

Curriculum Vitae (22-7-2014)

Dr. Ewold Verhagen

Scientific Group Leader
Center for Nanophotonics
FOM Institute AMOLF
Science Park 104, 1098 XG Amsterdam, The Netherlands
Tel: +31 20 754 7100, E-mail: verhagen@amolf.nl
Date and place of birth: 28-10-1980, Leiderdorp, The Netherlands
Researcher ID: [J-9419-2013](https://orcid.org/0000-0001-9419-2013). Google Scholar profile: [Ewold Verhagen](https://scholar.google.com/citations?user=U11111111111111111111)



Past professional experience

2013 - present Scientific group leader *Photonic Forces* group, FOM Institute AMOLF, Amsterdam
2010 - 2012 Postdoc, EPFL, Lausanne, Switzerland.
2010 Postdoc, FOM Institute AMOLF, Amsterdam, The Netherlands
2005 - 2009 PhD researcher, FOM Institute AMOLF, Amsterdam, The Netherlands

Education

16/12/2009 PhD degree (Cum Laude) Physics, Utrecht University
Thesis: *Subwavelength light confinement with surface plasmon polaritons*
Advisors: Prof. Dr. A. Polman and Prof. Dr. L. Kuipers
31/08/2005 Doctoraal (M.Sc.) Experimental Physics, Utrecht University

Distinctions and awards

2014 Vidi Award, NWO Vernieuwingsimpuls
2011 Honorary mention for the *Christiaan Huygens prijs*
2011 Awarded 2-year Marie Curie postdoctoral fellowship (IEF) by ERC.
2010 Awarded 2-year Rubicon Fellowship by NWO.
2010 *FOM Valorisation Chapter Award*, the annually awarded prize for the description of possible applications in a PhD thesis of FOM.
2010 *Natuurkunde proefschrift prijs* (PhD thesis award, awarded to the best PhD thesis in The Netherlands in 2010)
2010 Best paper award, MRS Spring Meeting symposium D.
2009 Awarded PhD degree with distinction 'Cum Laude'.
2008 Participant in the 58th Meeting of Nobel Laureates in Lindau.

Brief summary of research achievements

Ewold Verhagen studies the physics of light confined at the nanoscale. He is particularly interested in the interactions between light and nanomechanical motion, the applications of field enhancement in micro-/nanocavities and plasmonic resonators, and efficient coupling of light to subwavelength volumes.

During his PhD research at the FOM Institute for Atomic and Molecular Physics (AMOLF), he performed experimental and theoretical research in the emerging fields of plasmonics and metamaterials. He studied the behavior and applications of light confined to subwavelength length scales in metallic nanostructures in the form of surface plasmon polaritons.

He demonstrated efficient nanofocusing of light on a chip to deeply subwavelength dimensions, showing how surface plasmons were compressed adiabatically in a tapered gold waveguide and guided below the diffraction limit. In a series of experiments, he demonstrated strongly enhanced absorption and emission rates in emitters coupled to plasmonic resonators, of particular interest for enhancing LEDs and solar cells. Finally, he described how light waves in nanoscale waveguides can be made to run 'backwards', described by a negative index of refraction. This led to the discovery of a new class of three-dimensional 'metamaterials', which can exhibit an isotropic negative index of refraction at optical frequencies.

His postdoc work in the Laboratory of Photonics and Quantum Measurement of Tobias Kippenberg at the EPFL focused on the interaction between light in high-Q microcavities and mechanical motion, in the newly arising field of *quantum optomechanics*. He developed novel silica microresonators exhibiting strong optomechanical coupling, and used these in a cryogenic experiment to cool a mechanical mode to an average occupancy of 1.7 motional quanta by radiation pressure sideband cooling. He demonstrated that the optomechanical coupling rate can exceed both the optical and the mechanical decoherence rate in the system, thus enabling quantum control of a mechanical oscillator with light (*Nature*, 2012).

Since the end of 2012, he leads the new research group *Photonic Forces* at the FOM Institute AMOLF. His group studies photonics in high-quality microcavities and nanophotonic waveguides, with a special interest in the coupling between light and nanomechanical motion through radiation pressure forces in nanophotonic systems. In 2014, he was awarded the NWO Vidi grant to perform quantum measurements in nano-optomechanical systems.

Publications and presentations

Ewold Verhagen has authored 20 papers in refereed journals, which were together cited 996 times with an h-index of 14 (source: Web of Science, 07/2014). He has given 25 talks at international conferences, of which 12 invited. He has furthermore given 16 invited seminars at various academic institutions.

Publications

1. R. Thijssen, T. J. Kippenberg, A. Polman, and E. Verhagen, *Parallel transduction of mechanical motion using plasmonic resonators*, submitted (2014)
2. R. Maas, E. Verhagen, J. Parsons, and A. Polman, *Negative refractive index and higher-order harmonics in layered metallodielectric optical metamaterials*, **ACS Photonics**, in press (2014)
3. R. Thijssen, E. Verhagen, T. J. Kippenberg, and A. Polman, *Plasmon nanomechanical coupling for nanoscale transduction*, **Nano Lett.** **13**, 3293 (2013)
4. E. Verhagen, S. Deléglise, S. Weis, A. Schliesser, and T. J. Kippenberg, *Quantum-coherent coupling of a mechanical oscillator to an optical cavity mode*, **Nature** **482**, 63 (2012)
5. P. Spinelli, C. van Lare, E. Verhagen, and A. Polman, *Controlling Fano lineshapes in plasmon-mediated light coupling into a substrate*, **Opt. Express** **19**, A303 (2011)
6. F. J. Beck, E. Verhagen, S. Mokkaapati, A. Polman, and K. R. Catchpole, *Resonant SPP modes supported by discrete metal nanoparticles on high-index substrates*, **Opt. Express** **19**, A146 (2011)
7. E. Verhagen, R. de Waele, L. Kuipers, and A. Polman, *Three-dimensional negative index of refraction at optical frequencies by coupling plasmonic waveguides*, **Phys. Rev. Lett.** **105**, 223901 (2010)
8. E. Verhagen, L. Kuipers, and A. Polman, *Plasmonic nanofocusing in a dielectric wedge*, **Nano Lett.** **10**, 3665 (2010)
9. D. J. Dikken, M. Spasenović, E. Verhagen, D. van Oosten, and L. Kuipers, *Characterization of bending losses for curved plasmonic nanowire waveguides*, **Opt. Express** **18**, 16112 (2010)
10. V. E. Ferry, M. A. Verschuuren, H. B. T. Li, E. Verhagen, R. J. Walters, R. E. I. Schropp, H. A. Atwater, and A. Polman, *Light trapping in ultrathin plasmonic solar cells*, **Opt. Express** **18**, A237 (2010)
11. E. J. A. Kroekenstoel, E. Verhagen, R. J. Walters, L. Kuipers, and A. Polman, *Enhanced spontaneous emission rate in annular plasmonic nanocavities*, **Appl. Phys. Lett.** **95**, 263106 (2009)
12. I. Sersic, M. Frimmer, E. Verhagen, and A. F. Koenderink, *Electric and magnetic dipole coupling in near-infrared split ring metamaterial arrays*, **Phys. Rev. Lett.** **103**, 213902 (2009)
13. M. Spasenović, D. van Oosten, E. Verhagen, and L. Kuipers, *Measurements of modal symmetry in subwavelength plasmonic slot waveguides*, **Appl. Phys. Lett.** **95**, 203109 (2009)
14. E. Verhagen, L. Kuipers, and A. Polman, *Field enhancement in metallic subwavelength aperture arrays probed by erbium upconversion luminescence*, **Opt. Express** **17**, 14586 (2009)
15. E. Verhagen, M. Spasenović, A. Polman, and L. Kuipers, *Nanowire plasmon excitation by adiabatic mode transformation*, **Phys. Rev. Lett.** **102**, 203904 (2009)
16. J. A. Dionne, E. Verhagen, A. Polman, and H. A. Atwater, *Are negative index materials achievable with surface plasmon waveguides? A case study of three plasmonic geometries*, **Opt. Express** **16**, 21793 (2008)
17. E. Verhagen, J. A. Dionne, L. Kuipers, H. A. Atwater, and A. Polman, *Near-field visualization of strongly confined surface plasmon polaritons in metal-insulator-metal waveguides*, **Nano Lett.** **8**, 2925 (2008)
18. E. Verhagen, A. Polman, and L. Kuipers, *Nanofocusing in laterally tapered plasmonic waveguides*, **Opt. Express** **16**, 45 (2008)
19. E. Verhagen, L. Kuipers, and A. Polman, *Enhanced nonlinear optical effects with a tapered plasmonic waveguide*, **Nano Lett.** **7**, 334 (2007)
20. J. T. van Wijngaarden, E. Verhagen, A. Polman, C. E. Ross, H. J. Lezec, H. A. Atwater, *Direct imaging of propagation and damping of near-resonance surface plasmon polaritons using cathodoluminescence spectroscopy*, **Appl. Phys. Lett.** **88**, 221111 (2006)
21. E. Verhagen, A. L. Tchebotareva, and A. Polman, *Erbium luminescence imaging of infrared surface plasmon polaritons*, **Appl. Phys. Lett.** **88**, 121121 (2006)