

# BIO-DATA

**1. Name: Dr. Vinayak Garg**



**2. Designation: Associate Professor**

**3. Correspondence Address:** Department of Physics  
Punjabi University, Patiala  
Punjab, PIN- 147 002, INDIA

**4. Email and Contact Number:** [vinayak\\_physics@pbi.ac.in](mailto:vinayak_physics@pbi.ac.in), [vinayak2000@gmail.com](mailto:vinayak2000@gmail.com)  
: 95012 87448

**5. Affiliation:** Punjabi University, Patiala

**6. Date of Birth:** 09-03-1977

**7. Area of Specialization:** Condensed Matter Physics (Theory)

**8. Academic Qualifications:**

S. No.	Degree	Year	Subject	Board/ University	% of Marks
1.	Matric	1994	Maths., Science, S. Science Urdu, Skt., Hindi, English	HPBSE Dharamsala	81
2.	B.Sc.	1997	Phys. Chem. Maths. Eng.	HPU-Shimla	71
3.	M.Sc.	1999	Physics	HPU-Shimla	59
4.	Ph.D.	2010	Theoretical Condensed Matter Physics	HPU-Shimla	-

**9. Ph.D. Thesis Title, Supervisor's Name, University:**

“Static and Dynamic Properties of Quasi-One-Dimensional Quantum Electron Systems”  
Prof. P. K. Ahluwalia/ Prof. R. K. Moudgil  
HPU-Shimla/ Kurukshetra University-Kurukshetra

**10. Professional Recognition/ Award/ Fellowship:**

S. No.	Name of Award	Awarding Agency	Year
1.	Merit Scholarship in Matric	HPBSE, Dharamshala	1992
2.	CSIR-NET-JRF	CSIR, New Delhi	2001
3.	CSIR-NET-SRF	CSIR, New Delhi	2003

**11. Work Experience:**

S. No.	Position Held	Name of the University	From	To	Pay Scale
1.	<b>Associate Professor</b>	<b>Punjabi University, Patiala</b>	<b>03-11-2021</b>	<b>Till Date</b>	<b>143600/-</b>
2.	Assistant Professor	Punjabi University, Patiala	03-11-2009	02-11-2021	15600+6000 (GP)-39100/-
3.	Associate Lecturer	Jaypee University of Engg. & Tech.- Guna (M.P.)	12-09-2005	30-09-2006	23600/- (Consolidated)

**12. List of Theory Papers/Courses Taught at P.G. and U.G. Level:**

S. No.	Paper	Class
1.	Condensed Matter Physics-I	M.Sc. (Physics)
2.	Condensed Matter Physics-II	M.Sc. (Physics)
3.	Quantum Mechanics	M.Sc. (Physics)
4.	Advanced Quantum Mechanics	M.Sc. (Physics)
5.	Applied Mathematics	M.Sc. (Applied Physics)
6.	Classical Electrodynamics	M.Sc. (Physics)
7.	Advanced Electrodynamics	M.Sc. (Physics)
8.	Carbon Nanotubes	M.Sc. Physics (NanoSc. &Tech.)
9.	Applied Physics-I	B.Tech.
10.	Applied Physics-II	B.Tech.
11.	Research Methodology	Ph.D. Course Work/ M.Phil.
12.	Computational Physics Laboratory	M.Sc./Ph.D.

**13. Ph.D. Students Completed/Registered: 05**

S. No.	Name of Student	Title of Thesis	Date of Registration	Year of Completion
1	<b>Akariti Sharma</b>	Static and Dynamic Properties of Quasi-One-Dimensional Electron Systems at Finite Temperature	03-09-2015	<b>Ph.D. Degree Awarded (09-03-2020)</b>
2.	<b>Kulveer Kaur</b>	Finite Temperature Investigations of Quasi-One Dimensional Quantum Electron Systems	20-01-2017	<b>Ph.D. Degree Awarded (06-05-2021)</b>

3.	<b>Vishal Verma</b>	Finite Temperature Investigations of Coupled Quantum Wire Systems	31-10-2019	<b>Ph. D. degree Awarded (05-06-2024)</b>
4.	<b>Devi Puttar</b>	Investigation of Electron-Phonon Interaction Effects in Quantum Wire Systems	17-01-2020	<b>Ph. D. viva held on 11-03-2025, RAC Meeting held on 25-03-2025</b>
5.	Preeti Rani	Quasi-One-Dimensional Quantum Electron Systems: Finite Temperature and Exchange-Correlation Effects	12-12-2022	Registered

#### 14. M.Phil. Student Guided/Degree Awarded: 01

S. No.	Name of Student	Title of Thesis	Date of Registration	Year of Completion
1.	<b>Kulveer Kaur</b>	Ground-state Properties of Quasi-One-Dimensional Quantum Electron System	August-2014	<b>M. Phil. Degree Awarded (02-03-2016)</b>

#### 15. M.Sc. Physics (Nano Science and Technology) Students Guided for Projects: 19

S. No.	Name of Student	Title of Dissertation	Year of Completion
1.	Sakshi	Static properties of quantum electron nanowire	2012
2.	Gurmanpreet Singh	Dynamic properties of quantum electron nanowire	2012
3.	Gurpreet Kaur	Static properties of quantum electron nanowire in mean field approximation	2014
4.	Ranju	Static properties of quantum electron nanowire in random phase approximation	2014
5.	Shivani	Some ground state properties of electron nanowire in Random phase approximation	2015
6.	Amandeep Chaudhary	A comparative study of some of the properties of electron gas in one, two and three dimensions	2016
7.	Shaina	Static correlation functions of quantum well and wire at finite temperature in the Hartree-Fock approximation	2016
8.	Shaffy	Ground state energy and static properties of one-dimensional electron gas in Hubbard and random phase approximation	2017
9.	Sukhcain Kaur	Ground-state spin-resolved static correlation functions of quasi-one-dimensional electron gas	2018
10.	Sakshi	Ground state properties of coupled electron-hole quantum wire system in the random phase approximation	2019

11.	Shilpa	Ground state properties of coupled electron-electron quantum wire system in the random phase approximation	2019
12.	Raghwi	Collective excitation energy of an electron-phonon coupled quantum wire	2020
13.	Jyoti Garg	Plasmons in coupled electron-electron and electron-hole quantum wire systems at finite temperature	2021
14.	Priyanka	Introduction to low dimensional electron systems	Dec-2024
15.	Reena Rani	Introduction to low dimensional electron systems	Dec-2024
16.	Himani Sharma	Coulomb drag in coupled wires	Dec-2024
17.	Jashandeep Kaur	Lindhard function of three dimensional Fermi gas	in progress
18.	Karanveer	Lindhard function of two dimensional Fermi gas	in progress
19.	Ramanjot Kaur	Lindhard function of one dimensional Fermi gas	in progress

### **16. Reviewer/Referee for International Research Journals:**

- (i) Modern Physics Letters B                      (ii) AIP Conference Proceedings  
 (iii) Journal of Engineering & Technology Education    (iv) Physics Letters A

### **17. Administrative/Academic Experience\* :**

- (i) Head of Physics Department, Punjabi University, Patiala, since 01-04-2025 (for three years).
- (ii) Member, Board of UG/PG/PhD Studies in Physics at Punjabi University, Patiala.
- (iii) Member, Departmental Research Board/Faculty of Physical Sciences, Punjabi University, Patiala.
- (iv) Coordinator, IQAC/NIRF, Department of Physics, Punjabi University, Patiala.
- (v) Secretary/Member of Administrative Committee of Department (ACD).
- (vi) Member of various Departmental Committees (Admission Committee, Fee Concession Committee, Scholarship Committee, Students Activities, Promotion of Non-Teaching Staff, Syllabus Revision Committee, Organizing Conferences in the Deptt.).
- (vii) Incharge, Observatory and Computer Laboratory of Department of Physics.
- (viii) Member of advisory/purchase committee of CAS-I and CAS-II, and Project implementation Group (PIG) for FIST-II.
- (ix) Subject Expert in the Interview Committee of Desh Bhagat College of Education, Bardwal-Dhuri, Punjab.

(x) Member of Inspection Committee for Punjab Degree College, Mahimuana, Punjab

(xi) Member of Board of UG/PG studies, SGTB Khalsa College, Anandpur Sahib

(xii) **Organizing Secretary** for One Day National Seminar on Condensed Matter Physics and Materials (CMPM-2023) held in the Department of Physics on 8<sup>th</sup> May, 2023.

*\*From time to time since January 2010, at Physics Department of Punjabi University, Patiala.*

### **18. Research Work:**

- a. Invited Talks/Guest Lectures in Conferences/Symposia: **05**
- b. International Research Papers: **42**
- c. Conferences/Seminars/Presentations: **22**
- d. Papers under Preparation: **02**

### **19. Invited Talks/Guest Lectures: 05**

1. **“Ground-State Properties of Electron Quantum Wire”**, in the National Conference on Micro and Nano Electronic Systems and Devices-2016 (**MINO-IV**) held at VIT Jaipur (Rajasthan) during 18<sup>th</sup> to 19<sup>th</sup> March 2016.
2. **“Quantum Mechanics-an Overview”**, in the Department of Physics of GGN Khalsa College, Ludhiana (Punjab) on 24<sup>th</sup> January 2020.
3. **"Many-particle correlations in quantum wires at finite-temperature"**, in the National Symposium on Theoretical Sciences held at Department of Physics, Thapar Institute of Engineering and Technology, Patiala, during 13<sup>th</sup> to 14<sup>th</sup> May 2024.
4. **"Coulomb drag in GaAs-based quantum wires at finite temperature"**, in the National Conference on Luminescence and its Applications (**NCLA-2024**) held at Department of Physics, North-Eastern Hill University, Shillong, Meghalaya, during 28<sup>th</sup> to 30<sup>th</sup> August 2024.
5. **"Coulomb drag in GaAs-based quantum wires: A dynamical mean-field approach"**, in the International Conference on Advancements in Material Science for Sustainable Development (**AIMS-2025**) held at Department of Physics, Central University of Haryana, Mahendergarh during 13<sup>th</sup> to 15<sup>th</sup> February 2025.

## 20. International Publications: 42

1. Dynamic exchange-correlation effects on Coulomb drag in coupled nanowires  
Preeti Rani, **Vinayak Garg** and R.K.Moudgil  
**Physica Status Solidi B** **261**, 2400422, (2024)  
<https://doi.org/10.1002/pssb.202400422>  
**SCI Journal Impact Factor 1.5**, ISSN:1521-3951 (online): 0370-1972 (print)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
2. Finite-T intra- and inter-wire pair correlation functions of a coupled electron-hole quantum wire system  
Preeti Rani, Kulveer Kaur and **Vinayak Garg**  
**AIP Conf. Proc.** **3231**, 040002 (2024), <https://doi.org/10.1063/5.0235863>  
**Cite Score 0.7**, ISSN: 0094-243X (print): 1551-7616 (online)  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
3. On Some Structural Phase Transitions in Coupled Quantum Wires at Finite-Temperature  
Preeti Rani, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil  
**Physica Scripta** **99**, 045914, (2024), <https://doi.org/10.1088/1402-4896/acab9d>  
**SCI Journal Impact Factor 3.081**, ISSN: 0031-8949 (print) 1402-4896 (online)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
4. Plasmon-Phonon Coupled Modes in the Ground State of a Double Electron Quantum Wire Structure  
Devi Puttar, Vishal Verma, Preeti Rani and **Vinayak Garg**  
**AIP Conf. Proc.** **3067**, 020018 (2024), <https://doi.org/10.1063/5.0204355>  
**Cite Score 0.7**, ISSN: 0094-243X (print): 1551-7616 (online)  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
5. Density Imbalance Effect on Coulomb Drag Rate in a Coupled Electron-Electron Quantum Wire System,  
Vishal Verma, Devi Puttar, Preeti Rani and **Vinayak Garg**  
**AIP Conf. Proc.** **3067**, 020019 (2024), <https://doi.org/10.1063/5.0204348>  
**Cite Score 0.7**, ISSN: 0094-243X (print): 1551-7616 (online)  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
6. Coupled plasmon-LO-phonon modes in the ground state of a GaAs-based electron-electron biwire system  
Devi Puttar, Preeti Rani, Vishal Verma and **Vinayak Garg**  
**Journal of Physics: Conf. Ser.** **2663**, 012006, (2023)  
<https://doi.org/10.1088/1742-6596/2663/1/012006>  
**Cite Score 0.7**, ISSN: 1742-6596 (Online)  
UGC-CARE List Group II, [Scopus](#), [Scopus Source List](#)

7. Plasmon-Phonon Coupled Modes in a Semiconductor Electron Quantum Wire at Finite-Temperature  
Devi Puttar, Vishal Verma, **Vinayak Garg**, and R. K. Moudgil  
**AIP Conf. Proc.** **2901**, 040021 (2023), <https://doi.org/10.1063/5.0178789>  
**Cite Score 0.7**, **ISSN**: 0094-243X (print): 1551-7616 (online)  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
8. Spin-Drag Relaxation Rate in a Quasi-One-Dimensional Electron Gas  
Vishal Verma, Devi Puttar, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2901**, 040017 (2023), <https://doi.org/10.1063/5.0178734>  
**Cite Score 0.7**, **ISSN**: 0094-243X (print): 1551-7616 (online)  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
9. Induced Wigner crystallization in a coupled electron-hole quantum wire system at finite-temperature  
Preeti Rani , Kulveer Kaur and **Vinayak Garg**  
**IOP Conf. Ser.: Mater. Sci. Eng.** **1291**, 012023, (2023)  
[https://doi: 10.1088/1757-899X/1291/1/012023](https://doi:10.1088/1757-899X/1291/1/012023)  
**Cite Score 0.7**, **ISSN**: 1757-899X (Online)  
UGC-CARE List Group II, [Scopus](#), [Scopus Source List](#)
10. Exchange and correlation effects on spin Coulomb drag in a spin-polarized quasi-one-dimensional electron gas  
Vishal Verma, Devi Puttar, **Vinayak Garg** and R. K. Moudgil  
**Modern Physics Letters B** **37** (24), 2350085, (2023)  
<https://doi.org/10.1142/S0217984923500859>  
**SCI Journal Impact Factor 1.948**, **ISSN**: 0217-9849 (print); 1793-6640 (online)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
11. Coulomb drag effect in coupled quantum wire systems: finite-T and exchange-correlation effects  
Vishal Verma, Devi Puttar, **Vinayak Garg** and R. K. Moudgil  
**Physica B** **648**, 414382, (2023), <https://doi.org/10.1016/j.physb.2022.414382>  
**SCI Journal Impact Factor 2.988**, **ISSN**: 0921-4526 (print); 1873-2135 (online)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
12. Dynamic correlation and polaronic effects on the correlational properties of finite-temperature electron quantum wire  
Devi Puttar, Vishal Verma, **Vinayak Garg** and R. K. Moudgil  
**Physica Scripta** **98**, 015713, (2023), <https://doi.org/10.1088/1402-4896/acab9d>  
**SCI Journal Impact Factor 3.081**, **ISSN**: 0031-8949 (print) 1402-4896 (online)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
13. Exchange-correlation effects in coupled-quantum-wire systems at finite temperature  
Akariti Sharma, **Vinayak Garg** and R. K. Moudgil

- Physica Scripta** **97**, 065710, (2022), <https://doi.org/10.1088/1402-4896/ac6f90>  
**SCI Journal Impact Factor 3.081**, **ISSN**: 0031-8949 (print) 1402-4896 (online)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
14. Ground-state properties of an electron-phonon coupled quantum wire within the dynamic mean-field approximation  
Devi Puttar, Vishal Verma, **Vinayak Garg** and R. K. Moudgil  
**Physica Scripta** **97**, 065817, (2022), <https://doi.org/10.1088/1402-4896/ac6f27>  
**SCI Journal Impact Factor 3.081**, **ISSN**: 0031-8949 (print) 1402-4896 (online)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
15. Coulomb Drag Rate in a Coupled Electron-Electron Quantum Wire System  
Vishal Verma, Devi Puttar, **Vinayak Garg** and R. K. Moudgil,  
**IOP Conf. Ser.: Mater. Sci. Eng.** **1221**, 012031, (2022)  
[doi:10.1088/1757-899X/1221/1/012031](https://doi.org/10.1088/1757-899X/1221/1/012031)  
**Cite Score 0.7**, **ISSN**: 1757-899X (Online)  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
16. Impact of electron-phonon interactions on the Wigner Crystallization in an electron quantum wire  
Devi Puttar, Vishal Verma, **Vinayak Garg** and R. K. Moudgil  
**IOP Conf. Ser.: Mater. Sci. Eng.** **1221**, 012033, (2022)  
[doi:10.1088/1757-899X/1221/1/012033](https://doi.org/10.1088/1757-899X/1221/1/012033)  
**Cite Score 0.7**, **ISSN**: 1757-899X (Online)  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
17. Spin correlations and spin-density wave phase in a finite-temperature quasi-one-dimensional electron gas  
Kulveer Kaur, Akariti Sharma, **Vinayak Garg** and R. K. Moudgil  
**J. Phys.: Condens. Matter** **33**, 265401, (2021), <https://doi.org/10.1088/1361-648X/abf977>  
**SCI Journal Impact Factor 2.745**, **ISSN**: 0953-8984 (Print), 1361-648X (Web)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
18. Static correlation functions in the ground-state of a coupled electron-phonon quantum wire  
Devi Puttar, Vishal Verma, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2352**, 040039 (2021), <https://doi.org/10.1063/5.0052753>  
**Cite Score 0.7**, 978-0-7354-4105-7  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
19. Plasmon dispersion in a coupled electron-electron quantum wire system at finite temperature in the RPA  
Vishal Verma, Devi Puttar, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2352**, 050021 (2021), <https://doi.org/10.1063/5.0052754>  
**Cite Score 0.7**, 978-0-7354-4105-7



UGC-CARE List Group II, Scopus, [Scopus Source List](#)

20. Free correlation energy of unpolarized and fully spin-polarized electron quantum wire  
Kulveer Kaur, Akariti Sharma, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2265**, 030694 (2020), <https://doi.org/10.1063/5.0016689>  
**Cite Score 0.7**, ISBN: 978-0-7354-2025-0  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
21. Dynamic correlation effects on correlational properties of finite-temperature quasi-one-dimensional electron gas  
Kulveer Kaur, Akariti Sharma, **Vinayak Garg** and R. K. Moudgil  
**J. Phys.: Condens. Matter** **32**, 335403, (2020), <https://doi.org/10.1088/1361-648X/ab88f3>  
**SCI Journal Impact Factor 2.745**, ISSN: 0953-8984 (Print), 1361-648X (Web)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
22. Spin-resolved pair-correlation functions of quasi one dimensional electron gas at finite temperature  
Kulveer Kaur, Akariti Sharma, **Vinayak Garg** and R. K. Moudgil  
**Materials Today: Proc.** **26**, 3426, (2020),  
<https://doi.org/10.1016/j.matpr.2019.11.209>  
**Cite Score 1.8**, ISSN: 2214-7853  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
23. Finite-temperature correlations in a two-dimensional electron gas within a dynamical self-consistent mean-field approximation  
Nisha Bhukal, **Vinayak Garg** and R. K. Moudgil  
**Physica E** **106**, 133-139, (2019), <https://doi.org/10.1016/j.physe.2018.10.016>  
**SCI Journal Impact Factor 3.369**, ISSN / eISSN:1386-9477 / 1873-1759  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
24. Free exchange-correlation energy of coupled electron-hole quantum wire system  
Akariti Sharma, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2142**, 110015 (2019), <https://doi.org/10.1063/1.5122475>  
**Cite Score 0.7**, ISBN: 978-0-7354-1885-1  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
25. Free exchange-correlation energy of electron quantum wire in dynamical mean-field approximation  
Kulveer Kaur, Akariti Sharma, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2142**, 040006 (2019), <https://doi.org/10.1063/1.5122343>  
**Cite Score 0.7**, ISBN: 978-0-7354-1885-1  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)

26. Charge-Density-Wave instability in coupled quantum wire system at finite temperature, Akariti Sharma, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2115**, 030008 (2019), <https://doi.org/10.1063/1.5112847>  
**Cite Score 0.7**, ISBN: 978-0-7354-1851-6  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
27. Wigner crystallization in an electron quantum wire at finite temperature, Kulveer Kaur, Akariti Sharma, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2115**, 030011 (2019), <https://doi.org/10.1063/1.5112850>  
**Cite Score 0.7**, ISBN: 978-0-7354-1851-6  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
28. Collective excitation spectrum of an electron quantum wire at finite temperature  
Kulveer Kaur, Akariti Sharma, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2093**, 020008 (2019), <https://doi.org/10.1063/1.5097077>  
**Cite Score 0.7**, ISBN: 978-0-7354-1823-3  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
29. Pair correlation functions of coupled electron-hole quantum wire system at finite temperature  
Akariti Sharma, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **2050**, 020007 (2018), <https://doi.org/10.1063/1.5083594>  
**Cite Score 0.7**, ISBN: 978-0-7354-1776-2  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
30. Exchange-correlation effects in a finite-temperature quasi-one-dimensional electron gas  
Akariti Sharma, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil  
**Physica Status Solidi B** **255**, 1800174, (2018)  
<https://doi.org/10.1002/pssb.201800174>  
**SCI Journal Impact Factor 1.5**, Online ISSN:1521-3951 Print ISSN:0370-1972  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
31. Finite-T correlations and free exchange-correlation energy of quasi-one-dimensional electron gas  
**Vinayak Garg**, Akariti Sharma and R. K. Moudgil  
**Modern Physics Letters B** **32**, (5), 1850060, (2018)  
<https://doi.org/10.1142/S0217984918500604>  
**SCI Journal Impact Factor 1.948**, **ISSN**: 0217-9849 (print); 1793-6640 (online)  
UGC-CARE List Group II, Web of Science, [Science Citation Index Expanded](#)
32. Free exchange-correlation energy of an electron quantum wire  
Akariti Sharma, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **1953**, 050068, (2018), <https://doi.org/10.1063/1.5032723>  
**Cite Score 0.7**, ISBN: 978-0-7354-1648-2  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)

33. Plasmon excitation spectrum of an electron quantum wire at finite temperature  
Akariti Sharma, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **1953**, 060012, (2018), <https://doi.org/10.1063/1.5032743>  
**Cite Score 0.7**, ISBN: 978-0-7354-1648-2  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
34. Plasmons in a semiconductor electron quantum wire at finite temperature in the random phase approximation  
Akariti Sharma, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **1832**, 120006, (2017), <http://dx.doi.org/10.1063/1.4980691>  
**Cite Score 0.7**, ISBN: 978-0-7354-1500-3  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
35. Dynamical correlation effects on structure factor of spin-polarized two-dimensional electron gas  
Gurvinder Singh, Krishan Kumar, **Vinayak Garg**, and R. K. Moudgil  
**AIP Conf. Proc.** **1665**, 080025, (2015), <http://dx.doi.org/10.1063/1.4917929>  
**Cite Score 0.7**, ISBN: 978-0-7354-1310-8  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
36. Dynamical correlation effects on pair-correlation functions of spin polarized two-dimensional electron gas  
Krishan Kumar, **Vinayak Garg** and R. K. Moudgil  
**AIP Conf. Proc.** **1536**, 949, (2013), <http://dx.doi.org/10.1063/1.4810544>  
**Cite Score 0.7**, ISBN: 978-0-7354-1160-9  
UGC-CARE List Group II, Scopus, [Scopus Source List](#)
37. Spin-resolved correlations at arbitrary spin polarization and ground state of a quasi-one-dimensional electron gas  
**Vinayak Garg** and R. K. Moudgil  
**Physica E** **47**, 217, (2013), <https://doi.org/10.1016/j.physe.2012.11.010>  
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38. On the existence of Stoner instability in a semiconductor electron quantum wire  
**Vinayak Garg** and R. K. Moudgil  
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39. Confinement and correlation effects on plasmons in an atom-scale metallic wire  
R. K. Moudgil, **Vinayak Garg** and K. N. Pathak  
**Journal of Physics: Condensed Matter** **22**, 135003, (2010), [DOI:10.1088/0953-984/22/13/135003](https://doi.org/10.1088/0953-984/22/13/135003)  
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 R. K. Moudgil, **Vinayak Garg** and P. K. Ahluwalia  
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41. Spin-resolved correlations and ground-state of a three-dimensional electron gas: spin polarization effects  
 Krishan Kumar, **Vinayak Garg**, and R. K. Moudgil  
**Physical Review B** **79**, 115304, (2009), DOI: [10.1103/PhysRevB.79.115304](https://doi.org/10.1103/PhysRevB.79.115304)  
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42. Ground-state properties of a quasi-one-dimensional electron gas within a dynamical self-consistent mean-field approximation  
**Vinayak Garg**, R. K. Moudgil, Krishan Kumar and P. K. Ahluwalia  
**Physical Review B** **78**, 045406, (2008), DOI: [10.1103/PhysRevB.78.045406](https://doi.org/10.1103/PhysRevB.78.045406)  
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## 21. Papers presented/published in Conferences/Symposia: 22

1. Finite-T Static Charge Density Susceptibility of Coupled e-h and e-e Quantum Wire Systems, Preeti Rani, Kulveer Kaur and **Vinayak Garg**, National Conference on Advanced and Emerging Materials for Technological Applications (AEMTA-2024), organized by Department of Physics, SLIET Longowal during 15-16 March 2024.
2. Collective Excitation Spectrum of a Coupled Electron-Electron System at Finite-T, Preeti Rani and **Vinayak Garg**, 14<sup>th</sup> National Conference on Chemistry for the Sustainable Future (CSF-2024), organized by Department of Chemistry, Punjabi University, Patiala, during 06-07 March 2024.
3. Finite-T Intra-and Inter-wire Pair Correlation Functions of a Coupled Electron-Hole Quantum wire System, Preeti Rani, Kulveer Kaur and **Vinayak Garg**, 5<sup>th</sup> International Conference on Recent Advances in Materials and Manufacturing (ICRAMM 2023), organized by Department of Mechanical Engineering, Velalar College of Engineering and Technology, Erode, Tamil Nadu, during 29-30 December 2023.
4. Finite-T intra- and inter-wire static structure factors of an electron-hole quantum wire system, Preeti Rani, Vishal Verma, Devi Puttar, and **Vinayak Garg**, 8<sup>th</sup> National Conference on Science & Technology for Nation Development: Opportunities & Global Challenges, organized by Arya PG College, Panipat, Haryana on February 28, 2023.
5. Polaronic effects on the collective excitation energy in the ground state of a double electron quantum wire structure, Devi Puttar, Vishal Verma and **Vinayak Garg**, 7<sup>th</sup> National Conference on Innovations in Science, Engineering & Technology (NCISET-2022), organized by Arya PG College, Panipat, Haryana on February 19, 2022.

6. Plasmon-phonon coupled modes in the ground state of an electron quantum wire, Devi Puttar, Vishal Verma and **Vinayak Garg**, Conference on Future Endeavours of Science & Technology for Sustainable Growth, organized by Sri Guru Teg Bahadur Khalsa College Sri Anandpur Sahib, Punjab (Punjab Science Congress) during 7-9 February 2022.
7. The momentum transfer rate in coupled electron-electron quantum wire system at finite-temperature, Vishal Verma, Devi Puttar, Kulveer Kaur and **Vinayak Garg**, 12<sup>th</sup> National Conference on Chemical and Environmental Sciences: Advanced Innovations – 2020, held at Deptt. of Chemistry, Punjabi University Patiala during 19-20 February 2020.
8. Magnetic instability in unpolarized quasi-one-dimensional electron gas at finite-temperature, Kulveer Kaur, Vishal Verma, Devi Puttar and **Vinayak Garg**, 23<sup>rd</sup> Punjab Science Congress held at SLIET Longowal (Punjab) during 7-9 February 2020.
9. Static Correlation Functions of Coupled Electron-Hole Quantum Wire System at Finite Temperature, Akariti Sharma, Kulveer Kaur, **Vinayak Garg** and R. K. Moudgil, International Conference on Science: Emerging Scenario and Future Challenges (SESFC-2018), NIT Hamirpur, H. P., 8<sup>th</sup> Sept. 2018 to 9<sup>th</sup> Sept. 2018.
10. Static Correlation Functions of Quasi-One-Dimensional Electron Gas at Finite Temperature, Kulveer Kaur, Akariti Sharma, **Vinayak Garg** and R. K. Moudgil National Conference on Advanced Materials & Devices for Futuristic Applications (AMDFA-2018) at Deptt. of Physics, Chandigarh University, Gharau, Mohali, Punjab, 19<sup>th</sup> May 2018 to 20<sup>th</sup> May 2018.
11. Finite temperature Pair-correlation function of quasi-one-dimensional electrons gas in the STLS approximation, Akariti Sharma, Kulveer Kaur **Vinayak Garg** and R. K. Moudgil, National Seminar on Emerging Trends in Science and Technology (ETST-2017) at Deptt. of Physics, Arya PG College, Panipat, Haryana, 1<sup>st</sup> March 2017, 61, 2017.
12. Static Correlation Functions of Quasi-One-Dimensional Electron Gas in the Random Phase Approximation at Finite Temperature, Akariti Sharma and **Vinayak Garg**, Proc. of Recent advances in Emerging Technologies, ISBN 978-81-929890-1-3, (423-428), 2016, published by SGGSWU-Fatehgarh Sahib (Punjab).
13. Static Polarizability of Quasi-One-Dimensional Non-interacting Electron Gas at Finite Temperature, **Vinayak Garg** and Akariti Sharma: One Day National Conference on Current Advances in Theoretical and Experimental Physics (CATEP-15) at PG Deptt. of Applied Physics, S.D. College (Lahore), Ambala Cantt, 45, 2015.
14. Ground-state properties of quasi-one dimensional electron system including disorder effects, **Vinayak Garg** and Akariti Sharma, National Seminar on Recent Developments in Theoretical and Experimental Physics (RDTEP-15) at Deptt. of Applied Physics, S.D. College (Lahore), Ambala Cantt: 57, 2015.
15. Effect of disorder on the static correlation functions of quasi one-dimensional electron gas, **Vinayak Garg**, International Conf. on emerging areas of mathematics for science & technology at Deptt. of Mathematics, Punjabi University Patiala, 74, 2015.
16. Plasmons in an atomic-scale metallic wire, **Vinayak Garg**, R. K. Moudgil and K. N. Pathak, Proc. Solid State Phys. Symp. 54, 569 (2009).
17. Correlation Effects in a nano-sized coupled electron-hole wire, R. K. Moudgil, **Vinayak Garg**, and P. K. Ahluwalia, Proc. International Conference on Multifunctional Oxide Materials 39, (2009).
18. Ground-state correlation energy of a semiconductor electron quantum wire, **Vinayak Garg**, Krishan K. Majra, P. K. Ahluwalia, and R. K. Moudgil, Proc. Solid State Phys. Symp. 52, 601 (2007).
19. Dynamic correlations in a charged bose quantum wire: **Vinayak Garg** and P. K. Ahluwalia, Proc. Solid State Phys. Symp. 50, 579 (2005).

20. Dynamic correlations in a two dimensional charged bose gas, **Vinayak Garg**, A. K. Sharma, and P. K. Ahluwalia, Proc. Solid State Phys. Symp. 49, 500 (2004).
21. Spin correlations in a two dimensional electron gas at finite temperature, **Vinayak Garg**, A. K. Sharma, and P. K. Ahluwalia, Proc. of the National Conference on Materials and their Applications, 69 (2004).
22. Finite temperature investigation of two dimensional electron gas in QSTLS approximation, A. K. Sharma, **Vinayak Garg**, and P. K. Ahluwalia, Proc. Solid State Phys. Symp. 45, 253 (2002).

## 22. Papers under Preparation: 02

1. Coulomb drag between parallel quantum wires: exchange-correlation and particle density imbalance effects  
Vishal Verma, **Vinayak Garg** and R.K.Moudgil
2. Spin Coulomb drag in quasi-one-dimensional electron gas: A dynamical mean-field approach  
Preeti Rani, **Vinayak Garg** and R.K.Moudgil

## 23. Any other Information:

I completed my Ph.D. in Theoretical Condensed Matter Physics on the topic “**Static and Dynamic Properties of Quasi-One-Dimensional Quantum Electron Systems**” in 2010. In this thesis, some of the ground-state properties of quasi-one-dimensional electron system (Q1DES) as realized in quantum wires were studied in detail. Specifically, the possibility of Wigner crystallization (electron's localization) and Bloch instability (magnetic phase transition) in a Q1DES, and induced Wigner crystallization in coupled Q1DES's was investigated at absolute zero.

Currently, I am working to explore Q1DES's theoretically at finite temperature (T) for the possibility of *Wigner crystallization*, *Charge-Density-Wave instability*, *Spin-Density-Wave instability*, *Coulomb drag* and *spin Coulomb drag*. These unique and interesting physical phenomena in Q1DES's occur due to the dynamics of exchange-correlations and severe confinement of electrons. Besides the conventional *electron-electron* interactions, the role of *electron-phonon (e-ph)* coupling on the ground-state and finite-T properties of Q1DES 's is also being investigated.

Our present work is motivated by the fact that Q1DES's contain incredibly rich Physics due to the involvement of many-particle correlations, and the above mentioned quantum effects are experimentally observable.

### Computer Knowledge:

Sound knowledge of FORTRAN, XMGRACE, LATEX, MATHEMATICA and LINUX (Scientific, Debian, Ubuntu etc.).

Can effectively work in MS-World, MS-power point and Excel.

**(Dr. Vinayak Garg)**

**11<sup>th</sup> April, 2025**