Vijay Koju

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EDUCATION

Middle Tennessee State University, Murfreesboro, TN — Fall 2012 - Present
Graduate Student, PhD Candidate in Computational Science Program
GPA of 3.927 on a 4.0 scale (PhD expected: May 2017)

Middle Tennessee State University, Murfreesboro, TN — Fall 2012 - Fall 2015
Masters of Science in Computer Science
GPA of 3.920 on a 4.0 scale

Truman State University Kirksville, MO — Fall 2008 - Spring 2012
Bachelor of Science in Physics, Minor in Mathematics
GPA of 3.79 on a 4.0 scale

EXPERIENCE

Oak Ridge National Lab, Oak Ridge, TN — Summer 2015
Summer Internship

- Berry phase imaging (BPI) development: a novel modality for back-reflectance imaging of scattering samples
  - Implemented MPI version of serial Monte Carlo code for photon propagation in scattering media.
  - Implemented embedded Air Force target in the Monte Carlo code to investigate its impact in back-reflectance of photons from the scattering sample.

Oak Ridge National Lab, Oak Ridge, TN — Summer 2014
Summer Internship

- High Performance Computing Monte Carlo Modeling of Photon Propagation in Highly Scattering Media
  - Implemented OpenMP version of serial Monte Carlo code.
  - Investigated the correlation between Berry phase and photon penetration depth.

Middle Tennessee State University, Murfreesboro, TN — Fall 2012 - Present
Graduate Research

- Highly sensitive biosensors based on Bloch surface waves
  - Design and optimize periodic and aperiodic multilayer structures of TiO_2-SiO_2 for making biosensors using Genetic Algorithm, Simulated Annealing, and Particle Swarm Algorithm.
  - Implement efficient 3D Rigorous Coupled Wave Analysis (RCWA) code using scattering matrix method to study multilayers with grating profiles.
  - Finite element (COMSOL Multiphysics), Finite Difference Time Domain (Lumerical Solutions) and RCWA modeling of Bloch surface waves.
  - Conceptualize new biosensing techniques using prism and grating coupling of light in dielectric multilayers.
- Extraordinary Acoustic Transmission mediated by Helmholtz Resonators
  - Numerical simulation of acoustic waveguides and lenses using with Helmholtz resonators.
  - Finite Element analysis using COMSOL multiphysics.
- Slow Light in Photonic Bandgap Materials using Bloch Surface Waves
  - Frequency and Time domain analysis of pulse transmission through Photonic Bandgap materials.
  - Programming slow light simulation in MATLAB and Fortran 90.
- Numerical Simulations of Coupled Nonlinear Schrödinger equations using Finite Difference methods
  - Implementation of various finite difference schemes for solving coupled nonlinear Schrödinger equations in MATLAB.
  - Error analysis and convergence tests and determine time and space accuracy of finite difference schemes.

Middle Tennessee State University, Murfreesboro, TN — Fall 2012 - Present

Teaching Assistant

- Teach an introductory astronomy lab (ASTR 1031).
- Assist professors as a learning assistant in large classes.
- Grade homework and exams.
- Proctor exams in large classrooms.
- Tutor introductory physics courses for Freshmen and Sophomores.

Truman State University, Kirksville, MO — Summer 2011

TruScholars Summer Undergraduate Research

- Investigated the cause of the O'Connell effect in eclipsing binary systems.
- Analyzed light curves of eclipsing binary systems from the *Kepler* database.
- Wrote programs in Python using modules such as SciPy, NumPy, and Matplotlib to extract, analysis, and visualize the light curves.

Truman State University, Kirksville, MO — Summer 2010

TruScholars Summer Undergraduate Research

- Operated robotic telescope at the Truman Observatory.
- Collected light curve data of eclipsing binary systems with the O'Connell effect.
- Analyzed the light curves from the *OGLE* database using IDL programs.

TECHNICAL SKILLS

Programming Experience

C/C++, Fortran 90, Python, JAVA, MATLAB, Octave, HTML, PHP, Javascript

Application Program Interfaces (APIs)

MPI, OpenMP, Pthreads, OpenGL, BLAS, LAPACK, PETSC, SLEPC, EIGEN, MS SQL, MySQL

Software

COMSOL Multiphysics (Finite Element Method), Lumerical Solutions (Finite Difference Time Domain Method), Microsoft EXCEL, Inkscape (Vector graphics design)

PROFESSIONAL TRAININGS

COMSOL Multiphysics – Professional 2-day training on COMSOL RF module from AltaSim Technology.

Silicon Photonics Design, Fabrication and Data Analysis – Professional 7-week edX online course from The University of British Columbia.

JOURNAL PUBLICATIONS

B. C. Crow, J. M. Cullen, W. W. Mckenzie, **V. Koju**, and W. M Robertson, "Experimental realization of extraordinary acoustic transmission using Helmholtz resonators", *AIP Advances*, 5, 027114 (2015)

V. Koju, and M. M. Beaky, "Null correlation between the O'Connell effect and orbital period change for SW Lac, CN And, and V502 Oph", *Information Bulletin on Variable Stars*, 6101, 6127 (2015)

V. Koju, E. Rowe, and W. M. Robertson, "Extraordinary Acoustic Transmission mediated by Helmholtz Resonators", *AIP Advances*, 4, 077132 (2014)

V. Koju, and W. M. Robertson, "Slow light by Bloch surface wave tunneling", *Optics Express* 22, 15679-15685 (2014)

CONFERENCE PUBLICATIONS

J. S. Baba, **V. Koju**, and D. John, "The impact of absorption coefficient on polarimetric determination of Berry phase based depth resolved characterization of biomedical scattering samples: a polarized Monte Carlo investigation ", *Proc. of SPIE* 9713, Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XXIII, 97130J (2016)

J. S. Baba, **V. Koju**, and D. John, "Monte Carlo based investigation of berry phase for depth resolved characterization of biomedical scattering samples", *Proc. SPIE* 9333, Biomedical Applications of Light Scattering IX, 93330O (2015)

TALKS

J. S. Baba, **V. Koju**, and D. John, "The impact of absorption coefficient on polarimetric determination of Berry phase based depth resolved characterization of biomedical scattering samples: a polarized Monte Carlo investigation", *SPIE Photonics West BIOS*, San Francisco, CA, February 15, 2016

J. S. Baba, **V. Koju**, and D. John, "Monte Carlo based investigation of berry phase for depth resolved characterization of biomedical scattering samples", *SPIE Photonics West BIOS*, San Francisco, CA, February 8, 2015

V. Koju, J. Baba, and D. John, "High-performance computing Monte Carlo modeling of photon propagation in highly scattering media", *Joint Institute for Computational Science Seminar*, Oak Ridge National Laboratory, TN, August 21, 2014

V. Koju, E. Rowe, and W. M. Robertson, "Extraordinary Acoustic Transmission Mediated by Helmholtz Resonators", *Department of Physics and Astronomy Colloquium*, Middle Tennessee State University, TN, September 27, 2013

V. Koju, and M. M. Beaky, "Study of the Variable O'Connell Effect in Over-Contact Eclipsing Binaries", *Student Research Conference*, Truman State University, MO, April 17, 2012

V. Koju, and M. M. Beaky, Differential Rotation: A Possible Cause of the Varying O'Connell Effect in Eclipsing Binaries", *TruSymposium*, Truman State University, MO, August 27, 2011

V. Koju, and M. M. Beaky, "Investigations into the Origins of the O'Connell Effect in Eclipsing Binary Star Systems", *Student Research Conference*, Truman State University, MO, April 14, 201

V. Koju, and M. M. Beaky, "Investigations into the Origins of the O'Connell Effect in Eclipsing Binary Star Systems", *National Conference of Undergraduate Research (NCUR)*, Ithaca College, NY, April 1, 2011

V. Koju, and M. M. Beaky, A Photometric Study of the O'Connell Effect in Eclipsing Binary Star Systems", *TruSymposium*, Truman State University, MO, August 28, 2010

POSTERS

V. Koju, and W. M. Robertson, "Highly sensitive biosensors based on grating coupled Bloch surface waves", *Scholar Week*, Middle Tennessee State University, TN, March 20, 2015

B. C. Crow, J. M. Cullen, W. W. Mckenzie, **V. Koju**, and W. M Robertson, "Experimental realization of extraordinary acoustic transmission using Helmholtz resonators",*Scholar Week*, Middle Tennessee State University, TN, March 17, 2015 (3^{rd} position)

V. Koju, E. Rowe, and W. M. Robertson, "Extraordinary Acoustic Transmission Mediated by Helmholtz Resonators", *Scholar Week*, Middle Tennessee State University, TN, April 21, 2014

V. Koju, and W. M. Robertson, "Simulation of Surface Plasmons and Bloch Surface Waves using COMSOL", *MTSU Summer Research Celebration*, Middle Tennessee State University, TN, July 26, 2013

V. Koju, and W. M. Robertson, "Finite Element Simulation of Surface Plasmon Resonance", *Scholars Week*, Middle Tennessee State University, TN, April 5, 2013 (2^{nd} position)

V. Koju, and W. M. Robertson, "Finite Element Simulation of Surface Plasmon Resonance", *Annual Meeting of the Tennessee Section of the American Association of Physics Teachers (TAAPT)*, Middle Tennessee State University, TN, March 23, 2013

M. M. Beaky, **V. Koju**, "Time-Depending Behavior of the O'Connell Effect in Eclipsing Binary Star Systems", *American Astronomical Society, AAS Meeting #200, #333.03*, May, 2012

V. Koju, and M. M. Beaky, "Migrating Starspots: A Possible Explanation of the periodic O'Connell Effect in *Kepler* Eclipsing Binaries", *MidAmerican Regional Astrophysics Conference (MARAC)*, University of Kansas, KS, April 13, 2012

GRANTS

Berry phase imaging (BPI) development: a novel modality for back-reflectance imaging of scattering samples
Principle Investigator: Justin S. Baba, Ph.D.
Lead Division: Electrical and Electronics Systems Research, Oak Ridge National Laboratory
Co-Investigators: Dwayne John, **Vijay Koju**

Monte Carlo simulation on the nature of photon propagation in scattering samples

Principle Investigator: Jusitin S. Baba, Ph.D.
Co-Investigators: **Vijay Koju**, Dwayne John
Award: 500,000 service units (SUs) on Darter super computer, Oak Ridge National Laboratory

PROFESSIONAL MEMBERSHIPS

- Student Member, Sigma Pi Sigma (Physics Honor Society) — Spring 2010 - Present
- Student Member, International Society for Optical Engineering (SPIE) — Fall 2016 - Present

AWARDS and HONORS

- Albert L. and Ether Carver Smith Scholarship — Fall 2016 - Spring 2017
- Albert L. and Ether Carver Smith Scholarship — Fall 2015 - Spring 2016
- President's Honorary Scholarship — Fall 2008 - Spring 2012
- Dr. Robert Peavler Memorial Scholarship — 2010 - 2011
- L. Scott and Carol D. Ellis Scholarship — 2010 - 2011
- Mahatma Gandhi Scholarship — 2005 - 2006

NEWS RELEASES

- **insideHPC**, "*Video: HPC Transforms Diagnostic Medical Imaging.*" Nov. 04, 2015
  `http://insidehpc.com/2015/11/video-hpc-transforms-diagnostic-medical-imaging/`
- **National Institute for Computational Sciences (NICS)**, "*Following the Photons.*" Oct. 21, 2015
  `https://www.nics.tennessee.edu/baba-collaboration`
- **National Institute for Computational Sciences (NICS)**, "*NICS Intern Spotlight, Student Simulates Light Transport in Turbid Media.*" Aug. 15, 2014
  `https://www.nics.tennessee.edu/intern2014-koju`
- **Innovations – Basic and Applied Sciences Magazine, Vol. 3, No. 1**, "*True Blue Lettermen, Computational Science*" Fall 2015
  `http://www.mtsu.edu/cbas/Issu_Innovations2015_100.pdf`
- **Middle Tennessee State University**, "*Computational Science Program (COMS)*" Fall 2015
  `http://www.mtsu.edu/programs/computational-science-phd/`