

Diploma Work

Metal Optics Near the Plasma Frequency with Periodic Boundary Conditions

The rapid development of micromachining technologies suitable for micrometre- and nanometre-sized structures has enabled resonant objects with sizes close to optical wavelengths. Patterning of metallic films using UV-lithography and e-beam lithography formed by etching is a possible method.

This technology enables a downscaling of structures commonly used at microwave and millimetrewave frequencies in antennas and frequency selective

surfaces. In principle, no new physics is introduced, but the materials properties and the manufacturing tolerances need to be carefully considered already in the design phase.

The diploma work shall suggest justified designs suitable for later realization and future implementation in hardware.

The diploma work is carried out in a multitiered research group doing research in magnetic sensors, flat VCSEL lenses, microrockets, and functional surfaces. All work will be made with a high degree of possibility for the diploma worker to influence all parts of the work with ample help from supervisors within and outside of the research group.

Qualifications

A student with knowledge of electromagnetic field theory with a focus on applied physics.

The student should be interested in numerical simulation of Maxwell's equations using a commercially available solver (CST Microwave Studio 2008) with inclusion of material dispersion models and periodic boundary conditions (infinite arrays).

Diploma Work Draft

- Literature survey
- Study of materials properties including dispersion models
- Periodic boundary, dielectric/metal definition, and excitation of unit cell in CST Microwave Studio 2008
- Design of
 - metallic foil filter
 - metallic foil with dielectric backing filter
 - planar resonant transparent lens, transforming collimated light to a focus point
 - planar resonant reflective surface, transforming collimated light to a focus point
- Report writing

Method of Work

The diploma work is conducted at the Department of Engineering Sciences.

Application

Please send questions and diploma work application to Henrik.Kratz@angstrom.uu.se or call 018-4713019.

