# Nihar Prakash Gargava   nihargargava@gmail.com   http://nihargargava.com

| | |
|---|---|
| **Education** | ***École Polytechnique Fédérale de Lausanne, Switzerland***   Sept 2017 - Present |
| | Masters of Science in Mathematics |
| | Expected graduation: Feb 2019 |
| | |
| | ***Indian Institute of Technology, Kanpur, India***   July 2013 - May 2017 |
| | Bachelor of Science in Mathematics and Scientific Computing |

**Scholastic Achievement**

- Qualified and secured an All India Rank of 871 out of over 123 thousand candidates in the second round, in Joint Engineering Exam (Advanced), a two-phase exam where over 1.26 million candidates appeared.
- Secured a rank of All India Rank 5 in National Entrance Screening Test 2013, an entrance exam where over 70 thousand candidates appeared.
- Selected for the prestigious Charpak Research Internship Program 2016, organized by 'Campus France', a French-national agency.
- Recipient of INSPIRE scholarship, granted by the Department of Science and Technology, India.
- Recipient of the J.N.Tata Scholarship for Higher Education.
- Recieved that Charles Rapin Grant, a scholarship for Masters studies at EPFL.

**Background**

**Programming**
I have experience in Python, C, C++, openCV, openGL, sage. I have worked on programming project independently and like to develop openGL-based mathematical visualizations. I have a working knowledge of HTML, php and webGL. Here is my github.

**Mathematics**
I have a basic background in almost all areas of theoretical mathematics. My mathematical interests aren't concretely decided, however I feel most inclined to pursue certain areas in geometry (and some intersection with number theory). I maintain this mathematics blog.

- **Current courses (EPFL)**: Probabilistic method, Automorphic forms and L-functions
- **Past courses (EPFL)**: Probablity Theory, Combinatorial Geometry, Set theory, Riemann Surfaces, Homotopical algebra, Lie groups, Inro. to Riemannian Geometry, Analysis on groups
- **Past courses (IITK)**: Programming, Real Analysis, ODE & Linear Algebra, Abstract Algebra, Probability and Statistics, Mathematical Logic, Data Structures & Algorithms, Complex Analysis, Galois theory, Differential Geometry, Numerical methods, Topology, Lie groups, Alg. Number Th., Alg. Topology, Topics in Arithmetic, Functional Analysis, Intro. to Algebraic Groups, Fluid Mechanics, Theory of Computation, Hyperbolic Geometry, Geometry of differential forms, Measure theory, Partial differential equations.

**Conference attended**

**Combinatorics and Arithmetic for Physics: special days**   Oct, 2018
*Organised by Prof. G H E Duchamp, Prof. Maxim Kontsevich, Prof. Gleb Koshevoy, Prof. H N Minh at Institut des Hautes Études Scientifiques*

**Workshops attended**

**Differential Geometry**   July, 2017
*Organised by Prof. Mahan Maharaj, Prof. Indranil Biswas, Prof. Tejas Kalelkar*
*at Indian Institute of Science Education and Research, Pune*

**J-holomorphic curves and Gromov Witten invariants**   July, 2017
*Organised by Prof. Ritwik Mukherjee, Prof. Somnath Basu*
*at National Institute of Science Education and Research, Bhubhaneswar*

**Representation Theory of Finite Groups**   June, 2017
*Organised by Prof. K V Subramanian, Prof. Amritanshu Prasad and Prof. K. Raghavan*
*at Chennai Mathematical Institute, Chennai*

**Probability and Representation Theory**   March, 2016
*Organised by Prof. Arvind Ayyer, Prof. Amritanshu Prasad and Prof. K. Raghavan*
*at Institute of Mathematical Sciences, Chennai*

| | | |
|---|---|---|
| **Masters thesis** | **Algebraic coding theory** | Fall, 2018 |

*Supervised by Maryna Viazovska, EPFL*

- This is an ongoing project that involves the study of various asympotic bounds in coding theory. Part of the project so far involved running tests on institute's computer clusters to get empirical data to investigate the possibility of cyclic codes being asymptotically good.

| | | |
|---|---|---|
| **Projects** | **Arithmetic Hyperbolic 3-Manifolds** | Fall, 2017 |

*Supervised by Maryna Viazovska, EPFL*

- This project consisted of reading the book *The Arithmetic of Hyperbolic 3-Manifolds (Maclaclan, Reid)*. This project provided me a background in the knowledge of arithmetic hyperbolic 3-manifolds as quotients of Adéle groups and harmonic analytic methods on Adèles and Idèles.
- I read Don Zagier's 1987 paper titled *Hyperbolic manifolds and special values of Dedekind zeta-functions*, which involved finding a special value of the Dedekind zeta function using volumes of arithmetic hyperbolic 3-manifolds.
- An expository report for the paper and the necessary background required has been written.

**Polylogarithms and Combinatorial Hopf Algebra**   Summer, 2016

*Supervised by Prof. Gérard H E Duchamp, Prof. H N Minh*
*Laboratoire d'Informatique de Paris-Nord, Université Paris-Nord*

- This project continued the existing line of work of Prof. Duchamp and Prof. Minh that concerned with understanding polylogarithms with the aid of tools from combinatorics of words. This is an ongoing project and more details can be given on request.

**Classical Invariant Theory**   Sixth Semester, 2016

*Supervised by Prof. Preena Samuel, IITK*

- Documented and read *Classical Invariant Theory (Kraft, Processi)*, building towards algebraic groups.
- Wedderburn Theory and the Double Centralizer Theorem was covered.
- Understood the Schur-Weyl Duality and in the context of the Representation Theory of $GL(n, \mathbb{C})$.

**Algebraic Geometry**   Winter, 2015

*Supervised by Prof. Sudarshan Gurjar, IIT Bombay*

- Covered the book *Algebraic Curves (William Fulton)*.
- Recieved fundamental knowledge of algebraic geometry including Riemann-Roch theorem, sheaves and Noether-normalization theorem.

**Representation theory and Combinatorics**   Fifth Semester, 2015

*Supervised by Prof. A K Lal, IITK*

- Read *Enumerative Combinatorics, Vol 2 (Richard Stanley), Young Tableaux (William Fulton)*.
- Understood the Representation Theory of $S_n$ and the connection with Schur polynomials and Young Tableaux. Details are documented.

**Algebraic and Enumerative Combinatorics**   Summer, 2015

*Supervised by Prof. B. Sury, Indian Statistical Institute, Bangalore*

- Studied Polya Theory of orbit counting and representation theory of symmetric groups, along with an introduction to matching theory.
- Applied Polya Theory to count the number of hexaflexagons structures, and derive the series A000207 from A000108. Details are in this report.
- Read the popular text *Combinatorics: Theory and Applications (V. Krishnamurthy)*, found an erroneous proof and a way to circumvent the error. Built a notation guide.

**KNOT (a 3D visualization tool for Mathematical Knots)**   Summer, 2014

*Guided by Prof. Aparna Dar, IITK*

- Read the books *The Knot Book (Collin Adams)* and *Knot Theory and Its Applications (Kunio Murasugi)*
- Implemented Knot Theory on openGL to compute invariants like Dowker-Thistlethwaite codes, crossing numbers, writhe, Fox-N-Colorability of any knot using concepts in Computational Geometry like the Bentley-Ottmann sweep line algorithm.

**Background Subtraction and Object Tracking**   Summer, 2014

*Guided by Programming Club, IITK*

- Developed an open source software to remove mobile objects from a video feed and extract the background image and various statistical models were tested and perfected to achieve the desired accuracy and efficiency. Haar-like feature cascading was implemented using openCV.

**ISAAC ( a 2D openGL-based physics simulation engine)**   First semester, 2013

*Course project under Prof. Subhajit Roy, IITK*

- Worked upon an interface where user-drawn 2D solids could collide and interact. The entire physics algorithm was designed from scratch. My project helped me achieved a distinction in the course.

**ABU Robocon 2014 ( International robotics competition)**    Winter, 2013
*Supervised by Mechatronics Lab, IITK*

- Worked to program a pole-to-pole, laterally traversing robot for the institute team.

- Won awards: **Best Innovative Design** at **National ROBOCON 2014**, **Most Innovative Implementation** at **Student Research Convention 2014, IITK**.

**Positions of Responsibility**

**Masters**
- Teaching assistant of "Advaced Linear Algebra for Physics - 2"    2017-18
- Teaching assistant for "Advaced Linear Algebra for Physics - 1"    2018-19

**Bachelors**
- Interest group leader, CoNTRA (Combinatorics, Number Theory, Representation, Algebra)    2016-2017
- Hobby Group Leader, Science Coffeehouse (a science discussion group)    2015-2016
- Coordinator, Card and Board Games Club    2015-2016
- Coordinator, English Literature Society    2015-2016
- Academic Mentor for Mathematics, Counseling Service    2014-2015

**Extra-curricular Activities**

Active participant in many student activities, skilled in dancing (I have won a state-level competition at the age of 11), skilled in playing music instruments such as Flute and Saxophone, ardent science enthusiast (organise and give talks at Science Coffeehouse), board games lover.

I once took a week-long workshop aimed at high school students. Here is some material that I had made.

I sometimes make animated pedagogical visuals. They can be found here.