

Luke A. Sweatlock

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Summary

Ph.D. candidate in Applied Physics specializing in plasmonics, a rapidly evolving subfield of nanophotonics with diverse technological applications. Extensive experience with numerical simulations, and proficient in a variety of laboratory characterization techniques. Seeking a research-oriented full time position in materials science or applied physics.

Education

- California Institute of Technology, Pasadena CA** May 2008
Ph.D. program in Applied Physics. Expected completion in May 2008.
- Visiting research assistant, Harvard University *Cambridge MA (6 mo.)*
 - Visiting research assistant, AMOLF Institute *Amsterdam NL (2 mo.)*
- California Institute of Technology, Pasadena CA** 2002
M.S. Applied Physics
- Cornell University, Ithaca NY** 2001
B.S. Engineering Physics, *magna cum laude*

Research & Career History

- Graduate Researcher, California Institute of Technology** 2001-present
(Advisor: H. A. Atwater)
Plasmonics for nanophotonic networking; design and characterization
- Development of advanced numerical simulation techniques
 - Analysis & design of active and passive plasmonic waveguide devices
 - Physics & applications of resonant optics in metal particles and nanostructures
- Associate Member of Technical Staff, Agere Systems** 2000-2001
- Characterization of optical transmitter products
 - Development of thermographic imaging capability & rollout to two lab facilities
- Summer Research Intern, Lucent Technologies** 1997-2000, summers
- Thermomechanical testing of microelectronic device packages; software development
- Undergraduate Research Assistant, Cornell University** 1999-2000
(Advisor: T. Rhodin)
Growth & characterization of epitaxial thin films

Skills

Numerical Simulation & Analysis

- Extensive experience with Finite Difference Time Domain (FDTD) simulation of photonics and plasmonics using MAFIA© and OptiFDTD©.
- Development of sophisticated post-processing and analytical methods in MATLAB and FORTRAN.

Optical & Optoelectronic Characterization Experience

- Confocal microscopy, transmission spectroscopy, and ellipsometry with optical sources in UV-visible and near IR.
- Thermography and high resolution thermal imaging; application to heat flow modeling in microelectronic systems.
- Microwave waveguide engineering in GHz band.
- Performance characterization of optoelectronic devices, including reliability testing and failure mode analysis.

Laboratory Skills

- Familiarity with various analytical techniques including scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDX), Rutherford backscattering spectroscopy (RBS), near-field scanning optical microscopy (NSOM), and differential scanning calorimetry (DSC).
- Cleanroom experience including optical & electron lithography, and ion exchange chemistry.

Publications

- C. E. Hofmann, E. J. R. Vesseur, L. A. Sweatlock, H. J. Lezec, F. J. Garcia de Abajo, A. Polman and H. Atwater, "Plasmonic Modes of Annular Nanoresonators Imaged by Spectrally-resolved Cathodoluminescence," *Nano Letters* **7** 3612 (2007)
- J. S. Biteen, L. A. Sweatlock, H. Mertens, N. S. Lewis, H. A. Atwater and A. Polman, "Plasmon-enhanced photoluminescence of Si quantum dots: Simulation and experiment," *Journal of Physical Chemistry C*, **111** 13372-13377 (2007).
- H. A. Atwater, J. A. Dionne, L. A. Sweatlock. "Subwavelength-Scale Plasmon Waveguides". In M. L. Brongersma & P. G. Kik (Ed.), *Surface Plasmon Photonics* (pp. 87-104). Dordrecht, NL: Springer.
- J. A. Dionne, L. A. Sweatlock, H. A. Atwater, and A. Polman, "Plasmon slot waveguides: Towards chip-scale propagation with subwavelength-scale localization," *Physical Review B*, **73** 035407 (2006).
- J. A. Dionne, L. A. Sweatlock, H. A. Atwater, and A. Polman, "Planar metal plasmon waveguides: frequency-dependent dispersion, propagation, localization, and loss beyond the free electron model," *Physical Review B*, **72** 075405 (2005).
- L. A. Sweatlock, S. A. Maier, H. A. Atwater, J. J. Penninkhof, and A. Polman, "Highly confined electromagnetic fields in arrays of strongly coupled Ag nanoparticles," *Physical Review B*, **71** (2005).
- J. J. Penninkhof, A. Polman, L. A. Sweatlock, S. A. Maier, H. A. Atwater, A. M. Vredenberg, B. J. Kooi, "Mega-electron-volt ion beam induced anisotropic plasmon resonance of silver nanocrystals in glass," *Applied Physics Letters*, **83** 4137-4139 (2003).

Selected Conference Proceedings Publications

- H. A. Atwater, S. A. Maier, A. Polman, J. A. Dionne, and L. A. Sweatlock, "The new 'p-n junction': Plasmonics enables photonic access to the nanoworld," *MRS Bulletin*, **30** 385-389 (2005).
- L. A. Sweatlock, S. A. Maier, and H. A. Atwater, "Microwave analogue to a subwavelength plasmon switch," *Proceedings of Electronic Components & Technology Conference* (2003).
- L. A. Sweatlock, D. Lischner, and J. Weiss, "Thermal characterization of plastic ball grid array packages via infrared thermography," *Proceedings of Electronic Components & Technology Conference* (2001).

Ongoing Research Projects

- V. Ferry, L. A. Sweatlock, K. Catchpole, A. Polman, H. A. Atwater, "Optimization of plasmonic light harvesting techniques for photovoltaic application," *work in progress*
- L. A. Sweatlock, V. Ferry, J. A. Dionne, H. A. Atwater, "Advanced numerical analysis techniques applied to metal-insulator-metal plasmonic waveguides," *manuscript in preparation*
- D. Pacifici, H. J. Lezec, L. A. Sweatlock, R. J. Walters, H. A. Atwater, "Universal optical transmission features in periodic and quasiperiodic hole arrays," *manuscript in preparation*
- J. A. Dionne, K. A. Diest, L. A. Sweatlock, H. A. Atwater, "PlasMOSstor: a metal-oxide-silicon field effect plasmonic modulator," *submitted*
- J. J. Penninkhof, A. Polman, L. A. Sweatlock, H. A. Atwater, A. Moroz, A. van Blaaderen, "Optical cavity modes in gold shell colloids," *submitted*

Miscellaneous Computer Skills

Management of computer workstation hardware and network resources. • Data analysis in Origin and Excel. • Image processing in Photoshop and ImageReady. • Scientific typesetting with LaTeX. • Experience with instrument control in LabVIEW and VisualBasic.

Teaching Experience

- Teaching assistant & occasional lecturer, *APh 132: Optoelectronic Devices & Nanophotonics* (2005 & 2007).
- Mentor to undergraduate student in the SURF research program (2006), and high school summer student (2004).
- Training of colleagues in numerical simulation techniques.

References

Prof. Harry A. Atwater, Jr.

Howard Hughes Professor and Professor of Applied Physics and Materials Science
California Institute of Technology, MC 128-95, Pasadena CA 91125
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Additional references available upon request.