

Uday K. Chettiar

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SUMMARY

A focused, hard-working and independent learner; highly skilled in computational electromagnetics with experience in both writing custom software for EM simulation (FDTD) and using commercial tools (Comsol, CST). Experienced in programming with various languages including Python, C++ and Matlab. Highly experienced in numerical programming including time domain methods, linear algebra, optimization methods including stochastic and convex optimization, machine learning and artificial intelligence; familiarity with various statistical packages including R. My academic accomplishments include over 30 publications in peer reviewed journals (h-index = 22), over 13 talks at international conferences and 2 patents. I am also a referee for several scientific journals including Physical Review Letters, Journal of Optical Society of America B, Optics Letters and Applied Physics Letters.

I am authorized to work in the United States and will not need visa sponsorship.

EDUCATION

PhD	Purdue University , ECE West Lafayette, Indiana, USA	GPA: 4.0/4.0	Aug 2003 – Dec 2008
MS	Purdue University , ECE West Lafayette, Indiana, USA	GPA: 4.0/4.0	Aug 2003 – May 2008
BTech	Indian Institute of Technology Bombay , EE Mumbai, India	GPA: 9.22/10.0	Aug 1999 – May 2003

AWARDS AND HONORS

- Finalist for the student presentation award at Frontiers in Optics conference, 2007
- Recipient of Incubic/Milton Chang student travel award, 2007
- NASA Nano 50 Award for the top 50 nanotechnologies, 2006
- Benjamin Franklin-Meissner Fellowship at Purdue University, 2003
- Ranked 168 (top 0.11%) among 150,000 in the joint entrance examination for Indian Institute of Technology, 1999
- Gold medalist in the Indian National Physics Olympiad, 1999

EXPERIENCE

- 02/2009-12/2013 **Post Doctoral Research Associate**, Electrical and Systems Engineering, University of Pennsylvania. Supervisor: Prof. Nader Engheta.
- Lead researcher on multiple projects involving nano-optics, plasmonics, phase transition materials, nonlinear optics, metatronics and metamaterials.
 - Used machine learning and optimization techniques to explore parameter space and design optimized nanostructures. Relied extensively on programming in Matlab and Python.
 - Worked on numerical modeling of nonlinear processes in time domain in order to model phase transition materials, and numerical modeling in frequency domain to model stationary processes
- 08/2003-02/2009 **Graduate Student Researcher**, School of Electrical and Computer Engineering, Purdue University. Advisor: Prof. Vladimir M. Shalaev.
- Developed simulation tools based on parallelized Finite Difference Time Domain (FDTD) method and Fourier modal method to simulate optical metamaterials.
 - Provided theoretical and modeling support for the world's first experimental demonstration of negative index of refraction at optical wavelengths and held the record for the demonstration at shortest wavelength (710 nm). Used various optimization methods and parallel programming on supercomputer clusters to arrive at the target design. Worked extensively in a Linux environment.
 - Provided theoretical and modeling support for the world's first optical magnetic material across the whole visible spectrum.
 - My work was reported by numerous media outlets including two television news shows.
- 05/2002-05/2003 **Summer Internship**, Society for Applied Microwave Electronics and Research (SAMEER), Mumbai, India (Supervisor: Dr. Anuj Bhatnagar).
- Developed a setup with accompanying software for the characterization of optical fibers through the mode field distribution. The software provided the optical fiber parameters by appropriate data processing and statistical analysis on the images obtained by the setup.
- Undergraduate Student Researcher**, Department of Electrical Engineering, Indian Institute of Technology Bombay, India (Advisor: Prof. R. K. Shevgaonkar)

- Analyzed and provided a theoretical model for pulse propagation through a nonlinear direction coupler using coupled mode analysis and nonlinear Schrodinger equation (NLSE). Created a program to solve the nonlinear equation in time domain using several techniques to ensure numerical stability.

INVENTIONS

- Cloaking apparatus, has structure formed of material that has permittivity less than unity or approximately equal to unity, where structure is fixed between cloaked object and observer and includes two surfaces, W. Cai, V. M. Shalaev, Uday K. Chettiar, and A. V. Kildishev, Provisional US patent filed, US2008165442-A1, November 2007.
- Object visibility properties modifying apparatus, has metamaterial properties that are selected such that electromagnetic wave is guided around object, and metamaterial layers provided with electromagnetic properties, W. Cai, Uday K. Chettiar, A. V. Kildishev, and V. M. Shalaev, Provisional US patent files, US2010110559-A1, October 2009.

SKILLS

- **Programming Skills:** C, C++, Parallel computing (MPI, PBS), Fortran, Cluster computation, Python.
- **Software Packages:** Matlab, Mathematica, Comsol, CST Microwave Studio, Lumerical FDTD, R, MS Excel.
- **Fabrication:** UV Lithography.

PUBLICATIONS AND PRESENTATIONS (reverse chronological order)

Journal Papers

- [35] Uday K. Chettiar and N. Engheta, "Metatronic Transistor and Amplifier," under preparation.
- [34] Uday K. Chettiar and N. Engheta, "Optical Bistable Element Using Phase Transition Materials," under preparation.
- [33] Uday K. Chettiar and N. Engheta, "Optical bistability in nanoantennas with Kerr nonlinearity," under preparation.
- [32] Uday K. Chettiar and N. Engheta, "Meta-Atom with second-harmonic-only scattering and invisible at first harmonic: Mixing plasmonic cloaking with 2nd order optical nonlinearity," under review.
- [31] Uday K. Chettiar, A. R. Davoyan, and N. Engheta, "Hotspots from nonreciprocal surface waves," *Optics Letters*, vol. 39, pp. 1760, 2014.
- [30] M. Saboktakin, X. C. Ye, Uday K. Chettiar, N. Engheta, C. B. Murray, and C. R. Kagan, "Plasmonic enhancement of nanophosphor unconversion luminescence in Au nanohole arrays," *ACS Nano*, vol. 7, pp. 7186, 2013.
- [29] C. T. Derose, R. D. Kekatpure, D. C. Trotter, A. Starbuck, J. R. Wendt, A. Yaacobi, M. R. Watts, Uday K. Chettiar, N. Engheta, and P. S. Davids, "Electronically controlled optical beam-steering by an active phased array of metallic nanoantennas," *Optics Express*, vol. 21, pp. 5198, 2013.
- [28] M. Saboktakin, X. C. Ye, S. J. Oh, S. H. Hong, A. T. Fafarman, Uday K. Chettiar, N. Engheta, C. B. Murray, and C. R. Kagan, "Metal-enhanced upconversion luminescence tunable through metal nanoparticle-nanophosphor separation," *ACS Nano*, vol. 6, pp. 8758, 2012.
- [27] Uday K. Chettiar and N. Engheta, "Internal homogenization: Effective permittivity of a coated sphere," *Optics Express*, vol. 20, pp. 22976, 2012.
- [26] Uday K. Chettiar and N. Engheta, "Optical frequency mixing through nanoantenna enhanced difference frequency generation: Metatronic mixer," *Physical Review B*, vol. 86, pp. 075405, 2012.
- [25] Uday K. Chettiar, R. F. Garcia, S. A. Maier, and N. Engheta, "Enhancement of radiation from dielectric waveguides using resonant plasmonic coreshells," *Optics Express*, vol. 20, pp. 16104, 2012.
- [24] P. Fan, Uday K. Chettiar, L. Cao, F. Afshinmanesh, N. Engheta, and M. L. Brongersma, "An invisible metal-semiconductor photodetector," *Nature Photonics*, vol. 6, pp. 380, 2012.
- [23] O. Luukkonen, Uday K. Chettiar, and N. Engheta, "One-way waveguides connected to one-way loads," *IEEE Antennas and Wireless Propagation Letters*, vol. 11, pp. 1398, 2012.
- [22] M. D. Thoreson, J. Fang, A. V. Kildishev, L. J. Prokopenko, P. Nyga, Uday K. Chettiar, V. M. Shalaev, and V. P. Drachev, "Fabrication and realistic modeling of three-dimensional metal-dielectric composites," *Journal of Nanophotonics*, vol. 5, pp. 051513, 2011.
- [21] S. Xiao, V. P. Drachev, A. V. Kildishev, X. Ni, Uday K. Chettiar, H. K. Yuan, and V. M. Shalaev, "Loss-free and active optical negative-index metamaterials," *Nature*, vol. 466, 2010.
- [20] Uday K. Chettiar, P. Nyga, M. D. Thoreson, A. V. Kildishev, V. P. Drachev, and V. M. Shalaev, "FDTD modeling of realistic semicontinuous metal films," *Applied Physics B*, vol. 100, 2010.
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- [16] A. V. Kildishev, Uday K. Chettiar, Z. Jacob, V. M. Shalaev, and E. E. Narimanov "Materializing a binary hyperlens design," *Applied Physics Letters*, vol. 94, 2009.

- [15] A. V. Kildishev, W. Cai, Uday K. Chettiar, and V. M. Shalaev, "Transformation optics: approaching broadband electromagnetic cloaking," *New Journal of Physics*, vol. 10, 2008.
- [14] Uday K. Chettiar, S. Xiao, A. V. Kildishev, W. Cai, H. K. Yuan, V. P. Drachev, and V. M. Shalaev, "Optical metamagnetism and negative index metamaterials," *Materials Research Society Bulletin*, vol. 33, 2008 (**Invited**).
- [13] W. Cai, Uday K. Chettiar, A. V. Kildishev, and V. M. Shalaev, "Designs for optical cloaking with high-order transformations," *Optics Express*, vol. 16, 2008.
- [12] V. P. Drachev, Uday K. Chettiar, A. V. Kildishev, H. K. Yuan, W. Cai, and V. M. Shalaev, "The Ag dielectric function in plasmonic metamaterials," *Optics Express*, vol. 16, 2008.
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- [10] W. Cai, Uday K. Chettiar, A. V. Kildishev, V. M. Shalaev, and G. W. Milton, "Nonmagnetic cloak with minimized scattering," *Applied Physics Letters*, vol. 91, 2007.
- [9] Uday K. Chettiar, A. V. Kildishev, H. K. Yuan, W. Cai, S. Xiao, V. P. Drachev, and V. M. Shalaev, "Dual-band negative index metamaterial: double negative at 813nm and single negative at 772nm," *Optics Letters*, vol. 32, 2007.
- [8] W. Cai, Uday K. Chettiar, A. V. Kildishev, and V. M. Shalaev, "Optical cloaking with metamaterials," *Nature Photonics*, vol. 1, 2007. **Cited over 707 times as of Dec 2013 (Web of Science)**
- [7] W. Cai, Uday K. Chettiar, H. K. Yuan, V. C. de Silva, A. V. Kildishev, V. P. Drachev, and V. M. Shalaev, "Metamagnetics with rainbow colors," *Optics Express*, vol. 15, 2007.
- [6] A. V. Kildishev and Uday K. Chettiar, "Cascading optical negative index metamaterials," *Applied Computations Electromagnetics Society Journal*, vol. 22, 2007.
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- [2] V. P. Drachev, W. Cai, Uday Chettiar, H. K. Yuan, A. K. Sarychev, A. V. Kildishev, G. Klimeck, and V. M. Shalaev, "Experimental verification of an optical negative-index material," *Laser Physics Letters*, vol. 3, 2006.
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Selected Conference Presentations (as presenter or first author)

- [13] Uday K. Chettiar and N. Engheta, "Optical Bistable Element Using Phase Transition Materials," *Metamaterials*, Bordeaux, France, September 16-21, 2013.
- [12] Uday K. Chettiar and N. Engheta, "Optically Controlled Tunable Metatronic Elements," *Gordon Research Conference: Plasmonics*, Waterville, ME, June 10-15, 2012.
- [11] Uday K. Chettiar and N. Engheta, "Internal Homogenization: Effective Permittivity of Coated Spheres," *Optical Society of America (OSA) Frontiers in Optics*, San Jose, CA, October 16-20, 2011.
- [10] Uday K. Chettiar and N. Engheta, "Pairs of optical nanoantennas for enhancing second-harmonic generation," *Optical Society of America (OSA) Frontiers in Optics*, Rochester, NY, October 24-28, 2010.
- [9] Uday K. Chettiar and N. Engheta, "Mixing Plasmonic Cloaking with Second-Order Optical Nonlinearity," *Optical Society of America (OSA) Frontiers in Optics*, San Jose, CA, October 11-15, 2009.
- [8] Uday K. Chettiar, M. D. Thoreson, P. L. Koswatta, A. V. Kildishev, and V. M. Shalaev, "Modeling and fabrication of random composite superlens prototypes," *SPIE Optics+Photonics*, San Diego, CA, August 2-6, 2009.
- [7] A. V. Kildishev, Uday K. Chettiar, V. P. Drachev, and V. M. Shalaev, "Numerical simulations of nanostructured optical metamaterials: challenges and trends," *SPIE Optics+Photonics*, San Diego, CA, August 10-14, 2008 (**Invited**).
- [6] Uday K. Chettiar, A. V. Kildishev, H. K. Yuan, W. Cai, S. Xiao, V. P. Drachev, and V. M. Shalaev, "Optical double negative metamaterial at 813 nm," *Optical Society of America (OSA) Frontiers in Optics*, San Jose, CA, September 16-20, 2007.
- [5] Uday K. Chettiar, A. V. Kildishev, H. K. Yuan, W. Cai, S. Xiao, V. P. Drachev, and V. M. Shalaev, "Double negative index metamaterial: simultaneous negative permeability and permittivity at 813 nm," *OSA Topical Meeting on Photonic Metamaterials*, Jackson Hole, WY, June 4-7, 2007.
- [4] Uday K. Chettiar, A. V. Kildishev, H. K. Yuan, W. Cai, V. P. Drachev, and V. M. Shalaev, "Negative metamaterial for two distinct polarizations: double negative at 813 nm and single negative at 770 nm," *Conference on Lasers and Electro-optics (CLEO/QELS)*, Baltimore, MD, May 6-11, 2007.
- [3] Uday K. Chettiar, A. V. Kildishev, and V. M. Shalaev, "Angular dependence in optical negative index materials," *IEEE AP-S International Symposium*, Albuquerque, NM, July 9-14, 2006 (**Invited**).

- [2] Uday K. Chettiar, A. V. Kildishev, T. A. Klar, H. K. Yuan, W. Cai, A. K. Sarychev, V. P. Drachev, and V. M. Shalaev, "From low-loss to lossless optical negative-index materials," Conference on Lasers and Electro-optics (CLEO/QELS), Long Beach, CA, May 21-26, 2006.
- [1] Uday K. Chettiar, A. V. Kildishev, H. K. Yuan, W. Cai, A. K. Sarychev, V. P. Drachev, and V. M. Shalaev, "Simulation of optical negative index materials," Optical Society of America (OSA) Frontiers in Optics, Tucson, AZ, October 17-20, 2005.

REFERENCES

Available upon request