Alok Shukla

Curriculum Vitae

Department of Mathematics,
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"It is a deeper subject than I appreciated and, I begin to suspect, deeper than anyone yet appreciates."— Robert P. Langlands on automorphic forms.

Education

Aug 2012 - **PhD(Mathematics)**, *The University of Oklahoma*, Norman, OK.
May 2018 **Research interests:** Number Theory, Automorphic Forms and Representations, Arithmetic Geometry, Optimization, Quantum Computation, Machine Learning.

Fall 2015 **Semester Program on "Computational Aspects of the Langlands Program"**, *ICERM, Brown University*, Providence, RI.

Spring 2014 **M.A. in Mathematics**, *The University of Oklahoma*, Norman, OK.
GPA - 4.0.

Course Work in Aircraft Engineering and Manufacturing Technology,
Indian Institute of Technology, Madras, India.
HAL Management Trainee Program

Bachelor of Engineering in Electrical and Electronics Engineering,
Birla Institute of Technology, Mesra, Ranchi, India, First class with distinction..

Research

Published / Accepted

○ **Co-dimensions of the spaces of cusp forms for Siegel congruence subgroups in degree two**, **Pacific Journal of Mathematics** 293(2018), no. 1, 207–244.

○ **A Short Proof of Cayley's Tree Formula**,
The American Mathematical Monthly, $125(2018)$**, no.** $1, 65 - 68$.

○ **Trajectory optimization using Quantum computing,**
(with Prakash Vedula), **Journal of Global Optimization**, 26, DOI: https://doi.org/10.1007/s10898-019-00754-5.

○ **On Klingen Eisenstein series with level in degree two,**
(with Ralf Schmidt). **Journal of Ramanujan Mathematical Society,** 34 (2019), 373-388.

○ **Means Compatible with Semigroup Laws,**
(with R. Padmanabhan), **Quasigroups And Related Systems** 27 (2019), 317 - 324.

○ **Pullback of Klingen Eisenstein series and certain critical L-values identities,** To appear in the **Ramanujan Journal**.

Preprints

- **A novel quantum grid search algorithm and its application,** (with Prakash Vedula), https://arxiv.org/pdf/1903.07268.pdf.

- **When do we have 1 + 1 = 11 and 2 + 2 =5?,** (with R. Padmanabhan), http://math.ou.edu/~ashukla/2plus2.pdf.

- **Machine learning based trajectory optimization,** (with Prakash Vedula), http://math.ou.edu/~ashukla/Trajectory_PCA.pdf.

Math-education

- **On teaching mathematics to gifted students, (Submitted),** http://math.ou.edu/~ashukla/Gifted.pdf.

Awards and Scholarships

- **Mathematics Department Fellowship**, The University of Oklahoma. Special fellowship awarded by the Department of Mathematics to the most promising and dedicated PhD students. (2013-2017)

- **Richard V. Andree Memorial Scholarship**, The University of Oklahoma (2017).
- **Richard V. Andree Memorial Scholarship**, The University of Oklahoma (2016). Awarded by the Department of Mathematics to PhD students for their academic excellence, and department and university citizenship.

- **Mathematics Department Scholarship**, The University of Oklahoma (2016). Awarded by the Department of Mathematics to PhD students for academic progress and their contributions to the department.

- **John Clark Brixey Graduate Scholarship**, The University of Oklahoma (2015). Awarded by the Department of Mathematics to PhD students.

- **Sooner Heritage Scholarship**, The University of Oklahoma (2013). Awarded by the University to students based on a students' financial need.

- **Nanyang Research Fellowship** for PhD program in Mathematical Sciences, NTU, Singapore (2012). The NTU Research Scholarship is awarded to outstanding graduate students for research leading to a higher degree at the University.

Experience

July 2018– Present
Postdoctoral fellow, Department of Mathematics, University of Manitoba, *Winnipeg*, MB, Canada.

- Research: Number theory, Arithmetic Geometry.
- Teaching:
  Introduction to Calculus, **Math 1500**, Fall 2018. Enrollment: 140.

  Introduction to Calculus, Math 1700. Winter 2019. Enrollment: 44.

  Engineering Mathematical Analysis, Math 2130. Summer 2019. Enrollment: 84.

2018
Graduate Teaching Assistant, Department of Mathematics, University of Oklahoma, *Norman*, OK, USA.

- **Independent Instructor for the following courses.**

Semester	Course	Description	Enrollment
Spring 2018	Math 2433	Calculus III	30
Summer 2017	Math 2443	Calculus IV	13
Spring 2017	Math 2433	Calculus III	26
Fall 2016	Math 1643 (Section 15)	Precalculus for Business, Life, and Social Sciences	38
Summer 2016	Math 2423	Calculus II	32
Summer 2015	Math 2423	Calculus II	23

- **Instructor for the following discussion classes.**

Semester	Course	Description	Enrollment
Spring 2015	Math 2423 (Section 11 & 12)	Calculus II	53 (25 + 28)
Fall 2014	Math 2934 (Section 61)	Calculus III	49

- **Head Learning Specialist: Math Help Center.**
  I have tutored in Math Help Center and helped students in learning calculus since August, 2012. I hold the position of a Head Learning Specialist since January, 2015.

- **Grading.**
  I have graded several courses, including calculus and discrete mathematics, since August, 2012.

Sep 2010 — **Deputy Manager, Hindustan Aeronautics Limited**, *Helicopter Division*,
July 2012 Bangalore, India.

Managerial responsibilities included: leading and motivating the Radio/Radar and Instrument groups, preparing task plans, allocating daily tasks, training the team on upgraded avionics system, liaising with various agencies like FAG - Flight Analysis Group, Final Assembly shops, FTL - Flight Testing Labs, QC - Quality Control etc and interacting with customer IAF (Indian Air Force) pilots after flight tests to understand their requirement and to facilitate flight snag rectification.

Technical responsibilities included: Advanced Light Helicopter (ALH - Dhruv) avionics system installation, integration, functional testing and snag rectification on the following systems.

- DMC - Display and Mission Computer.
- INCOM/COM - Radio Communication.
- DIU - Data Interface Unit.
- MFD - Multi Functional Display.
- RAM - Radio Altimeter.
- IFF - Identification of Friend and Foe.

July 2004 – **Engineer (Flight Hangar) and Deputy Manager, Hindustan Aeronautics**
Sep 2010 **Limited**, *Aircraft Division*, Nashik, India.

Technical responsibilities included final stage aircraft avionics integration checks and ground and flight snag rectification on the following systems.

- CAC - Core Avionics Compter.
- BCAC - Backup CAC.
- INGPS - Inertial Navigation and Global Positioning System.
- HUD/UFCP – Head Up display/Upfront Control Panel.
- INCOM/COM - Radio Communication System.
- LRMTS - Laser Ranger and Marked Target Seeker.
- RAM - Radio Altimeter.
- IFF - Identification of Friend and Foe.
- VOR/ILS - VHF Omni-range Radio beacon and Instrument Landing system.
- RWR – Radar Warning System.

2003–2004 **Software Engineer, IBM**, *Bangalore*, Karnataka, India.
Design, coding and testing for the project "HealthNet & APCS Client Level Security" for the client Advance PCS, USA. The project was based on AS/400 platform. CASE tool COOL/2E (previously known as SYNON) and programming languages COBOL/400, RPG/400, CLP/400 were used.

2002–2003 **Software Developer, TCS**, *Noida*, Phase-II, India.
Coding and testing for the USA based client Walgreens for the project "Store Call-Ins & Walgreen's Application Maintenance (WAM)". The project was based on AS/400 platform. CASE tool COOL/2E and programming languages RPG/400, CLP/400 were used.

Seminar Talks Given

- Title: Some mathematical gems,
  MAGIC Math Camp, University of Manitoba, July 11, 2019.

- Title: Some surprising connections!,
  Math Camp for Gifted Students, University of Manitoba, July 10, 2019.

- Title: The Arithmetic Geometric Mean has no compatible group law,
  Rings and Modules Seminar, University of Manitoba, May 27, 2019.

- Title: When do we have $1 + 1 = 11$ and $2 + 2 = 22$?,
  Rings and Modules Seminar, University of Manitoba, May 22, 2019.

- Title: Some interesting connections!,
  Department of Mathematics, IIT Palakkad, March 25, 2019.

- Title: Modular forms and Eisenstein series,
  Rings and Modules Seminar, University of Manitoba, January 15, 2019.

- Title: On the paramodular conjecture for genus 2 curves,
  Student Algebra Seminar, OU, September 21, 2017.

- Title: Some Interesting Connections!,
  Graduate Student Seminar, OU, April 3, 2017.

- Title: Co-dimensions of the spaces of cusp forms for Siegel congruence subgroups,
  31st Automorphic Forms Workshop, East Tennessee State University, March 8, 2017.

- Title: An introduction to Ramanujan Graphs,
  Student Algebra Seminar, OU, April 19, 2016.

- Title: On Klingen Eisenstein series with level,
  Algebra and Representation Theory Seminar, OU, April 15, 2016.

- Title: On Klingen Eisenstein Series,
  Speed TORA VII, University of North Texas, April 10, 2016.

- Title: On Klingen Eisenstein Series,
  Graduate Student and Postdoc Seminar, ICERM, Brown University, October 12, 2015.

- Title: Automorphic Representations and Eisenstein Series,
  Algebra and Representation Theory Seminar, OU, October 31, 2014.

- Title: An introduction to automorphic representations (part II),
  Student Algebra Seminar, OU, October 29, 2014.

- Title: An introduction to automorphic representations (part I),
  Student Algebra Seminar, OU, October 22, 2014.

Poster Presented

- TORA VII, University of North Texas, April 10, 2016

- Student Research and Creativity Day, The University of Oklahoma, March 4, 2016.

○ Workshop I, II and III, ICERM, Brown University, Fall 2015.

Conferences Attended

○ Machine Learning in Finance and applications,
University of Manitoba, November 15, 2019.

○ TORA VIII,
Oklahoma State University, March 31-April 2, 2017.

○ 31st Automorphic Forms Workshop,
East Tennessee State University, March 6–9, 2017.

○ The 2016 Paul J. Sally, Jr. Midwest Representation Theory Conference,
University of Iowa, October 14–16, 2016.

○ TORA VII,
University of North Texas, April 8-10, 2016.

○ Computational Aspects of L-functions,
ICERM, Brown University, November 9-13, 2015.

○ Explicit Methods for Modularity of K3 Surfaces and Other Higher Weight Motives,
ICERM, Brown University, October 19-23, 2015.

○ Modular Forms and Curves of Low Genus: Computational Aspects,
ICERM, Brown University, September 28 - October 2, 2015.

○ TORA VI, Texas-Oklahoma Representations and Automorphic Forms Conference,
The University of Oklahoma, March 7-9, 2014.

Service & Math Popularization

○ **Served as an elected member of the Norman Public School's Gifted and Talented Advisory Council for 2015-2017.** As a member of Gifted and Talented Advisory Council, I have proposed several ideas for improving math-education in Norman Public Schools. As a result of one of my suggestions, a database of expert volunteers was created. These volunteers were parents who were willing to share their knowledge, expertise and passion in their respective fields, with school-students, as guest lecturers. I volunteered myself to teach mathematics and show its beauty to school students.

- **Served as the Chair of the Mathematics Department Chair's Advisory Committee, University of Oklahoma.** The main objectives of the Chair's Advisory Committee was to act as a bridge between the graduate students and the Chair of the Mathematics Department. As the chair of this committee, I organized bi-weekly meetings, helped conduct an anonymous survey of graduate students in the department, provided suggestions on making an equitable distribution of teaching assignments to graduate students, provided feedbak on making math help-center more effective and efficient, and suggested improving access to computational facilities and printers for graduate students. Indeed, thanks to the caring and proactive leadership in the department, many of the proposals of the Advisory Committee were accepted, leading to much-needed improvements.

- **I represented my department at the Oklahoma Women in Science Conference.** The event was attended by about 1000 girl students of grades 6-12 and through interactive puzzles and games they were offered a taste of the 'real' mathematics; `Tulsa, October 11, 2016 and October 17, 2017.`

- Engaged kids with mathematical games and puzzles during the **Graduate Student Senate Science Day program for homeless children,** University of Oklahoma, `7th April, 2015.`

- Organized a special math popularization event and volunteered to teach elementary school students at the **Madison Elementary School, Norman;** `March 2016.`

- **Volunteered for the annual Math day events** for school students organized by the Math Department at the University of Oklahoma, `Nov 15, 2012; Nov 14, 2013; Nov 20, 2014.`

- **I was one of the two organizers of the weekly Grad Student-Postdoc Seminar** at ICERM, Brown University, `Fall 2015.`

Computer skills

Languages	RPG, RPGILE, SQL, Java, C, C++, Python.	Packages	Mathematica, Matlab, Sage, Magma.
Platforms	OS/400, UNIX, Windows, Linux.	Databases	DB2.
Tools	COOL:2E (SYNON).		

- Contributed in bug-fixing for the LMFDB (http://www.lmfdb.org/) project.
- Developed ABS DLI Downloader Software (https://alokshukla.wordpress.com/tag/abs-dli-downloader/) in Java, for downloading books form the Digital Library of India.

Entrepreneurship

- **I co-founded Gauss Academy (https://gaussacademy.org/)** with the following mission:
  Teaching- To spread the joy of mathematics! We believe that every child deserves a quality mathematics education.
  Research- To engage in cutting edge mathematical research to solve real life problems.

- **Serving over 1000 Students:** Our first client is a high school in Oregon. We are happy to serve its over 1000 students for the academic year (2018-19).

- **I served both as the software developer and the web-administrator of our website,** which offers a cloud based solution for mathematics-learning for school students.