UNIVERSITÄT LEIPZIG

Faculty of Physics and Earth Sciences
Peter Debye Institute for Soft Matter Physics
Prof. Dr. Frank Cichos

Department Molecular Nanophotonics, Linnéstraße 5, 04103 Leipzig, Germany

PhD position available
"Hollow DNA-based hybrid nanostructures for optimized optical sensing"

A PhD position is available to work at the department Molecular Biophysics at Leipzig University under the supervision of Prof. Dr. Ralf Seidel on hollow DNA-based hybrid nanostructures for optimized optical sensing. This experimental PhD project is part of the Marie Skłodowska-Curie Doctoral Networks HORIZON-MSCA-DN-2021 project called DYNAMO.

Description of the PhD project

Objectives: Aim of this project is the development of hollow DNA-based hybrid nanostructures for optimized optical sensing applications (SERS, fluorescence spectroscopy) and analyte molecule trapping/manipulation. Advanced spectroscopy based on surface enhanced EM fields requires metallic nanostructures that support strong localized field enhancement together with specific placement of analyte molecules. With the help of the recently developed construction kit to fabricate complex metal nanostructures using modular DNA origami structures as molds, the candidate will synthesize plasmonic metal nanostructures with localized strong field enhancement (e.g., rod-like structures with gaps, cavities, pores) and characterize their performance in sensing applications in order to find optimal designs. Beyond this, the candidate will integrate in these structures specific binding sites for analyte molecules (e.g., conjugated proteins, DNA-binding proteins, nucleic acids) to allow a specific placement of the analyte molecules at the sites of strong field enhancement. Furthermore, methods to place the analyte molecules in specific orientations inside the plasmonic nanostructures in order to increase the reliability and reproducibility of optical sensing applications will be established. Finally, the candidate will adapt the hybrid nanostructure platform to integrate nanopores in the surrounding DNA scaffold such that it can be integrated with hybrid nanopore sensing applications to provide nanopores with DNA-tailored diameters as well as magnetic manipulation.

Expected Results: Tailored hollow metal nanostructures with specific presentation of analyte molecules exhibiting an improved performance in optical sensing applications. Robust methodology to fabricate nanopores for hybrid sensing applications.

Planned Secondments: To design and test suitable hollow hybrid nanostructures for SERS, the candidate will visit HU Berlin for 3 months during year one. To get insight into hybrid nanopore assembly, the candidate will visit Cambridge University for 2 months in year two. To integrate fabricated hollow hybrid nanostructures with solid state nanopores, the candidate will visit the Italian Institute of Technology for 3 months in year three. Depending on the project progress there will be additional short-term stays at TU Delft and CNRS for testing enhanced fluorescence sensing applications.

The working language is English. The PhD position is offered for a period up to three years. The position is to start as soon as possible and on February 1, 2023 at the latest.

Please visit our group website for more details about our research: https://home.uni-leipzig.de/mbp/

Requirements and application

We are seeking a highly motivated PhD candidate with an excellent Master's degree in Physics, Material Science or Biotechnology with excellent English proficiency. According to the rules for the position, the candidate must not have resided or carried out the main activity (work, studies, etc.) in Germany for more than 12 months in the 36 months immediately before the recruitment date. No restrictions of citizenship apply to the PhD position. The candidate should be committed to collaborative and interdisciplinary work, and have excellent oral and written communication skills (records of creative and independent scientific research and active participation in its dissemination in peer-reviewed journals are welcome). Experience with modern single molecule optical microscopy and spectroscopy techniques is welcome.

Applications including 1) a letter of interest (max. 1 page), clearly stating the specific motivation of the candidate to join the group, work on this project, career goals, etc., 2) a CV, 3) grade transcripts or equivalent record of excellent academic performance, clearly indicating courses taken and grades in each course (for MS and BS), 4) the names of at least two consenting referees should be sent to Prof. Dr. Frank Cichos, cichos@physik.uni-leipzig.de. The application deadline is **September 30, 2022**.

DYNAMO

DYNAMO is designed as an innovative and pioneering training network, with the unique vision of developing the next-generation hybrid nanopore technology exploiting DNA nanostructures integrated with multifunctional solid-state platforms, by:

- Bringing together a unique team of 6 world-leading academic groups, at the forefront of nanoscience and single molecule sensing and manipulation, and 1 high tech company, to translate the innovations into real-world applications.
- Training 10 Junior Researchers on a unique mix of experimental and computational skills at the physics/chemistry/biotechnology interface.
- Enabling technological advances through the combination of enhanced optical spectroscopies, plasmonics and DNA nanotechnology. This will lead to the development of nanopore technologies with unprecedented functionality and single molecule control.
- Reaching single molecule capturing and tweezing functionality in solid-state nanopore in a way that has not been possible before. This will pave the way to fascinating new discoveries into the fundamental structures of biomolecules and the interaction forces among them.

Opportunities when joining DYNAMO

- Participate in a highly committed network of academic and industrial leaders in the field of nanopore technology, single molecule spectroscopies and advanced nanostructures design and fabrication.
- Participate in a worldwide unique training program, comprising individual research projects, interactive and hands-on courses, workshops, and secondments covering the entire route to application of material sciences:
- In-depth knowledge on the potential and limitations of state-of-the-art nanopore technologies.
- In-depth knowledge on single molecule spectroscopies and single molecule electrical measurements.
- Training in intellectual property, business models, and regulatory approval pathways.
- Personalized training with room for development of personal and transferable skills (leadership, analytical, communication, interpersonal, free thinker mindset, creativity).
- Initiate network-wide events, such as workshops and symposia.
- Prepare for excellent performance in academia, industrial R&D, project management, consultancy and beyond.