**Topic for a Master’s Thesis**

„Large area programming of a plasmonic PCM for active Metasurfaces“

Nanophotonics is a discipline in physics which deals with the **emission, detection and transformation** of light at length scales well below the employed wavelength (usually nanoscale). Ideally, nanophotonic optical components are freely adaptable and programmable in their functions.

**Phase-change materials (PCMs)** have been found to be optimal candidates for this. They have a high optical contrast between their amorphous and crystalline structural phases which originates from a newly discovered binding mechanism called “metavalent” bonding. Normally, PCMs can only be switched between two dielectric phases in the mid-infrared spectral range.

Recently, our group introduced the next-generation PCM $\text{In}_3\text{Sb}_1\text{Te}_2$ (**IST**), which can be switched between dielectric and metallic optical behavior, to infrared nanophotonics. IST can be classified in a new material class of **non-volatile, switchable “bad metals”**.

With a home-build Laser-Switching Setup, we could already demonstrate the direct writing and erasing of plasmonic IST nanoantennas into a thin film of amorphous IST without need for cumbersome nanofabrication methods like electron beam lithography. This **new technology** now allows for the rapid prototyping of metallic nanophotonic components.$^1$

In the next step, our **methods** shall be extended to a new switching setup, the Photonic Professional GT from the Fraunhofer IPT. Due to a precise and fully automated stage, large area switching of the PCM becomes possible. The implementation of graphical designed CAD models rises the opportunity of designing complex antenna surfaces, so-called metasurfaces, with unconventional functionalities like beam steering or lensing. These metasurfaces with different PCMs shall be fabricated on a large area of several hundred square micrometers and then characterized in a setup in the physics lab. In this collaboration the current research of nanooptics and phase-change materials is directly transferred to industrial practice from the Fraunhofer IPT.

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