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# Vishal Pramod Kasliwal

Wave Computing  
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Nationality: Indian  
Languages Spoken: English & Hindi

## EMPLOYMENT

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1. Research & Development Software Engineer at Wave Computing (*December 2017 - present*)

Wave Computing is developing the next-generation of solutions for speeding up Deep Learning applications using Dataflow Processing Units (DPUs), which contain thousands of interconnected dataflow Processing Elements (PEs). DPUs power Wave Computing's custom appliance for developing, testing, and deploying Deep Learning models. I develop agents (kernel and data movement software kernels) which are executed by Wave Computing's Dataflow Computers for Deep Learning acceleration.. Kernels implemented include

- IEEE 754-2008 compliant rounding kernels.
  - forward & backward propagation for various activation functions including ReLU.
  - backward propagation for bias.
2. High Performance Computing (HPC) Research Engineer at Colfax International (*March 2017 - December 2017*)

I conducted research on new HPC technologies and provide HPC consulting services to clients across a broad range of industries.

- I parallelized an oil & gas sector client's Computational Fluid Dynamics (CFD) reservoir simulation leading to a  $> 10X$  speed-up. I re-factored the 40,000+ line C codebase to enable domain-decomposition for further performance improvement.
- I performed a detailed analysis of the performance potential of various commercial C++ compilers by
  - developing a test-suite of scientific computational kernels
  - quantifying the performance of the code generated by each compiler for each test in the suite
  - analyzing the assembly instructions generated by each compiler in order to understand the performance behavior

The technical whitepaper describing my findings may be found at Colfax Research.

- I presented a lecture on Intel Advisor for Stanford University's ME344: Introduction to High Performance Computing course on July, 20th, 2017.
3. Postdoctoral Fellow in LSST Data Management & Galaxy Surveys (*Sept. 2015 - Feb. 2017*)

Univ. of Pennsylvania, Dept. of Physics & Astronomy  
Princeton Univ., Dept. of Astrophysical Sciences  
Supervisors: Dr. Bhuvnesh Jain, Dr. Robert Lupton  
Dr. Adam Lidz, Dr John Swinbank,  
& Dr. Mike Jarvis

My postdoctoral duties were split between my responsibilities as an algorithms and software developer on the software stack for the Large Synoptic Survey Telescope (LSST) with the Princeton LSST Data Management group and my research on the analysis of stochastic light curves from accretion flows around binary supermassive black-holes at UPenn.

Work done at Princeton:

- optimal image stacking
- covariance propagation through image co-addition
- star galaxy separation using machine learning techniques
- functionality and bug-fix contributions to the LSST software stack

Work done at UPenn:

- developed an algorithm to identify potential binary supermassive black hole candidates from time-domain data.
- implemented a new module in the light-curve software library - K $\bar{A}$ L $\bar{I}$  to determine the orbital parameters of supermassive binaries from time-domain data using Monte-Carlo Markov Chain methods.

## EDUCATION

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Drexel University

September 2015

Ph.D. in Physics

Thesis: *Probing AGN Accretion Physics through AGN Variability: Insights from Kepler*

Advisors: Dr. Michael S. Vogeley & Dr. Gordon T. Richards

Students Supervised: Jackie Moreno (Graduate), Jack O'Brien (Undergraduate),  
& Brandon Rupert (Undergraduate)

Virginia Commonwealth University

May 2007

M.S. in Physics & Applied Physics

Thesis: *CAFM Studies of Epitaxial Lateral Overgrowth GaN Films*

Advisor: Dr. Alison A. Baski

University of Richmond

May 2005

B.A. in Mathematics & Physics

Thesis: *The Bispectrum as a Quantifier of non-Gaussianity in the Cosmic Microwave Background*

Advisor: Dr. Emory F. Bunn

## STATISTICS, ANALYTICS & COMPUTING

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- Proficient in C, C++, Python & Cython for
  1. scientific computing, statistics & statistical modeling, pattern recognition, data science, data analysis, data modeling, analytics, machine learning.
  2. code optimization including parallel computing with OpenMP, Intel Cilk Plus, and the Python Multiprocessing module.
  3. programming Intel Xeon Phi Knight's Landing CPUs and Intel Xeon Phi Knight's Corner accelerator cards using Intel LEO extensions & OpenMP 4.5 in C & C++.
  4. generating hardware random numbers using Intel Bull Mountain technology.
  5. creating frameworks for scientific analysis using design patterns & object-oriented design principles.

6. algorithm development with Intel Math Kernel Library, Intel Data Analytics Library, scipy, numpy, & scikit-learn.
  7. unit-testing with py.test and C++ Boost UTF.
- Proficient in programming Deep Learning computational kernels in WFG, Wave Computing’s proprietary programming language for programming Data Flow Processing Units (DPUs).
  - 10 months experience speeding-up oil & gas sector client CFD codebase & refactoring codebase to permit domain-decomposition.
  - 1.5 year of experience developing LSST Stack software in a collaborative professional environment with regular usage of standard development tools and techniques for agile development, continuous integration, and version control. Tools used include Atlassian JIRA, Jenkins, and Git.
  - Principle developer of C++, Python, & Cython library  $\kappa\text{ALI}$  for light-curve analysis using stochastic models including Continuous-time Autoregressive-Moving Average (C-ARMA) & modulated C-ARMA processes.
  - 12+ years of experience with Linux, L<sup>A</sup>T<sub>E</sub>X, Mathematica, and MS Windows & 7 years of experience with Mac OS X for programming and development.
  - Experience with IDL, bash, SQL, R, Intel CompilerXE toolchain, gcc toolchain, MATLAB, LON-CAPA, Photoshop and Office Suites including MS Office, OpenOffice & LibreOffice.

## CERTIFICATES

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- Deep Learning Specialization
  - Neural Networks and Deep Learning
  - Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization
  - Structuring Machine Learning Projects
  - Convolutional Neural Networks
  - Sequence Models

## PUBLICATIONS

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- “A Performance-Based Comparison of C/C++ Compilers”, <https://colfaxresearch.com/compiler-comparison/>, 2017
- “Science-driven Optimization of the LSST Observing Strategy”, <https://arxiv.org/abs/1708.04058>, 2017
- “Large Synoptic Survey Telescope Galaxies Science Roadmap”, <https://arxiv.org/abs/1708.01617>, 2017
- \* “Extracting Information from AGN Variability”, MNRAS, 470, 3, 3027-3048, 2017
- “The LSST Data Management System”, Proceedings of ADASS XXV, 2015
- \* “Do the Kepler AGN light curves need reprocessing?”, MNRAS, 453, 2075, 2015
- \* “Are the variability properties of the Kepler AGN light curves consistent with a damped random walk?”, MNRAS, 451, 4328, 2015
- “Thirty Meter Telescope Detailed Science Case: 2015”, <http://arxiv.org/abs/1505.01195>, 2015
- “AFM and CAFM studies of ELO GaN films”, Proc. SPIE 6473, 647308, 2007
- “Local electronic and optical behaviors of a-plane GaN grown via epitaxial lateral overgrowth”, Appl. Phys. Lett., 90, 011913, 2007

## CONFERENCE & MEETING PARTICIPATION

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- Presented *Applications of High Performance Computing in Artificial Intelligence* at the Rajasthan Student Startup Exposure Program 2018 (RSSEP2018), September 8th, 2018, San Jose, CA
- Presented a lecture on Intel Advisor at Stanford University for the class ME344: Introduction to High Performance Computing, July 20th, 2017, Stanford, CA
- Presented *Optical Variability Signatures from Massive Black Hole Binaries* at the 229<sup>th</sup> Meeting of the American Astronomical Society, January 7<sup>th</sup>, 2017, Grapevine, TX
- Presented *Extracting Information From AGN Variability: an LSST AGN Collaboration Proposal* at the 2017 LSST AGN Science Collaboration Roadmap Development Meeting, January 3<sup>rd</sup>, 2017, Grapevine, TX
- Presented *Extracting Information from AGN Variability* at the 2016 KARL LSST Workshop, November 2016, Louisville, KY
- Presented *Surveying the Dynamic Sky with the LSST* at the 2016 KARL LSST Workshop, November 2016, Louisville, KY
- Presented *AGN Variability: Insights from Kepler* at the 2016 Hotwiring the Transient Universe V Meeting, October 2016, Villanova, PA
- Participated in the LSST 2016 Project & Community Workshop, August 2016, Tuscon, AZ
- Presented *Probing Accretion Processes through Variability* at the 2016 TMT Science Forum ‘International Partnership for Global Astronomy’, May 2016, Kyoto, Japan.
- Presented *AGN Variability: Insights from Kepler* in the Princeton HSC Science Discussion Series, March 2016, Princeton, NJ.
- Presented *AGN Variability on Short Timescales: What does Kepler tell us about AGN Variability?* at the 2015 TMT Science Forum ‘Maximizing Transformative Science with TMT’, June 2015, Washington, DC.
- Presented *What can Kepler tell us about AGN variability?* at the 225th Meeting of the American Astronomical Society, January 2015, Seattle, WA.
- Presented *Do Kepler AGN Light Curves Exhibit a Damped Random Walk?* at the 224th Meeting of the American Astronomical Society, June 2014, Boston, MA.
- Participated in the SciCoder Workshop, June 2010, New York, NY
- Attended the 215th Meeting of the American Astronomical Society, Jan. 2010, Washington, DC.
- Participated in the NSF-PIRE Summer School: Lensing of the CMB and High-z Galaxies, July. 2009, Philadelphia, PA.
- Presented *The Bispectrum of Galactic Dust: Implications for Microwave Background non-Gaussianity* at the 204th Meeting of the American Astronomical Society, May 2004, Denver, CO.

## GRANTS, OBSERVING PROPOSALS, SERVICE, & AWARDS

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- Peer reviewer for *The Astrophysical Journal*.
- Peer reviewer for *Monthly Notices of the Royal Astronomical Society*.
- Co-investigator on K2 GO16088, K2 GO14088, K2 GO12013, K2 GO8052, & K2 GO10052 Observing Campaigns, University of Pennsylvania, 2016
  - Dr. Gordon T. Richards (PI)

- Dr Michael S. Vogeley (CoI)
- Helped write NASA grant NNX14AL56G, Drexel University, 2014 - 2017.
  - Dr. Gordon T. Richards (PI)
  - Dr Michael S. Vogeley (CoI)
- Jackson J. Taylor Best Senior Seminar in Physics Award, University of Richmond, 2005.
- Marsh White Award for the Outstanding Undergraduate Paper at the Society of Physics Students Undergraduate Research Session, Southeastern Section of the American Physical Society, 2003.
- National level participant in the Mathematics Training and Talent Search Programme (I.I.T., Mumbai), 2002.
- National level participant in the 2nd Indian Astronomy Olympiad, I.S.R.O., 2000.

## MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

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- Full Member of the American Astronomical Society (AAS)
- Member of the Large Synoptic Survey Telescope (LSST) Data Management (DM)
- Member of the Thirty Meter Telescope (TMT) International Science Development Team (ISDT): Time Domain Science
- Member of the Thirty Meter Telescope (TMT) International Science Development Team (ISDT): Supermassive Black Holes
- Member of the LSST Galaxies Collaboration
- $\Sigma\Pi\Sigma$  Drexel University, Philadelphia, PA.
- $\Sigma\Pi\Sigma$  Virginia Commonwealth University, Richmond, VA.

## SERVICE & OUTREACH

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- Started the *The Sky in the City* astronomy night program at the Dornsife Center (Drexel University). Responsibilities include running the program for the Drexel Physics Department and acquisition of telescopes to support the event.  
May 2015 - *present*
- Volunteer at the Drexel University Lynch Observatory for telescope open houses. Responsibilities include setting up, operating, and storage of the department's telescopes.  
Sept. 2008 - *present*
- Organized and co-taught the “Fun Physics” lectures at Drexel University Department of Physics. Topics included General Relativity, Advanced Mathematical Physics, & Spinor Physics.  
Fall 2008 - Fall 2009

## PRIOR POSITIONS HELD

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- Graduate Research Assistant (*April 2014 - Sept. 2015*)
- Graduate Teaching Assistant (*Sept. 2008 - March 2014*)
- Adjunct Instructor (*June 2007 - June 2008*)

- Graduate Teaching Assistant (*Aug. 2005 - May 2007*)
- Research Assistant (*May 2003 - May 2005*)
- Computing Lab Assistant (*Jan. 2002 - May 2005*)

## REFERENCES

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- Dr. Michael S. Vogeley  
Director of Graduate Studies; Professor

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Drexel Univ.  
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- Dr. Gordon T. Richards  
Associate Professor

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- Dr. Adam Lidz  
Associate Professor

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- Dr. John D. Swinbank  
Professional Specialist

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