CSC-Tübingen PhD Scholarship Program

2023 application round: prospective PhD positions at the University of Tübingen

Faculty: Faculty of Science
Institute / Section / Subject: Institute for Applied Physics / Plasmonic Nanostructures Group
Supervising Professor(s): Prof. Dr. rer. nat. Monika Fleischer

About the Supervisor(s): Prof. Fleischer's research focuses on the lithographic fabrication and spectroscopic analysis of metallic nanostructures for nano-optics, plasmonics, near-field microscopy and sensing. The metal nanostructures are combined with e.g. bioassays, quantum dots or organic films to investigate the emerging properties of the hybrid systems. The optical properties are modelled by numerical simulations. For information, see: http://www.uni-tuebingen.de/plasmonics/

Specification: Sub-patterned optical nano-antennas with ultra-high precision geometric control

Topic Description: When noble metal nanostructures are excited by light, the free electron density in the metal performs collective oscillations that are called plasmons. Such particles act like antennas for visible light. By fine-tuning the shape of such nanostructures through sub-patterning with single-digit precision, local coupling of the electric fields at edges of the structure can lead to extremely high electric near-fields, and/or the emission direction of the antennas can be specifically modified. These options are attractive e.g. for sensing applications, and the coupling can be used to fine-tune the resonances of the system. Techniques with ultra-high control down to the atomic level are required to engineer high-quality antennas. To optimize geometric control, in this project single crystalline gold flakes will be combined with the advanced methods of atomic layer deposition of ultra-thin oxide layers and focused helium ion beam milling for lateral outline control. The resulting antennas will be imaged by scanning electron microscopy, and their optical properties and emission patterns will be investigated by micro-spectroscopic analyses supported by numerical simulations.

Degree: Dr. rer. nat.
Required Degrees: Master degree in Physics, Optics, Nanoscience, or comparable
**Language Requirements:** Fluency in spoken and written English is highly important, since projects are discussed and results need to be correctly expressed in theses and papers. English at the proficiency level of C1-C2 (high scores in all categories of the TOEFL test, i.e. min. 94 points, better 100 points) are required. Basic German knowledge will facilitate everyday life, but is not mandatory.

**Notes:** Applicants should have good practical & analytical skills. Previous experience in nanofabrication, microscopy and/or spectroscopy is welcome. Participation in tutoring lab courses will be expected.