

Dr. Rajeshkumar Omprakash Sharma

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Summary

I recently Joined Dr. B R Ambedkar Institute of Technology, Sri Vijaya Puram, A&N Islands as Assistant Professor. In 2018, I completed my PhD in Condensed Matter Physics at the Sardar Vallabhbhai National Institute of Technology (SVNIT) in Surat, Gujarat. I was awarded the National Post-Doctoral Fellowship by the Science and Engineering Research Board (SERB), Government of India and hosted by the Indian Institute of Science (IISc), Bangalore, under the mentorship of Dr. Tanmoy Das. My current research focuses on the electronic, magnetic, superconducting, and topological properties of materials. I use VASP for DFT and CASINO code for QMC simulations. For scripting and plotting, I have been using Bash, Python, Fortran, Mathematica, and Gnuplot.

Personal Information

Date of Birth 05/07/1987

Nationality Indian

Gender Male

Marital status Married

Address (Home) 35, Harshiddhinagr, Kailash chaukadi, Althan-Bamroli road, Surat-394221, India.

Address (Mailing) F007, Physics Department, IISc, C. V. Raman Road, Bangalore-560012, India.

Research/Teaching Positions

Assistant Professor

Dr. B.R. Ambedkar Institute of Technology

Sri Vijaya Puram, A&N
Islands

06 Oct. 2025 - Present

- Teaching Engineering Physics.
- Combined teaching responsibilities with active research.
- Head of the Science and Humanities Department.

Research Associate

Computational and Data Science Department (CDS), Indian Institute of Science,

Bangalore, India

01 April 2024 - 30 Sep.

2024

- Investigate the electronic, magnetic, and superconducting properties of diverse materials through Density Functional Theory (DFT) and theoretical approaches.
- Explore the Superconducting Pairing Symmetry in $R_2Fe_3Si_5$ (R = rare-earth) compounds by employing spin-fluctuation calculations with a tight-binding parametrization of low-energy electronic states.

National Postdoc Fellow (N-PDF)

Department of Physics, Indian Institute of Science,

Bangalore, India

28 Feb. 2022 - 27 Feb.

2024

- Investigate the electronic, magnetic, and superconducting properties of diverse materials through Density Functional Theory (DFT) and theoretical approaches.
- Explore the Superconducting Pairing Symmetry in $R_2Fe_3Si_5$ (R = rare-earth) compounds by employing spin-fluctuation calculations with a tight-binding parametrization of low-energy electronic states.

Research Associate - III

Department of Physics, Indian Institute of Science,

Bangalore, India

01 July 2021 - 31 Dec.

2021

- Employ DFT in conjunction with VASP for precise calculations of electronic and magnetic properties.
- Conduct in-depth investigations into unconventional superconductivity at $LaVO_3/SrTiO_3$ interfaces, employing advanced DFT methodologies.
- Explore, conceptualize, and engineer novel 2D square-octagon lattice materials with superconducting capabilities.

Research Associate - II

Department of Physics, Panjab University

Chandigarh, India

13 Aug. 2019 - 30 June

2021

- Explore ground state properties of one-dimensional coupled wire systems through both theoretical and computational frameworks.
- Applied QMC techniques for detailed simulations alongside the Random Phase Approximation (RPA) within linear response theory for rigorous theoretical analysis.
- Utilize the CASINO software for executing QMC calculations, ensuring high precision in computational results.

Assistant Professor

Department of Physics, Marwadi University

Rajkot, Gujarat, India

22 Feb. 2018 - 23 July
2019

- Instructed courses in Physics for B.Sc., Electromagnetic Theory for M.Sc., and Engineering Physics for B.E./B.Tech. programs.
- Designed and oversaw Physics laboratories for both B.Sc. and M.Sc. students, enhancing practical learning experiences.
- Fulfilled the role of class coordinator, providing guidance and mentorship to a group of 15 students, fostering their academic and personal growth.
- Combined teaching responsibilities with active research, leading to a collaborative publication with Prof. Philip Hogg at the Institute of Pascal, France.
- Enhanced professional teaching competencies by participating in a *Faculty Development Program*, focusing on innovative teaching methodologies and academic leadership.

Assistant Professor

Kim, Gujarat, India

Vidhyadeep Institute of Management and Technology, Anita

07 Aug. 2012 - 23 Dec.
2013

- Served as the Subject Coordinator for Engineering Physics in the B.E. program, overseeing curriculum development and implementation.
- Taught Environmental Science to first-year B.E. students.
- Led the coordination of the Engineering Physics Laboratory, enhancing the experimental learning experience for students.
- Participated as a member of the college bus transport committee, contributing to the improvement of campus transportation services.
- Attended the *Faculty Development Program* at Gujarat Technological University in Chandkheda, Ahmedabad, focusing on pedagogical skills enhancement and academic innovation.

Teaching Assistant

Vadodara, Gujarat,
India

The Maharaja Sayajirao University of Baroda

24 July 2010 - 12 May
2012

- Instructed Engineering Physics to first-year B.E. students.
- Taught courses on LASER technology and its applications to first-year B.E. students in both regular and part-time classes.
- Served as an instructor for Physics laboratories for first and second-year B.E. students, fostering hands-on learning and experimental skills.
- Awarded a *Certificate of Appreciation* by the Vice Chancellor of MSU for contributions to the *Swarnim Gujarat* initiative, recognizing efforts in enhancing the university's community and outreach.

Ad-hoc lecturer

Sigma Institute of Engineering and Technology,

Vadodara, Gujarat,
India

01 Aug. 2009 - 23 July
2010

- Instructed Engineering Physics to first-year B.E. students.
- Supervised Physics laboratory sessions for first-year B.E. students, ensuring effective practical learning experiences.
- Taught Environmental Science and Semiconductor Physics to B.E. students.
- Contributed as a member of the Tech-fest Committee, organizing and coordinating technical events to promote innovation and collaboration among students.

Education

Ph.D.

Sardar Vallabhbhai National Institute of Technology (SVNIT)

Dec. 2013 - Oct. 2018

Applied Physics Department (APD)

Surat, Gujarat, India

- **Thesis Title :** The quantum Monte Carlo study of ground-state properties of electron-hole bilayer system.
- **Thesis Submitted :** 28 December 2017.
- **PhD Viva Voce :** 27 June 2018.
- **Degree Awarded :** 13 October 2018.
- **Supervisor :** Dr. L. K. Saini, Assistant Professor, APD, SVNIT.
- **Description :** We utilized Variational Monte Carlo (VMC) and Diffusion Monte Carlo (DMC) methods to investigate the impact of electron-hole correlations on parallel-coupled, infinitely thin electron-hole bilayers (EHBLS). The attractive Coulomb interaction between electrons and holes leads to the formation of excitons and biexcitons. Our exploration focused on how variations in layer separation (d) influence the phase transition among fluid, excitonic, and biexcitonic states. In mass-asymmetric systems, a smaller critical layer separation was required for biexciton formation, attributed to intralayer correlations among the heavier holes. For mass-symmetric EHBLS, fluid phases remained stable at high densities and small layer separations. The ferromagnetic Wigner crystal phase became less prominent as the density decreased, particularly at $r_s = 20$. The antiferromagnetic Wigner crystal phase was found to be unstable within the considered range of r_s and d .

M.Sc. in Physics

Mar. 2007 - Mar. 2009

The Maharaja Sayajirao University of Baroda (MSU)

Vadodara, Gujarat,
India

Applied Physics Department

- **Percentage :** 62.9 % with First Class
- **Project Title :** Shape measurement of diffusively reflecting 3D objects using volume speckle field and phase retrieval.
- **Description :** When rough an object is illuminated with coherent radiation, such as laser light, it generates a volumetric speckle field. This speckle field carries valuable information about the object's state. By sampling this speckle field, one can directly reconstruct the phase and, consequently, the 3D shape of the object. This method has been primarily explored for shape measurements of diffusively reflecting objects but can also be extended to measure surface deformations.

- **Supervisor :** Dr. Arun Anand, Assistant Professor, APD, MSU.

- **Subjects :**

First Semester : Mathematical Physics; Mechanics-I; EMT; Mechanics of deformable elastic solids.

Second Semester : Mechanics-II (quantum & statistical); Physics of semiconductor devices; Electromagnetic theory; Crystal physics; Electronics; Modern optics.

Third Semester : Nuclear reactor & polymer Physics; Optical, Dielectric & Magnetic properties of material; Electronics; LASER and Applications.

Fourth Semester : Physical Techniques in Industries; Non Destructive Testing of Materials; Luminescent Materials & its Applications; Electronics; Fiber Optics and its Applications.

B.Sc. in Physics

Mar. 2004 - Mar. 2007

Veer Narmad South Gujarat University (VNSGU)
Navyug Science College

Surat, Gujarat, India

- **Percentage :** 64.2 % with First Class

- **Subjects :**

First Year : Chemistry, Physics and Mathematics

Second Year : Physics and Mathematics

Third Year : Mechanics, Solid State Physics; Electricity & Magnetism; Optics; Atomic & Nuclear Physics; Relativity; Cosmology, Statistical Physics & Thermodynamics.

Skills

QMC Codes CASINO

DFT Codes VASP, QUANTUM ESPRESSO, Wannier90 and related software.

Other Codes MATHEMATICA.

Basic Programming Fortran code, Python and BASH Shell Script in Linux.

Computing Skills Experience in using Parallel Computing clusters.

Configured Beowulf cluster using Rocks Cluster Distribution.

Software GNUPLOT, GRACE, ORIGINLAB, Microsoft Office and LibreOffice.

Graphics INKSCAPE, Libreoffice-draw and Microsoft PowerPoint.

Languages English, Hindi and Gujarati.

Workshops/Conferences/Seminars/School

International

2017	International Conference on the Nanotechnology: Ideas, Innovations & Initiatives-2017 (ICN:3I-2017), 06-08 December 2017.	<i>IIT Roorkee, Roorkee, India</i>
(Conference)		
2017	Conference on Frontiers in Two-Dimensional Quantum Systems (smr 3167), 13-17 November 2017.	<i>ICTP, Trieste, Italy</i>
(Conference)		
2017	Advances in Biological Systems and Material Science in NanoWorld (ABSMSNW-2017), 19-23 February 2017.	<i>IIT (BHU), Varanasi, India</i>
(Conference)		
2016	The second International Conference on Soft Materials (ICSM-2016), 12-16 December 2016.	<i>MNIT, Jaipur, India</i>
(Conference)		
2016	The tenth international Summer School on Quantum Monte Carlo and the CASINO program X, 23-30 July 2016.	<i>The Apuan Alps Centre for Physics, Vallico Sotto, Tuscany, Italy</i>
(School)		
2015	International Conference on Condensed Matter & Applied Physics (ICC-2015), 30-31 October 2015.	<i>Bikaner, India</i>
(Conference)		

National

2020	Current Trends in Condensed Matter Physics, September 2020.	25-29	<i>NIT Jalandhar, India</i>
2017	Nanotechnology & Biotechnology-the Pinnacle of Scientific Efforts (NBPSE-2017), 20-24 March 2017.		<i>SVNIT, Surat, India</i>
2017	Role Of Physics in Technology Development (RPTD-2017), 02-06 January 2017.		<i>SVNIT, Surat, India</i>
2016	Solar Photovoltaic Energy: Contemporary Technology and Recent Advances (SPECTRA-2016), 08-12 October 2016.		<i>SVNIT, Surat, India</i>
2016	Advanced Scientific Tools for Material and Nuclear Technology (ASTMNT-2016), 02-06 May 2016.		<i>SVNIT, Surat, India</i>
2015	Science & Technology of Advanced Materials, 21-23 August 2015.		<i>SVNIT, Surat, India</i>
2015	High Performance Computing Architecture and Applications for engineering & Scientists, 24-26 January 2015.		<i>SVNIT, Surat, India</i>
2009	Seminar on Recent Advances in Condensed Matter and Material Physics (RACMMP-2009), 28 February 2009.		<i>The MS University, Vadodara, India</i>
2008	One Day Workshop on Fundamentals of Quantum Mechanics, 20 January 2008.		<i>Navyug Science College, Surat, IN.</i>
2006	Two Day Workshop on Fundamentals of Quantum Mechanics, 24-25 December 2006.		<i>Navyug Science College, Surat, IN.</i>

Presentation

International Conference on the Nanotechnology : Ideas, Innovations, & Initiatives-2017 (ICN:3I-2017).

IIT Roorkee, Roorkee,
India

Oral Presenter on : *A diffusion Monte Carlo Study of Different Spin Configurations of Electron-Hole Bilayer system*

06-08 December 2017

- We study the different spin-configurations of the electron-hole bilayer (EHBL) with Diffusion Monte Carlo method at fixed density, interlayer distance and hole-to-electron mass ratio.
- We find that spin-configuration of EHBL system, which consists of only up-electrons in one layer and up-holes in other i.e. ferromagnetic arrangement within and across the layers, is more stable.

Conference on Frontiers in Two-Dimensional Quantum Systems (smr-3167)

ICTP, Kastler Lecture Hall (AGH), Trieste,
Italy

Poster Presenter on : *Quantum Monte Carlo study of excitons and biexcitons in mass-asymmetric electron-hole bilayer*

13-17 November 2017

- We study the effect of unequal mass of electron and hole on the ground state properties of electron-hole bilayer (EHBL) with variational and diffusion Monte Carlo method over wide range of layer parameters.
- The different phases of EHBL are identified from the behavior of pair-correlations functions and condensate fraction.
- We find that the EHBL system is in the biexcitonic fluid phase when layer separations less than 0.25 a.u.

Advances in Biological Systems and Material Science in NanoWorld (ABSMSNW-2017).

IIT (BHU), Varanasi,
India

Poster Presenter on : *Ground state energy calculation of electron-hole bilayer system using quantum Monte Carlo method*

19-23 February 2017

- We study the different spin-configurations of the electron-hole bilayer (EHBL) with Diffusion Monte Carlo method at fixed density, interlayer distance and hole-to-electron mass ratio.
- We find that spin-configuration of EHBL system, which consists of only up-electrons in one layer and up-holes in other i.e. ferromagnetic arrangement within and across the layers, is more stable.

The second International Conference on Soft Materials (ICSM-2016)

MNIT, Jaipur, India

Poster Presenter on : *Quantum Monte Carlo study of Buckled GaAs Monolayer*

12-16 December 2016

- We calculate the ground state energy, ionization potential and electron affinity of GaAs monolayer using the VMC and FN-DMC.
- We find the energies changes with system size and hence the quasi-particle and optical-gap.
- We find DMC quasi-particle gap 3.4(8) eV whereas DFT-LDA gap is 1.45 eV.

International Conference on Condensed Matter & Applied Physics (ICC-2015)

Govt. Engineering
College Bikaner,
Bikaner, India

Poster Presenter on : *Correlation Effects on Spin-Polarized Electron-Hole Quantum Bilayer*

30-31 October, 2015

- We present a numerical calculation for the pair-correlation functions of spin-polarized EHBL at zero temperature using the self-consistent mean-field approximation of Singwi, Tosi, Land and Sjölander (qSTLS).
- We find that the critical layer density decreases (increases) due to the inclusion of finite width (mass-asymmetry) effect during the phase-transition from charge-density wave to Wigner crystal ground-state

Publications

 ORCID  Publons  Google Scholar  Research Gate  Mendeley

Sharma2025

2025

23. Rajesh O. Sharma and T. Das, “Phase-space approach to Wannier pairing and Bogoliubov orbitals in square-octagon lattices”, *Phys. Rev. B* **111**, 214522 (2025).

2024

22. A. K. Pariari, Rajesh O. Sharma, M. Balal, M. Hücker, T. Das, and S. R. Barman, “Experimental Detection of Topological Electronic State and Large Linear Magnetoresistance in SrSn 4 Superconductor”, *Adv. Funct. Mater.* **24**12515, 1–13 (2024).
21. R. Pal, B. Pal, S. Mondal, Rajesh O. Sharma, T. Das, P. Mandal, and A. N. Pal, “Spin-reorientation driven emergent phases and unconventional magnetotransport in quasi-2D vdW ferromagnet Fe₄GeTe₂”, *npj 2D Mater. Appl.* **8**, 30 (2024).

2023

20. A. Girdhar, V. Ashokan, Rajesh O. Sharma, N. D. Drummond, and K. N. Pathak, “Wire-width and electron-density dependence of the crossover in the peak of the static structure factor from 2kF → 4kF in one-dimensional paramagnetic electron gases”, *Physical Review B* **107**, 115414 (2023).

2022

19. S. Halder, M. Garg, N. S. Mehta, A. Kumari, Rajesh O. Sharma, T. Das, S. Chakraverty, and G. Sheet, “Unconventional Superconductivity at LaVO₃ /SrTiO₃ Interfaces”, *ACS Applied Electronic Materials* **4**, 5859–5866 (2022).

2021

18. Rajesh O. Sharma, N. D. Drummond, V. Ashokan, K. N. Pathak, and K. Morawetz, “Ground-state properties of electron-electron biwire systems”, *Physical Review B* **104**, 035149 (2021).

2020

17. **Rajesh O. Sharma**, T. T. Rantala, and P. E. Hoggan, “Quantum Monte Carlo Approach for Determining the Activation Barrier of Water Addition to Carbon Monoxide Adsorbed on Pt(111) within 1 kJ/mol”, *Journal of Physical Chemistry C* **124**, 26232–26240 (2020).
16. **Rajesh O. Sharma**, T. T. Rantala, and P. E. Hoggan, “Selective hydrogen production at Pt(111) investigated by Quantum Monte Carlo methods for metal catalysis”, *International Journal of Quantum Chemistry* **120**, 1–7 (2020).

2019

15. **Rajesh O. Sharma** and P. E. Hoggan, “Chapter fourteen - physisorption energy of h and h₂ on clean pt(111) as a useful surface energy reference in quantum monte carlo calculation”, *Advances in Quantum Chemistry* **79**, edited by L. U. Ancarani and P. E. Hoggan, 311 –322 (2019)

2018

14. **Rajesh O. Sharma**, L. K. Saini, and B. P. Bahuguna, “Phase diagram of a symmetric electron-hole bilayer system: a variational Monte Carlo study”, *Journal of Physics: Condensed Matter* **30**, 185404 (2018).
13. B. P. Bahuguna, L. K. Saini, **Rajesh O. Sharma**, and B. Tiwari, “Hybrid functional calculations of electronic and thermoelectric properties of GaS, GaSe, and GaTe monolayers”, *Physical Chemistry Chemical Physics* **20**, 28575–28582 (2018).
12. B. P. Bahuguna, L. K. Saini, **Rajesh O. Sharma**, and B. Tiwari, “Strain and electric field induced metallization in the GaX (X = N, P, As, & Sb) monolayer”, *Physica E: Low-dimensional Systems and Nanostructures* **99**, 236 –243 (2018).
11. **Rajesh O. Sharma**, L. K. Saini, and B. P. Bahuguna, “A variational Monte Carlo study of different spin configurations of electron-hole bilayer”, *AIP Conference Proceedings* **1953**, 040030 (2018).
10. B. P. Bahuguna, L. K. Saini, and **Rajesh O. Sharma**, “Electric field effects on the optical properties of buckled GaAs monolayer”, *AIP Conference Proceedings* **1942**, 090007 (2018).
9. B. P. Bahuguna, L. K. Saini, and **Rajesh O. Sharma**, “The dielectric response and electronic properties of GaS monolayer: A first-principles study”, *AIP Conference Proceedings* **2006**, 030016 (2018).

2017

8. **Rajesh O. Sharma**, L. K. Saini, and B. P. Bahuguna, “Diffusion Monte Carlo study of excitons and biexcitons in a mass-asymmetric electron–hole bilayer”, *Physical Chemistry Chemical Physics* **19**, 20778–20785 (2017).
7. B. P. Bahuguna, L. Saini, **Rajesh O. Sharma**, and B. Tiwari, “Structural, electronic and optical properties of layered GaSe_{1-x}As_x”, *Computational Materials Science* **139**, 31–38 (2017).
6. **Rajesh O. Sharma**, L. K. Saini, and B. P. Bahuguna, “Quantum Monte Carlo Study of Buckled GaAs Monolayer”, *Macromolecular Symposia* **376**, 1600206 (2017).
5. B. P. Bahuguna, L. K. Saini, and **Rajesh O. Sharma**, “Electronic and Optical Properties of GaAs Bilayer”, *Macromolecular Symposia* **376**, 1600208 (2017).

2016

4. **Rajesh O. Sharma**, L. K. Saini, and B. P. Bahuguna, “Ground state properties of electron-hole bilayer: Mass-asymmetric effect”, *Physical Review B* **94**, 205435 (2016).
3. B. P. Bahuguna, L. K. Saini, B. Tiwari, and **Rajesh O. Sharma**, “Electric field induced insulator to metal transition in a buckled GaAs monolayer”, *RSC Adv.* **6**, 52920–52924 (2016).
2. L. K. Saini, M. G. Nayak, and **Rajesh O. Sharma**, “Correlation effects on spin-polarized electron-hole quantum bilayer”, *AIP Conference Proceedings* **1728**, 020001 (2016).
1. B. P. Bahuguna, **Rajesh O. Sharma**, and L. K. Saini, “The LDA+U calculation of electronic band structure of GaAs”, *AIP Conference Proceedings* **1728**, 020601 (2016).

References

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