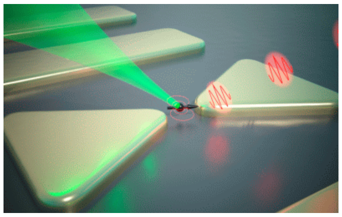
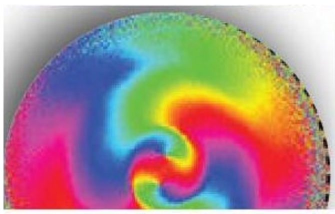
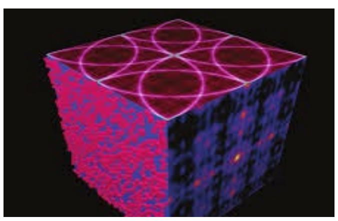
Resonant Nanophotonics group - contact Femius Koenderink



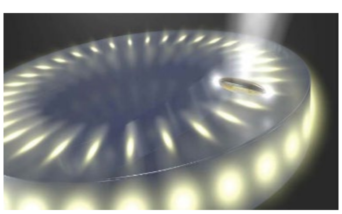
About the group - The Resonant Nanophotonics group investigates the fundamental physics of light-matter interactions at the nanoscale, with as main strengths plasmonics, metamaterials, hybrid nanophotonic resonators, and their coupling to fluorophores and single quantum systems. The group also explores applications in solid-state lighting, optical metrology and microscopy. More information about the group at https://amolf.nl/research-groups/resonant-nanophotonics and at http://www.koenderink.info and via email at f.koenderink@amolf.nl



Project 1: Partially-coherent Fourier interferometry for optical metrology
[Daily supervisor – Ruslan Röhrich] Fourier or k-space imaging is a fast and precise optical microscopy technique for single-shot measurements of the angle-resolved far-field scattering properties of small objects, even single nano-scatterers. Previously, our group has implemented a Fourier imaging setup with polarization and phase sensitivity for scatterered light, using a holography approach. The next step is to include a spectrally tuneable, partially-coherent light source, so that we can perform partially-coherent Fourier interferometry. The significance for fundamental nanophotonics is that radiation pattern tomography in polarization, phase *plus* wavelength, allows for a full understanding of nano-antennas and metasurface building blocks. This project mainly requires affinity with interferometry experiments and imaging processing algorithms. It has direct applications in semiconductor metrology.



Project 2: spatially programming gain in plasmon lattices and metasurfaces
[Daily supervisor – Radek Kolkowski & Isabelle Palstra] In our group we have recently studied plasmonic lattice lasers. These consist of arrays of nanoscale plasmonic particles covered in a gain medium of dye. By an interplay of strong scattering and local "lightning-rod" field enhancement, these systems act as a laser. An outstanding question is how these systems behave on the level of a few or even single unit cells. By spatially structuring the pump light that excites the gain medium, you can selectively and locally program the gain and loss inside the plasmonic array. By studying how the laser responds to this structured illumination, which you will generate with a programmable liquid-crystal "Spatial Light Modulator" (SLM) you can study which parts of the gain medium are participating in the lasing process and how this process of lasing happens on the scale of a few unit cells. For this project the `set up is running' – it requires the drive to do clever optics tests to elucidate conceptually challenging physics.



Project 3: Flow-cells to probe high-Q plasmonics with single emitters
[Daily supervisor – Isabelle Palstra & Ilan Shlesinger] Our group studies resonators for light in which light-matter interaction is enhanced in exceedingly narrow gaps (5 to 25 nm). Examples are recently realized "hybrid resonators" composed of high Q microcavities and plasmon antennas. Using these requires emitters to be placed in very narrow gaps between plasmonic particles. Unfortunately, these systems are notoriously difficult to fabricate using lithographic techniques. One pathway lies in the creation of a flow cell around the antenna structures, so that emitters can freely diffuse into and out of the gap. The objective of this project is to fabricate systems of antennas inside a flow cell and to do time-correlated single-photon counting measurements on them, focusing on fluorescence bursts to quantify light-matter interaction. This project is for students that have a drive for nanofabrication technology combined with fluorescence microscopy.