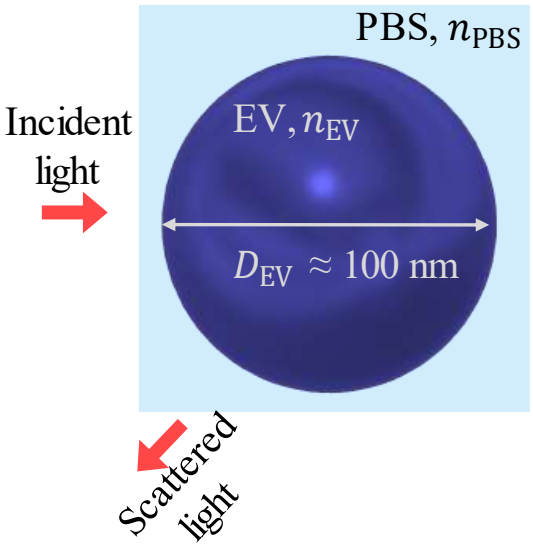
Master Thesis

Research related and Interesting

Retrieving the refractive index of spherical nanoparticles from the scattering data analysis



The scattering cross section for a given object is related to its size, shape and refractive index as well as the refractive index of the surrounding media. Accordingly, the refractive index of a nanoparticle can be retrieved only by knowing its shape, size, and its scattering data together with the material of the surrounding media. To do so, one can implement the Mie solution of Maxwell´s equation which is based on the Mie scattering theory to mathematically describe the scattering of electromagnetic waves by a small nanoparticle. The scattering cross section from a given dielectric nanoparticle will be then modeled and calculated using COMSOL Multiphysics. Afterword, the scattering data will be used in conjunction with a Mie theory to retrieve the corresponding refractive index.

The goal of the current Master project is using the mentioned method to evaluate the refractive index of biological elements such as exosomes, i.e., extracellular vesicles (EVs). Exosomes will be modelled in COMSOL Multiphysics as homogenous spherical nanoparticles in phosphate buffer saline (PBS). The structure will be illuminated with a plane wave in the range of 400-900 nm, in order to determine the scattering cross section of the exosome. The refractive index of the exosome will be then retrieved through reverse engineering of the scattering cross section using the Mie theory. Results will be applicable in biosensing of the exosomes and determining their health state.

Got curious? simply contact us for an informal meeting discussing the topic or send a thesis request per email to us.

Requirements: Knowledge of electromagnetic field theory, interest in modeling of electromagnetic systems and bioelectromagnetic,

Character of the project: 20% Theory / 70% Simulation, 10% Experiment.

We offer: An interesting master project at the edge of science in a friendly research environment.

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