

Alex J. Yuffa

National Institute of Standards and Technology
325 Broadway, Boulder, CO 80305, USA
☎ +1 720-933-0654
✉ ayuffa@gmail.com

RESEARCH INTERESTS

- General
 - Theoretical and computational electromagnetic and acoustic wave propagation and scattering
 - Bridging the gap between theoretical models/methods and their practical implementation
- Recent
 - RF metrology, antenna characterization, wave propagation in random and complex media, inverse scattering, T -matrix method, boundary integral equation methods, fast multipole method, remote sensing, polarimetric imaging, Anderson localization, causality

EDUCATION

- Dec. 13, 2013 **PhD in Applied Physics**, *Colorado School of Mines*, Golden, CO
Dissertation *Modern electromagnetic scattering*, Advisor: John A. Scales, GPA: 4.0/4.0
- Dec. 16, 2005 **MS in Applied Physics**, *Colorado School of Mines*, Golden, CO
Thesis *A new integral equation method for direct electromagnetic scattering in homogeneous media and its numerical confirmation*, Advisor: John A. DeSanto, GPA: 4.0/4.0
- Dec. 12, 2003 **BS in Engineering Physics**, *Colorado School of Mines*, Golden, CO
Graduated with High Scholastic Honors
- Dec. 12, 2003 **BS in Mathematical and Computer Sciences**, *Colorado School of Mines*, Golden, CO
Graduated with High Scholastic Honors

EXPERIENCE

PROFESSIONAL

- 09/2016–current **Physicist**, *National Institute of Standards and Technology*, Boulder, CO
- 11/2015–09/2016 **Physical Scientist**, *Army Research Laboratory*, Adelphi, MD
 - Produced 4 peer-reviewed publications and 1 invited international presentation
 - Research highlighted in *Optics & Photonics News* magazine and featured on its cover
- 09/2013–11/2015 **ORAU Postdoctoral Research Fellow**, *Army Research Laboratory*, Adelphi, MD
 - Produced 5 peer-reviewed publications, 1 patent application, and 8 presentations (2 invited)
 - Featured on the cover of *Applied Optics* journal
 - Had 2 manuscripts re-published in the prestigious *Virtual Journal for Biomedical Optics*

INDUSTRY

- 01/2006–01/2007 **Research Scientist II**, *Numerica Corporation*, Fort Collins, CO
 - Developed and implemented target-tracking algorithms in support of the Missile Defense Agency

ACADEMIC

- 01/2009–08/2013 **Research Assistant**, *Department of Physics*, Colorado School of Mines
 - Analyzed complex experimental wave propagation data and interpreted the results
 - Produced novel computational methods to describe wave propagation in complex media
 - Co-taught 2 graduate and 2 undergraduate courses on electromagnetic waves and math methods
- 08/2008–12/2008 **Adjunct Instructor**, *Dept. of Applied Mathematics & Statistics*, Colorado School of Mines
 - Taught two sections of Calculus III. Text: J. Stewart, *Calculus* 3rd ed., chapters 9–13 (2006)
- 01/2007–06/2008 **Teaching Assistant**, *Department of Physics*, Colorado School of Mines
 - Recitation instructor for Calculus-Based Physics II course
 - Instructor for the Software Module of the Physics Field Session course
 - Grader for undergraduate and graduate courses

PEER-REVIEWED JOURNAL PUBLICATIONS

1. J. Markkanen and **A. J. Yuffa**, "Fast superposition T-matrix solution for clusters with arbitrarily-shaped constituent particles," *J. Quant. Spectrosc. Radiat. Transfer* **189**, 181–188 (2017)
2. **A. J. Yuffa**, V. Kaydash, V. Korokhin, Yu. Shkuratov, E. Zubko, and G. Videen, "Phase-ratio imaging as applied to desert sands for tracking human presence," *Appl. Opt.* **56**, B184–B190 (2017)
3. Y.-L. Pan, C. Wang, L. A. Beresnev, **A. J. Yuffa**, G. Videen, D. Ligon, and J. L. Santarpia, "Measurement of back-scattering patterns from single laser trapped aerosol particles in air," *Appl. Opt.* **56**, B1–B4 (2017)
4. N. J. Short, **A. J. Yuffa**, G. Videen, and S. Hu, "Effects of surface materials on polarimetric-thermal measurements: Applications to face recognition," *Appl. Opt.* **55**, 5226–5233 (2016)
5. **A. J. Yuffa**, Ya. Gutierrez, J. M. Sanz, R. Alcaraz de la Osa, J. M. Saiz, F. González, F. Moreno, and G. Videen, "Near- and far-field scattering resonances frequency shift in dielectric and PEC cylinders," *J. Opt. Soc. Am. A* **33**, 391–395 (2016)
6. M. Kocifaj, F. Kundracik, G. Videen, **A. J. Yuffa**, and J. Klačka, "Optical resonances in electrically charged particles and their relation to the Drude model," *J. Quant. Spectrosc. Radiat. Transfer* **178**, 224–229 (2016)
7. **A. J. Yuffa**, Ya. Gutierrez, J. M. Sanz, R. Alcaraz de la Osa, J. M. Saiz, F. González, F. Moreno, and G. Videen, "Frequency shift between near and far-field scattering resonances in dielectric particles," *J. Opt. Soc. Am. A* **32**, 1638–1642 (2015)
8. G. Videen, E. Zubko, W. Sun, Yu. Shkuratov, and **A. J. Yuffa**, "Mixing rules and morphology dependence of the scatterer," *J. Quant. Spectrosc. Radiat. Transfer* **150**, 68–75 (2015)
9. **A. J. Yuffa**, K. P. Gurton, and G. Videen, "Three-dimensional facial recognition using passive long-wavelength infrared polarimetric imaging," *Appl. Opt.* **53**, 8514–8521 (2014)
10. K. P. Gurton, **A. J. Yuffa**, and G. W. Videen, "Enhanced facial recognition for thermal imagery using polarimetric imaging," *Opt. Lett.* **39**, 3857–3859 (2014)
11. **A. J. Yuffa**, P. A. Martin, and J. A. Scales, "Scattering from a large cylinder with an eccentrically embedded core: An orders-of-scattering approximation," *J. Quant. Spectrosc. Radiat. Transfer* **133**, 520–525 (2014)
12. **A. J. Yuffa** and J. A. Scales, "Measuring the void: Theoretical study of scattering by a cylindrical annulus," *J. Quant. Spectrosc. Radiat. Transfer* **131**, 188–193 (2013)
13. **A. J. Yuffa** and J. A. Scales, "Linear response laws and causality in electrodynamics," *Eur. J. Phys.* **33**, 1635–1650 (2012)
14. **A. J. Yuffa** and J. A. Scales, "Object-oriented electrodynamic S-matrix code with modern applications," *J. Comput. Phys.* **231**, 4823–4835 (2012)
15. J. A. DeSanto and **A. J. Yuffa**, "A new integral equation method for direct electromagnetic scattering in homogeneous media and its numerical confirmation," *Waves in Random and Complex Media* **16**, 397–408 (2006)

PATENT

G. Videen, K. P. Gurton, and **A. J. Yuffa**, "Method for modeling a three-dimensional topological surface of an object from long-wave-infrared radiation emitted from the object," U.S. patent 9 609 238, March 28, 2017

CONFERENCE PROCEEDINGS & OTHER PUBLICATIONS

1. Cover Art, *Optics & Photonics News* (December 2015)
2. N. Short, Sh. Hu, K. P. Gurton, **A. J. Yuffa**, P. K. Gurram, and G. Videen, "Changing the paradigm in human identification," *Optics & Photonics News* (December 2015)
3. Cover Art, *Applied Optics* **53** (2014)
4. K. P. Gurton, **A. J. Yuffa**, and G. Videen, "LWIR polarimetry for enhanced facial recognition in thermal imagery," *Proc. SPIE* **9099**, 90990G (May 21, 2014)
5. **A. J. Yuffa** and J. A. Scales, "Need for new property measurements methods to assess irradiation damage: Part 2," *Nuclear Materials Compatibility Data-Mining, Assessment, Storage, and Identification of Research Needs*, ed. N. Gubel *et al.* (Y-12 National Security Complex, 2012)

AWARDS & HONORS

- 2015 Research highlighted in *Optics & Photonics News* magazine and featured on its cover
2014 Featured on the cover of the *Applied Optics* journal
2012 Featured in *Mines Weekly* for a novel wave propagation code, Colorado School of Mines
2003 Physics Faculty Distinguished Graduate Award, Dept. of Physics, Colorado School of Mines

SPECIALIZED TRAINING

Physics
&
Mathematics

- **Multiple Scattering**
 - Literature used
 - P. A. Martin, *Multiple Scattering* (2006)
 - P. Sheng, *Intro. to Wave Scattering, Localization and Mesoscopic Phenomena* (2006)
- **Applied Mathematics, Generalized Functions, and Complex Variables**
 - Literature used
 - P. Grinfeld, *Introduction to Tensor Analysis and the Calculus of Moving Surfaces* (2013)
 - I. Stakgold, *Boundary Value Problems of Mathematical Physics*, Vol. 1–2 (2000)
 - R. S. Strichartz, *A Guide to Distribution Theory and Fourier Transforms* (2003)
 - A. I. Markushevich, *Theory of Functions of a Complex Variable*, Vol. 1–3 (1977)

High
Performance
Computing

- **The Front Range High Performance Computing (HPC) Symposium**
 - Colorado School of Mines, September 23–24, 2011
- **An Introduction to Graphics Processor Programming for HPC**
 - Colorado School of Mines, August 24, 2009
- **An Introduction to High Performance Computing on RA** (2,144 Intel core Linux cluster)
 - Colorado School of Mines, August 17–21, 2009

COMPUTER SKILLS

(SKILL LEVEL RATING SCHEME: *Basic, Intermediate, Advanced, Expert*)

- **Fortran 90/95**
 - *Advanced* skill level
 - Developed electromagnetic software
- **C++**
 - *Intermediate* skill level
 - 2 semesters of formal training
- **Linux/Unix**
 - *Advanced* skill level
 - 10⁺ years of experience
 - Beowulf cluster administrator
- **Python**
 - *Advanced* skill level
 - Developed electromagnetic software
- **MATLAB**
 - *Intermediate* skill level
 - 2 years of professional experience
- **Mathematica**
 - *Advanced* skill level
 - 10⁺ years of experience

SYNERGISTIC ACTIVITIES

- Python Developer and maintainer of a popular (500+ downloads/mo.) S-matrix code: openTMM
Fortran 90 Developer and maintainer of electromagnetic boundary element method code: JDAY
Journal Referee Optics Letters, Optics Express, Journal of Quantitative Spectroscopy & Radiative Transfer
Session Co-Chair USNC-URSI National Radio Science (January 2017)
Proposal Reviewer U.S. Army Research Office, U.S. Army Small Business Innovation Research (SBIR)

PRESENTATIONS & POSTERS

- Talk **Construction of 3D Images from Stokes Parameters**, *Computational STEM Seminar*, Colorado School of Mines (March 2017)
- Talk **Surface integral equation formulation of electromagnetic scattering for cloaking applications**, *USNC-URSI National Radio Science Meeting*, Boulder, Colorado (Jan. 2017)
- Invited Talk* **Extracting near-field scattering resonances from far-field measurements**, *EMN Meeting on Light-Matter Interactions*, Singapore (May 2016)
- Talk **Red-shift between near and far-field electric intensity peaks**, *Progress in Electromagnetics Research Symposium*, Prague, Czech Republic (July 2015)
- Talk **3D polarimetric imaging of complicated surfaces**, *Progress in Electromagnetics Research Symposium*, Prague, Czech Republic (July 2015)
- Talk **On spectral redshift separating near and far-field intensity resonances**, *Electromagnetic & Light Scattering XV*, Leipzig, Germany (June 2015)
- Talk **Near & far-field resonances**, *Workshop on Light Scattering*, Bremen, Germany (March 2015)
- Talk **Retrieving 3D facial features from LWIR polarimetric images**, *22nd Annual ARL/USMA Technical Symposium*, Aberdeen Proving Ground, Maryland (October 2014)
- Invited Talk* **Electromagnetic scattering by multiple particles**, *Naval Research Laboratory Meeting*, Washington, D.C. (October 2014)
- Talk **LWIR polarimetry for enhanced facial recognition in thermal imagery**, *SPIE Sensing Technology + Applications*, Baltimore, Maryland (May 2014)
- Invited Talk* **Consequences of causality in electrodynamics**, *Department of Physics & Astronomy*, Mississippi State University (April 2014)
- Poster **3D face reconstruction from IR polarimetric measurements**, *21st Annual ARL/USMA Technical Symposium*, Aberdeen Proving Ground, Maryland (April 2014)
- Poster **Scattering from a large eccentric cylinder**, *Electromagnetic & Light Scattering XIV*, Lille, France (June 2013)
- Poster **Multiple scattering: Enhanced energy density**, *SEMIwave Annual Review Meeting*, Indian Head, Maryland (October 2011)
- Talk **The undead Fresnel**, *Physics Department Colloquium*, Colorado School of Mines (Dec. 2010)
- Talk **Wide open Python**, *REMRSEC Graduate Seminar*, Colorado School of Mines (June 2010)
- Talk **A new integral equation method for direct electromagnetic scattering in homogeneous media and its numerical confirmation**, *Carr Theoretical Physics Group Seminar*, Colorado School of Mines (January 2007)
- Talk **A new formulation of the integral equation method for electromagnetic scattering**, *Summer Undergraduate Research Conference in Mathematics*, The Ohio State University (August 2003)

LANGUAGES

Bilingual English/Russian