesicles bring many advantages, such as chemical stability and robustness, controlled permeability as well as high versatility. Especially, unilamellar, monodisperse and about cell-sized polymer vesicles are of interest. The classic method of film rehydration produces polymer vesicles, which cannot be controlled in their size, form, and lamellarity. Thus, this method is not suited for cell mimicking purposes. The novel method of microfluidics yields the desired properties of the polymer vesicles. However, many difficulties and problems came up during the experimentation including the stability as well as the reproducibility of the exact size and effective numbers. Therefore, improvements should be made, before the method can serve as a foundation for the next steps in creating artificial cells.



Nanofabrication of RF-Resonators for Quantum Computing Applications

- Florian Röthlin

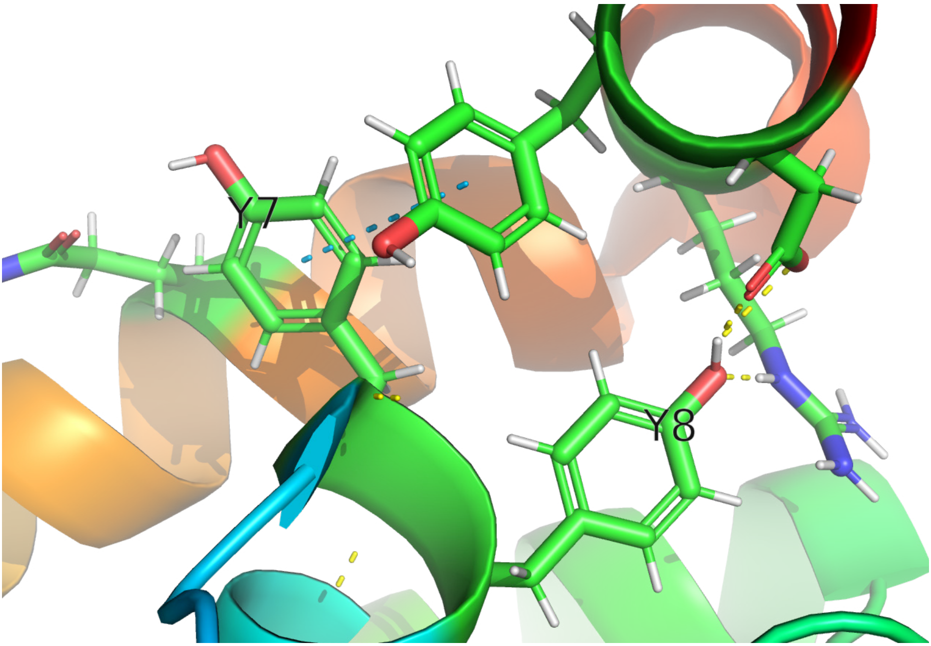


The long range coupling of qubits is an integral part of research in quantum electronics. One possible way for qubit coupling was demonstrated by coupling two superconducting qubits to the same superconducting microwave resonator (RF-resonator). This is based on a previous discovery that superconducting qubits are able to coherently interact with single microwave photons confined in the previously mentioned resonator. We fabricated two different geometries of superconducting RF-resonators based on a NiTiN thin film with a nanolithography fabrication process. We then characterized the RF-resonators at low temperatures to determine the impact of the different geometry.

Investigation of the Phosphorylation of DNAJA1 by Solution NMR Spectroscopy

- *Radu Cristian Leonte*

Post translational modifications are a vital last step in protein production, but they can also be applied later in the life cycle of a protein to regulate its activity. Preliminary results from Nillegoda et al. have shown that the phosphorylation of DNAJA1, a key player in the Hsp70 chaperone system, induces a phenotype with increased defective protein folding. Prompted by this information, the structure of the phosphorylated J-domain of DNAJA1 was analyzed through the use phosphomimetics, showing a significant loss of secondary and tertiary structure at two key residues in the amino acid sequence.



Functional Biocompatible Materials for Medical Applications

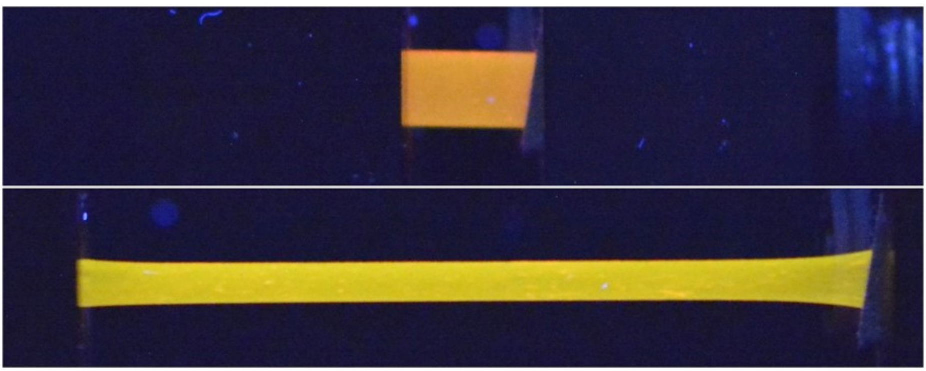
- Jonas Keller

Medical research is one of the most visible areas of scientific endeavor we encounter in everyday life and thus of high importance for both society and industry. Implants especially can significantly impact the quality of life for people afflicted by diseases or accidents. In this talk, we provide an overview over the importance of biocompatible materials used in medical practice. Our goal was to use titanium samples prepared in various ways to quantify their cytotoxicity, meaning the degree to which a substance can cause damage to a cell. First, we present all techniques used to manipulate the samples. A showcase is provided over the various methods that were used to assess the samples. We show how the cytotoxic assay was carried out. In the end, we classify our results, find wha they tell us and what they do not and finish with an outlook.

Testing and Analysis of Mechanochromic HDI-PU Polymer

- Daniel Gaus

Material stress is an abstract concept to measure in practice. To avoid having to destroy a sample, for instance a bridge or a building, one must use X-rays to measure the diffraction pattern of the metal atoms on the surface to determine the grid distortion. An alternative to this would be, if the material could directly display its status, for example via visual indication. This can be achieved by using mechanochromic polymers such as the Loop-HDI-PU polymer. These form excimer structures, which have a different emission wavelength, compared to their monomeric counterpart. In this block course, the mechanical and optical properties of this polymer were tested. The analysis of these examinations revealed that the Loop-HDI-PU polymer is a suitable material. However, it is not perfect. Future experiments should attempt to combine this polymer with other materials such as Loop-HMDI-PU to achieve a higher degree of versatility.



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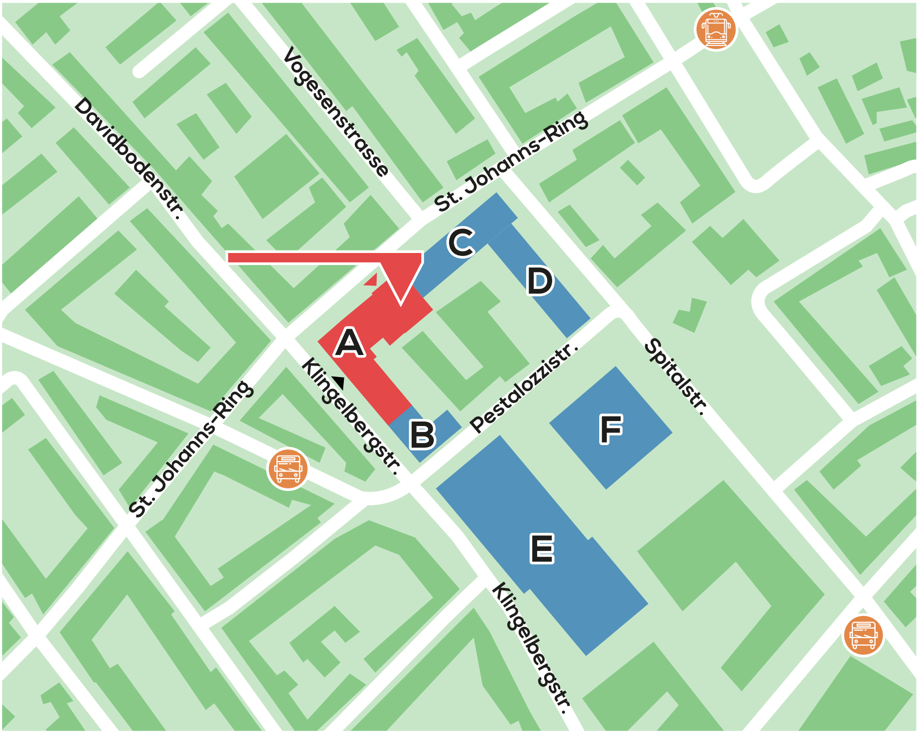
Poster Titles and Numbers

Poster Nr.	Poster Title
1	Microscopic Cannons: Insights Into the Type Six Secretion System *- Daniel Gaus*
2	CVD Growth of Si-Ge Alloys for Ge/SiGe Quantum Well Fabrication *- Davide D'Accurso*
3	Investigating The Magnetic Properties of $SrRu_2O_6$ by X-Ray Photoemission Electron Microscopy *- Florian Röthlin*
4	GeTe Surface AnalysisPSI *- Elaine Schneider*
5	Using X-Ray Microscopy to Create Dynamic Images of Magnetic Resonance Vortexes *- Jonas Keller*
6	Co-Entrapment of DNA Cargos and Photosensitzers in Self Assembling Peptide Nanoparticles *- Michelle Arnet*



A - Institut für Physik
B - Physikalische Chemie
C - Organische Chemie
D - Anorganische Chemie
E - Biozentrum/Pharmazentrum
F - Biozentrum Neubau