# Rahul Kumar

**CONTACT INFORMATION**

**Office:**
428 McAllister Building
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The Pennsylvania State University
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**EMPLOYMENT**

**Postdoctoral Fellow**

- Fulbright-Nehru postdoc fellow     Nov 15, 2022 – Nov 14, 2024
  Department of Mathematics
  **The Pennsylvania State University**
  State College, PA, USA.
  - Mentor: Professor Winnie Li

- **Institute for Basic Science**
  Center for Geometry and Physics, POSTECH     Nov 01, 2021 – Oct 31, 2022
  Pohang, South Korea.

- Discipline of Mathematics,
  **Indian Institute of Technology Gandhinagar**,     Oct 27, 2020 – Oct 14, 2021
  Palaj, Gandhinagar, Gujarat, India.
  - Mentor: Professor Atul Dixit

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**EDUCATION**

**Indian Institute of Technology Gandhinagar**, India.     Dec 28, 2015 – Oct 26, 2020

Ph.D., Mathematics

- Advisor: Professor Atul Dixit

- Ph.D thesis topic
  Generalized Hurwitz zeta and modified Bessel functions and associated modular relations.

- CPI: 9.34/10

**Indian Institute of Technology Kanpur**, India.     July 2013 - June 2015

M.Sc., Mathematics,

- Subjects: *Pure Mathematics*
- CPI: 8.0/10

**Dr. Bhimrao Ambedkar University Agra**, India.     July 2009 - July 2012
**B S A College Mathura**

B.Sc., Mathematics.

- Subjects : *Mathematics, Computer Science, Physics*
- Percentage: 65.25%

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**RESEARCH INTERESTS**

Analytic Number Theory, Special Functions, Modular Forms, Partition Theory.

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**PAPERS: PUBLISHED**

1. Zeros of combinations of the Riemann $\Xi$-function and the confluent hypergeometric function on bounded vertical shifts, (with A. Dixit, B. Maji, A. Zaharescu), Journal of Mathematical Analysis and Applications, 466 (2018), 307-323.

2. Generalized Lambert series, Raabe's cosine transform and a generalization of Ramanujan's formula for $\zeta(2m+1)$, (with A. Dixit, R. Gupta, B. Maji), Nagoya Mathematical Journal, 239 (2020), 232–293.

3. The generalized modified Bessel function and its connection with Voigt line profile and Humbert functions, Advances in Applied Mathematics, Volume 114, March 2020, 101986, 19 pp.

4. On Hurwitz zeta function and Lommel functions, (with A. Dixit), International Journal of Number Theory, Vol. 17, No. 2 (2021) 393–404.

5. Superimposing theta structure on a generalized modular relation, (with A. Dixit), Research in the Mathematical Sciences, 8, pp 01-83, Article number: 41 (2021).

6. On some $q$-series identities related to the generalized divisor function and their implications (with R. Gupta), Discrete Mathematics, 344 (11),112559, 2021.

7. Explicit transformations of certain Lambert series (with A. Dixit and A. Kesarwani), Research in the Mathematical Sciences, 9, pp 01-54, Article number: 34 (2022).

8. Extensions of Watson's theorem and the Ramanujan-Guinand formula, International Journal of Number Theory, Vol. 19, No. 1 (2023) 199–222.

9. Equivalent criterion for the grand Riemann hypothesis associated to Maass cusp forms (with S. Banerjee), to appear in Proceedings of the Royal Society of Edinburgh, Section A: Mathematics, Arxiv link.

10. Extended higher Herglotz functions II (with R. Gupta), Journal of Mathematical Analysis and Applications, 518 no. 2 (2023), Paper No. 126720 (16 pages).

11. A modular relation involving a generalized digamma function and asymptotics of some integrals containing $\Xi(t)$ (with A. Dixit), Hardy-Ramanujan Journal, 45 (2022), 140–151.

12. Extended higher Herglotz functions I. Functional equations (with A. Dixit, R. Gupta), Advances in Applied Mathematics, Volume 153, February 2024, 102622, pp. 01–41.

13. Arithmetic properties of the Herglotz-Zagier-Novikov function, (with Y. J. Choie), Advances in Mathematics, Volume 433, 15 November 2023, 109315, pp. 01–36.

14. Applications of the Lipschitz summation formula and a generalization of Raabe's cosine transform, (with A. Dixit), to appear in Constructive Approximation, 2023, pp. 01–40.

15. A note on odd zeta values over any number field and Extended Eisenstein series, (with S. Banerjee and R. Gupta), Journal of Mathematical Analysis and Applications, Volume 531, Issue 1, Part 2, 1 March 2024, 127883, pp 01–17.

16. A family of integrals related to values of the Riemann zeta function (with Paul Levrie, Jean-Christophe Pain and Victor Scharaschkin), to appear in International Journal of Number Theory, 2024.

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**PAPERS: SUBMITTED FOR PUBLICATION**

1. Explicit identities on zeta values over imaginary quadratic field (with S. Banerjee), submitted for publication, Arxiv link.

2. Number field analogue of divisor function à la Koshliakov (with S. Banerjee), submitted for publication, Arxiv link.

3. Kronecker second limit formula for real quadratic fields (with Y. J. Choie), submitted for publication, pp 01–34.

4. Period function from Ramanujan's Lost notebook (with Y. J. Choie), submitted for publication, pp 01–23.

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**AWARDS AND SCHOLARSHIPS**

- Selected for AMS-Simons travel grant, American Mathematical Society, 2024.
- Fulbright-Nehru postdoctoral fellowship, United States–India educational foundation, USA                                                                                          - 2022–2024.
- Selected for Ulam NAWA postdoctoral fellowship, Polish National Agency for Academic Exchange, Poland                                                            -2022–2024
- Selected for NBHM post-doctoral fellowship, India                          - 2021–2024
- Awarded "Atlas research travel grant" by IIT Gandhinagar                      - 2019
- Awarded "International conference travel grant" by IIT Gandhinagar          - 2019
- Qualified CSIR(Council of Scientific & Industrial Research)                      - 2015
  NET (National Eligibility Test) for Lectureship and Junior Research Fellowship.
- Qualified GATE (Graduate Aptitude Test in Engineering) exam for                - 2015
  Ph.D. program in IITs.
- Awarded MCM (Merit-Cum-Means) fellowship by IIT Kanpur                          -2015
- Cleared IIT-JAM exam for M.Sc. program in IITs                                  - 2013

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| **TEACHING EXPERIENCE** | • Instructor for the course **MA 502-Complex Analysis** at IIT Gandhinagar, March 2021–May 2021. |
| | • Graduate Teaching Fellow for the course **MA 202**-Mathematics IV (Probability, statistics and Numerical Methods) at IIT Gandhinagar, January 2020–April 2020. |
| | • Graduate Teaching Fellow for the course **MA 509**-Topics in Real Analysis at IIT Gandhinagar, August-November 2019. |
| | • Graduate Teaching Fellow for the course **MA 202**-Mathematics IV (Probability, statistics and Numerical Methods) at IIT Gandhinagar, January 2019–April 2019. |
| | • Graduate Teaching Fellow for the course **MA 201**-Mathematics III (Complex analysis and Ordinary Differential Equation) at IIT Gandhinagar, August 2018–November 2018. |
| | • Graduate Teaching Fellow for the course **MA 102**-Mathematics II (Linear Algebra and Ordinary Differential Equation) at IIT Gandhinagar, December 2017–April 2018. |
| | • Course Associate for the course **MA 101**-Mathematics I (Real Analysis and Several Variable Calculus) at IIT Gandhinagar, July 2017–November 2017. |
| | • Course Associate for the course **MA 102**-Mathematics II at IIT Gandhinagar, December 2016–April 2017. |
| | • Course Associate for the course **MA 101**-Mathematics I (Real Analysis and Several Variable Calculus) at IIT Gandhinagar, July 2016–November 2016. |

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| **SEMINARS & TALKS** | 32. Invited talk, The Legacy of Ramanujan, Celebrating the 85th birthdays of George Andrews & Bruce Berndt, The Pennsylvania State University, State College, PA, USA     June 06–09, 2024. |
| | 31. Contributed talk, COmbinatorial Number Theory And Connected Topics (CONTACT - III), India     March 16-17, 2024. |
| | 30. Lightening talk, Annual Clifford Lectures, The Web of Modularity, Tulane University, USA,     February 22-25, 2024. |
| | 29. Department Seminar talk, IIT Roorkee,     November 30, 2023. |
| | 28. Department Seminar talk, IISER Bhopal,     November 28, 2023. |
| | 27. Department Seminar talk, IIT Indore,     November 27, 2023. |
| | 26. Department GANIT Seminar talk, IIT Gandhinagar,     November 22, 2023. |
| | 25. Department Seminar talk, IIT Bombay,     November 21, 2023. |
| | 24. Contributed talk, *Kronecker limit formula for real quadratic fields*, PAlmetto Number Theory Series (PANTS) XXXVI, Clemson University, USA, October 21–22, 2023. |
| | 23. Invited talk, *Kronecker limit formulas and Associated special functions* (online mode), UT Tyler Number Theory and Combinatorics Seminar, University of Texas at Tyler USA,     August 29, 2023. |
| | 22. Contributed talk, *Applications of Lipschitz summation formula and asymptotic of plane partitions*, 35th Automorphic Forms Workshop, Louisiana State University, Baton-Ragoue, USA,     May 22–26, 2023. |
| | 21. Seminar talk, *Arithmetic properties of the Herglotz-Zagier-Novikov function*, Seminar Series: Topics in Special Functions and Number Theory, India,     April 27, 2023. |
| | 20. Lightning talk, *Ramanujan's formula for odd zeta values over number fields*, Bayou Arithmic Research Days (BARD 2), Tulane University, New Orleans, USA,     April 18, 2023. |
| | 19. Seminar talk, *Arithmetic properties of the Herglotz-Zagier-Novikov function*, Algebra |

and Number Theory Seminar, Department of Mathematics, the Pennsylvania State University, USA, April 06, 2023.

18. Contributed talk, *On an extension of Herglotz-Zagier function*, Southern Regional Number Theory Conference, Louisiana State University, Baton-Ragoue, USA, March 11-12, 2023.

17. Seminar talk, *Asymptotics of smallest part function and its generalization*, Combinatorics /Partitions Seminar, Department of Mathematics, the Pennsylvania State University, USA, Jan 17, 2023.

16. Contributed talk, *Extended higher Herglotz functions: functional equations*, 16th International Symposium on Orthogonal Polynomials, (Online mode) Special Functions and Applications, Centre de recherches mathématiques, Montreal, Canada, June 13-17, 2022.

15. Invited seminar talk, *Extended higher Herglotz functions*, Department of Mathematics, IIT Indore, India, May 30, 2022.

14. Young Scholar talk, *Theory of a zeta function arising from modular relations*, (Online mode) Recent advances in Mathematics and related areas, Kerala School of Mathematics, Kerala, India, April 21–24, 2022.

13. Invited talk, *Explicit transformations of certain Lambert series, International e-Conference on Number Theory and Differential Equations*, (Online mode) to celebrate Ramanujan's 134th birth anniversary, Central University of Karnataka, Kalaburagi, India, December 21, 2021.

12. Invited talk, *Theory of a zeta function arising from modular relations*, (Online mode) Texas Combinatorics and Number Theory Seminar, University of Texas at Tyler and Rio Grande Valley USA, October 07, 2021.

11. Invited talk, *A generalized modified Bessel function and explicit transformations of certain Lambert series*, (Online mode) seminar series for early career Indian mathematicians, India, May 28, 2021.

10. Contributed talk, *A generalized modified Bessel function and explicit transformations of certain Lambert series*, (Online mode) ICSFA-2020, BBDU Lucknow, India, December 23, 2020.

9. Contributed talk, *Superimposing theta structure on a generalized Modular relation*, (Online mode) International Conference on Number Theory and Algebra, to celebrate the birth anniversary of Srinivasa Ramanujan at IIT (BHU), Varanasi, December 22-23, 2020.

8. Invited talk, *A generalized modified Bessel function and explicit transformations of certain Lambert series*, (Online mode) Number Theory and Special Functions, India, December 17, 2020.

7. Contributed talk, *A connection between $\zeta(s,a)$ and Lommel functions and a new proof of Hurwitz's formula*, (Online mode) Virtual Math Fest, IMSc, India, July 20-26, 2020.

6. Contributed talk, *Superimposing theta structure on a generalized modular relation*, Symposium Number Theory at IIT Gandhinagar. December 22-23, 2019.

5. Contributed talk, *Zeros of combinations of Riemann $\Xi$ -function and confluent hypergeometric function on the bounded vertical shifts*, Analytic and combinatorial Number Theory: The Legacy of Ramanujan- A conference in honor of Bruce C. Berndt's 80th birthday at University of Illinois Urbana-Champaign. June 06-09,

2019.

4. Contributed talk, *Zeros of combinations of Riemann $\Xi$-function and confluent hypergeometric function on the bounded vertical shifts*, International conference on Number Theory, School of Mathematical Sciences, IISER, Thiruvananthapuram, India.                                        March 11-13, 2019.

3. Young scholar talk, *Zeros of combinations of Riemann $\Xi$-function and confluent hypergeometric function on the bounded vertical shifts*, International Conference on Class Groups of Number Fields and Related Topics (ICCGNFRT-2018) at HRI Allahabad.                                        October 11, 2018.

2. Seminar talk, *Infinitude of the zeros of Riemann zeta function and its generalization on the critical line*, Mathematics Discipline Seminar at IIT Gandhinagar. September 26, 2018.

1. Seminar talk, *Branch of logarithm*, Mathematics Discipline Seminar at IIT Gandhinagar.                                        March 16, 2016.

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**WORKSHOPS ATTENDED**

- *Advanced Instructional School on Modular Forms*, IIT Guwahati, India.  May 13-June 01, 2019
- *International Conference on Class Groups of Number Fields and Related Topics (ICCGNFRT-2018)*, HRI Allahabad.                                        October 08-11, 2018
- *ATMW Analytic Number Theory*, ISI Kolkata.                                        December 26-30, 2017
- *Number Theory: Arithmetic, Diophantine and Transcendence, conference celebrating 130th birth anniversary of S. Ramanujan*, IIT Ropar.                                        December 22-25, 2017
- GIAN course on *"Transcendental Numbers and Special Values of Dirichlet Series"*, IIT Ropar.                                        December 16-21, 2017
- *International Conference on Exploring History of Indian Mathematics*, IIT Gandhinagar.                                        December 04-06, 2017
- *International Conference on Class Groups of Number Fields and Related Topics (ICCGNFRT-2017)*, HRI Allahabad.                                        September 04-07, 2017
- *IST Advanced Linear Algebra*, IIT Gandhinagar.                                        July 10-22, 2017
- *Workshop on Application of Mathematics*, IIT Gandhinagar.                                        May 16, 2017
- *Indian Women and Mathematics: Regional Workshop on Research and Career Opportunities*, IIT Gandhinagar 2016.                                        December 20-21, 2016
- *The Jangjeon Mathematical Society on Number Theory and Special Functions and it's Applications*, Pondicherry University, Pondicherry.                                        August 08-10, 2016
- *International School on Computer Algebra (COCOA)*, IIT Gandhinagar.   February 22-26, 2016

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**PROFESSIONAL INVOLVEMENT & SERVICES**

- Journal reviewer for 'Advances in Mathematics'
- Journal reviewer for 'Ramanujan Journal'
- Journal reviewer for 'International Journal of Number Theory'
- Journal reviewer for 'Indagationes Mathematicae'
- Journal reviewer for 'Journal of the Ramanujan Mathematical Society'
- Journal reviewer for 'Integral Transforms and Special Functions'
- Journal reviewer for '(RACSM) Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales. Serie A. Matematicas'

- Journal reviewer for 'Journal of Applied Analysis'
- Journal reviewer for 'Indian Journal of Pure and Applied Mathematics'
- Journal reviewer for 'SIGMA (Symmetry, Integrability and Geometry: Methods and Applications)'
- Journal reviewer for 'Journal of Inequalities and Applications'
- Journal reviewer for 'Symmetry'
- Organized *Mathematics Discipline Seminar* at IIT Gandhinagar for two semesters January 2019-April 2019 and August 2019-December 2019.
- One of the organizers of Mathegon 2017, Mathegon 2018, and Mathegon 2019 (on account of National Mathematics Day Celebration), IIT Gandhinagar.
- One of the organizers of Pi day 2018, IIT Gandhinagar, March 14, 2018.
- Volunteered in the organization of *Kishore Vaigyanik Protsahan Yojana (KVPY)*, two times at IIT Gandhinagar,
- Volunteered in the organization of 'Symposium in Number Theory' at IIT Gandhinagar, December 22-23, 2019.
- Volunteered in the organization of the conference *International School on Computer Algebra (COCOA)*, IIT Gandhinagar, February 22-26, 2016.