

# Vijay Koju

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## Summary

Interdisciplinary computational scientist with 4+ years of programming and scientific computing experience. Exceptional skills in error-free programming, debugging and scientific/technical report writing. Creative use of commercial/open-source software tools to model, develop and perform testing and analysis.

**Languages:** C/C++, Python, Fortran, MATLAB, R, JAVA, HTML, PHP, Javascript

**Application Program Interfaces (APIs):** MPI, OpenMP, Pthreads, OpenGL, BLAS, LAPACK, PETSc, SQL, Hadoop, Spark

**Software:** COMSOL Multiphysics, Lumerical Solutions, Meep, Microsoft EXCEL, Inkscape

## Core Competencies:

Computational modeling	Scientific computing	Large scale parallel programming	Algorithm design
Thin film optical engineering	Data analysis	Software engineering	Database design

## EDUCATION

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### Ph.D. in Computational Science

May 2017 (Expected)

Middle Tennessee State University, Murfreesboro, Tennessee

### Masters of Science in Computer Science

December 2015

Middle Tennessee State University, Murfreesboro, Tennessee

### Bachelors of Science in Physics, (Minor: Mathematics)

May 2012

Truman State University, Kirksville, Missouri

## EXPERIENCE

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### **Argonne Training Program on Extreme-Scale Computing**, Argonne National Lab

July-August, 2016

- Solved and visualized large scientific problems using MPI, OpenMP, Cuda, VisIt and ParaView.
- Acquired problem solving techniques for non-trivial complex scientific problems.

### **Computational Biomedical Optics Summer Intern**, Oak Ridge National Lab

June-August 2014, 2015

- Implemented OpenMP and MPI light transport Monte Carlo (MC) code for supercomputers.
- Studied the effect of embedded Air Force target in the back-reflectance of photons from the scattering sample.
- Analyzed MC simulation data to study the correlation of Berry phase and photon penetration depth.

### **Research/Teaching Assistant**, Middle Tennessee State University

August 2012 – Present

- Designed one-dimensional periodic and aperiodic multilayer structures for making biosensors.
- Optimized multilayers using genetic algorithm, simulated annealing, and particle swarm optimization.
- Used COMSOL Multiphysics, Lumerical Solutions, and Meep to model Bloch surface wave (BSW) in photonic crystals.
- Conducted experiment for fluorescence and label-free detection of protein-antibody binding using BSW.
- Taught astronomy labs, tutored physics and graded homework for calculus based physics classes.
- Mentored an undergraduate student with her senior thesis research on extraordinary acoustic transmission.

### **TruScholar Summer Undergraduate Researcher**, Truman State University

June-August 2010, 2011

- Investigated the origins of the O'Connell effect in eclipsing binaries via computational modeling.
- Analyzed the light curve data of eclipsing binaries from the *OGLE* and *Kepler* databases.
- Developed python programs using NumPy, and Matplotlib to extract, analyze, and visualize the data.

## PROJECTS

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- Implemented Object-Oriented 3D Rigorous Coupled Wave analysis code in C++ and MATLAB.
- Implemented Finite Difference Time/Frequency Domain code for computational photonics.
- Developed university course and photography conference scheduler using MySQL database and PHP.

## TRAININGS

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### Electromagnetics in COMSOL Multiphysics: RF, Altasim Technology

February, 2015

- Attended a 2-day intensive professional training on COMSOL RF module for electromagnetic modeling.
- Built COMSOL models for frequency/transient electromagnetic problems.

### Silicon Photonics Design, Fabrication and Data Analysis, University of British Columbia

September-November, 2015

- Successfully completed a 7-week long edX professional online training on silicon photonics design and data analysis.
- Used Lumerical Solutions for FDTD modeling of silicon photonic waveguides and circuits.
- Analyzed computational and experimental data obtained from Mach Zehnder interferometers.

## JOURNAL PUBLICATIONS

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- **V. Koju**, and W. M. Robertson, "Leaky Bloch-like surface waves in radiation-continuum for sensitivity enhanced biosensors via azimuthal interrogation", *Scientific Reports*, 41, (In progress)
- **V. Koju**, and W. M. Robertson, "Excitation of Bloch-like surface waves in quasi-crystals and aperiodic dielectric multilayer structures", *Optics Letters*, 41, 2915-2918 (2016)
- 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, 027714 (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)

## INVITED TALK

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- **V. Koju**, and W. M. Robertson, "Computational modeling of Bloch surface waves in one-dimensional periodic and aperiodic multilayer structures", Physics Colloquium, Vanderbilt University, September 30, 2016.

## SELECTED TALKS

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- **V. Koju**, and W. M. Robertson, "Bloch-like surface waves in Fibonacci quasi-crystals and Thue-Morse aperiodic dielectric multilayers", *SPIE Optics + Photonics*, San Diego, CA, August 31, 2016 (Young Scientist Awards – 1<sup>st</sup> Place)
- **V. Koju**, J. S. Baba, and D. John, "The impact of absorption coefficient on polarimetric determination of Berry phase based depth resolved characterization of biomedical scattering sample: a polarized Monte Carlo investigation", *SPIE Photonics West BIOS*, San Francisco, CA, February 15, 2016

## GRANTS

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- "Berry phase imaging (BPI) development: a novel modality for back-reflectance imaging of scattering samples"  
Principal Investigator: J. S. Baba, Ph.D. Co-Investigators: **V. Koju**, D. John
- "Monte Carlo simulation on the nature of photon propagation in scattering samples"  
Principal Investigator: J. S. Baba, Ph.D. Co-Investigators: **V. Koju**, D. John

## PROFESSIONAL MEMBERSHIP AND SERVICE

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- Sigma Pi Sigma (Physics Honor Society), Student Member Spring 2010 – Present
- International Society for Optical Engineering (SPIE), Student Member Spring 2016 – Present
- American Physical Society (APS), Student Member Fall 2016 – Present
- Reviewed papers for Optics Letters, Journal of Sound and Vibrations and Review of Scientific Instruments.

## AWARDS AND HONORS

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- SPIE Young Scientist Awards (1<sup>st</sup> Place) September 2016
- MTSU Scholars Week Poster presentation (2<sup>nd</sup> Place) March 2013
- Albert L. and Ethel Carver Smith Scholarship Fall 2015 – Spring 2017
- Dr. Robert Peavler Memorial Scholarship Fall 2010 – Spring 2011
- L. Scott and Carol D. Ellis Scholarship Fall 2010 – Spring 2011
- President's Honorary Scholarship Fall 2008 – Spring 2012
- Mahatma Gandhi Scholarship 2005-2006