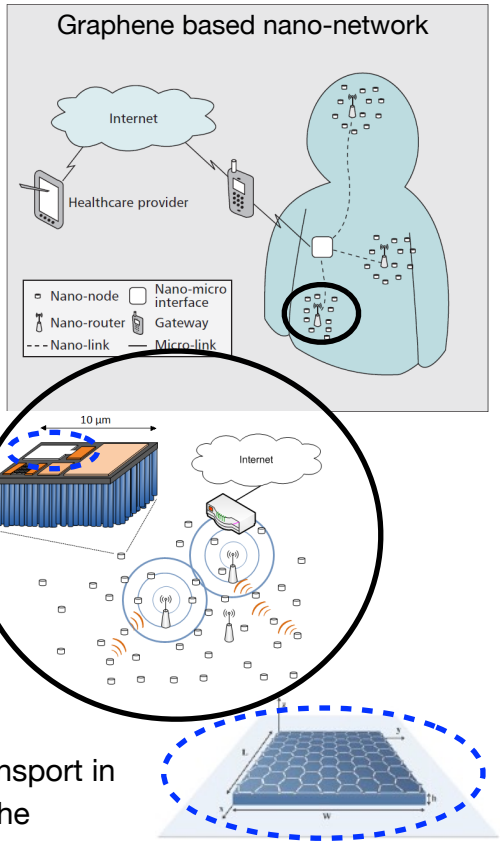
AG Theory of Complex Materials
I. Physikalisches Institut IA

RWTH AACHEN UNIVERSITY

Open Master Thesis Project

Title: Modelling of non-linear optical response of graphene



Motivation: Graphene is a unique nonlinear material for tunable plasmonic applications at terahertz and far infra-red frequencies. Though sources and detectors for terahertz radiation are now available, many passive and active components are missing, therefore the full potential of the terahertz region cannot be exploited. In this project, the nonlinear electromagnetic response of graphene will be studied. In order to describe the electromagnetic properties of graphene, it is necessary to self-consistently couple an appropriate phenomenological or microscopic model of the graphene conductivity with Maxwell's equations. Although advanced carrier transport models are available, e.g. ab initio models and models based on direct solution of the Boltzmann transport equation, they are typically computationally too expensive to be self-consistently coupled with Maxwell's equations. The main goal of this project is to develop a physically feasible but also numerically tractable model of carrier transport in graphene, based on the hydrodynamic approximation of the Boltzmann transport equation.

Tasks:

- to develop a phenomenological model of carrier transport in graphene, based on the hydrodynamic approximation of the semi-classical Boltzmann transport equation
- to develop numerical implementation of the carrier transport model
- to couple developed carrier transport model with an existing electromagnetic solver
- to analyse non-linear electromagnetic response of graphene

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